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SATISFACTION ASSESSMENT OF TEXTUAL SOFTWARE ENGINEERING ARTIFACTS

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ABSTRACT OF DISSERTATION

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A dissertation submitted in partial fulfillment of the
requirements for the degree of Doctor of Philosophy in the
College of Engineering
at the University of Kentucky

By
Elizabeth Ashlee Holbrook

Lexington, Kentucky

Director: Dr. Jane Huffman Hayes, Professor of Computer Science

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A large number of software projects exist and will continue to be developed that have textual requirements and textual design elements where the design elements should fully satisfy the requirements. Current techniques to assess the satisfaction of requirements by corresponding design elements are largely manual processes that lack formal criteria and standard practices. Software projects that require satisfaction assessment are often very large systems containing several hundred requirements and design elements. Often these projects are within a high assurance project domain, where human lives and millions of dollars of funding are at stake. Manual satisfaction assessment is expensive in terms of hours of human effort and project budget. Automated techniques are not currently applied to satisfaction assessment.

This dissertation addresses the problem of automated satisfaction assessment for English, textual documents and the generation of candidate satisfaction assessments that can then be verified by a human analyst with far less effort and time expenditure than is required to produce a manual satisfaction assessment. Validation results to date show that automated satisfaction methods produce candidate satisfaction assessments sufficient to greatly reduce the effort required to assess the satisfaction of textual requirements by textual design elements.

KEYWORDS: Satisfaction Assessment, Automated Requirements Analysis, Traceability, Textual Software Artifacts

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RULES FOR THE USE OF DISSERTATIONS

Name	Date

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Introduction and Overview

Creating quality software requires much more than good programming. Software engineers must be able to successfully create a requirement specification tailored to the needs of end-users, translate this into design documents, engineer code from the software design, and thoroughly test the final product. In addition to being complete and correct, all of the artifacts from the software development lifecycle should be clear, concise, and easy to understand. Unfortunately, this rarely occurs. Faults may be introduced at each stage of development. Translations between the phases of the software engineering lifecycle may not be correct. Omissions may occur between phases. The sooner faults are discovered and corrected, however, the less devastating they are in terms of development time and project budget [10, 11, 22].

1.1 Introduction

Ensuring that requirements are fully satisfied by software design elements is a critical part of any software project and helps lay the foundation for a quality software product. Additionally, determining whether requirements have been satisfied plays a key role in software validation. In small-scale projects, it is possible to manually verify whether requirements have been met by design. Analysts can treat requirements for a project as a checklist. Then, for each requirement, they can read the project design specification, searching for and highlighting portions that satisfy the requirement. However, many software projects are very large, having several hundred requirements and design elements. The scale of these projects makes it difficult, tedious, and error-prone to determine whether requirements have been satisfied by design elements. This is especially true for large-scale high-assurance systems such as those found in aerospace and defense. For projects in these domains, however, millions of dollars in funding and even human lives may be at stake if project requirements are not correctly satisfied. This work attempts to address the requirement satisfaction problem – assessing whether textual software design elements have fully or partially satisfied textual requirements.

In order to ensure consistency and assist in software maintenance, requirements traceability matrices (RTMs) are often used to trace requirements to design to code. A sample RTM, and the requirements and design elements it maps, is shown in Figure 1.1. An RTM contains of a list of requirements that are mapped to design elements and/or a list of design elements that are mapped to code segments, test cases, user manual sections, etc. Ideally, as a project is developed, an RTM is created and modified along with the elements it maps. Although this is the most efficient way to develop an RTM, RTMs are rarely constructed in this manner. Even if an RTM is created as software is developed, it is often too high-level to be useful for software maintenance and quality assurance (i.e., tracing requirements documents containing several hundred requirements to large sections of design or code), thus after-the-fact tracing is necessitated [3, 17, 26, 28, 40, 45, 59, 74, 112, 113].

RTM creation after a software system has been developed is a tedious and error-prone process. Automated tracing techniques have been introduced to assist analysts in this task [2, 17, 18, 19, 27, 45, 47, 48, 49, 50, 71, 72, 73, 111, 126, 127]. However, the question remains as to whether elements traced to one another are simply related or exhibit a true satisfaction relationship. ISO 9000:2000 defines software quality as the "degree to which a set of inherent characteristics fulfill requirements," where a requirement is a "need or expectation that is stated, generally implied, or obligatory" [56]. This definition of software quality is also known as requirement satisfaction. A design element satisfies a requirement when it either fully or partially addresses and captures the meaning of the requirement. In the case of partial satisfaction, a requirement may be satisfied by a combination of several design elements [55].

Satisfaction assessment is the process of determining which pieces of a requirement are satisfied by which pieces of a set of design elements. In addition to providing a measure of system quality, determining the satisfaction assessment of a set of requirements and design elements provides information that allows one to see how potential maintenance efforts will affect a system, how well a system is suited to reuse on a future project, and how well an existing system meets both pre-existing and newly-introduced requirements.

1.2 Defining Satisfaction

Before satisfaction is defined, the definition of software requirements and design elements must be made clear. A software requirement is a statement of what a software system must be capable of doing or handling. Software requirements are typically one sentence in length and may include a second or third sentence that defines terms in the main sentence. Requirements include three pieces of information: a) a subject: b) a modal verb, typically "shall;" and c) an object phrase describing what is required. The subject of a requirement is typically the name of the software system or a subsystem contained within it. The modal verb may be "will," "shall," or another word. In the United States, requirements are legally binding only if the modal verb is "shall," so in many requirement specifications written in English "shall" has become the standard verb. Finally, the requirement sentence must contain a phrase describing what the subject of the sentence must do or contain. For example, consider the requirement, "The system shall write files to .PDF format." "The system" is the subject, "shall" is the modal verb, and "write files to .PDF format" is what the subject must be able to do. Requirements may also be accompanied by sentences providing more detail in free form. For the given example, a second requirement sentence may describe .PDF format, or may say where output files are to be stored.

	DE1	DE2	DE3	DE4
R1		X	X	X
R2	X			
R3		X		

Key: R1 – Requirement 1, DE1 – Design Element 1

Requirements
R1: The system shall provide a method for input and output.
R2: The system shall allow 3 users to log on simultaneously.
R3: There shall be a way to record output in XML format.

Design Elements
DE1: The trackUser semaphore allows up to 3 users to be signed on at any point.
DE2: An output file, out.xml, will be written using the XML format specified in STDDOC1.2.3.
DE3: The system shall read user input in the format specified in STDDOC1.2.3.
DE4: User input may also be given manually through keyboard entry.

Figure 1.1. Sample RTM.

A software design element has a less rigid format than software requirements. Textual design elements are descriptions of how a requirement will be implemented or paragraphs that describe a requirement in more detail. For example, a software design element may be:

> "The .PDF format used by the system must follow standard format. The .PDF files will be written to a folder named 'output' that is located inside a user's home directory within the file structure. A .PDF reader will also be included in the system software package."

In this research, requirements and design elements are assessed in natural language form. No formal standardization or formatting techniques are necessitated because specifying a particular format for input would place an additional burden on individuals who write requirements and design. An independently verified RTM, such as the one shown in *Figure 1.1,* is also given as input to show which design elements are traced to each requirement.

For satisfaction assessment, each requirement and each design element is modeled as a collection of phrases, or "chunks," such that each chunk represents a single phrase of a requirement or design element. In this research, satisfaction assessment offers a solution to the problem of establishing satisfaction mappings between individual pairs of requirement and design element chunks. The assumption is that for a requirement to be completely satisfied, all of its important chunks must be addressed by subsequent chunks in the design element text.

Requirement: SRS5.12.3.4

<1>The DPU-CCM</1> <2shall be able</2> <3>***to count***</3> <4>***a consecutively reported error*** </4>. <5>When<5> <6>**the count**</6> <7>for</7> <8>***a particular error ID***</8>, <9>**exceeds**</9> <10>*250*</10> <11>for</11> <12>a particular reporting period</12>, <13>***the error code***</13> <14>will be replaced</14> <15>with</15> <16>*an error code sequence*</16> <17>which</17> <18>shall include</18> <19>the original error code</19> <20>and</20> <21>**the number of times**</21> <22>***the error***</22> <23>**was reported** </23>.

Design Element: DPUSDS5.12.1.5.2

<24>The ccmErrEnq() function</24> <25>tracks</25> <26>the last error reported</26> <27>and<27> <28>its<29> <30>frequency of occurrence</30>. <31>Once</31> <32>an error code</32><33>***has been reported***</33> <34>it</34> <35>becomes<35> <36> ***the previously reported error code***</36> <37>maintained</37><38> by </38> <39>ccmErrEnq() </39>. <40>**A repetition count**</40> <41>is</41> <42>then </42> <43>***incremented***</43> <44>for<44> <45>***each subsequent, consecutively reported***</45>, <46>identical</46><47> instance</47> <48>of</48><49> ***this previously reported error***</49>. <50>If</50> <51>this error code</51><52> **is reported** </52> <53>more</53> <54>than</54> <55>once</55> <56>in</56> <57>one</57> <58>high-rate housekeeping</58> <59>reporting period</59>, <60>then</60> <61>*a special error, S_ccm_ERR_REPEAT*</61> <62>is enqueued</62> <63>with</63> the <64>**repetition count**</64> <65>for</65> <66>***the error***</66> <67>encoded</67> <68>in</68 <69>the least significant byte</69>. <70>This mechanism</70> <71>effectively</71> <72>reduces</72> <73>the potential</73> <74>for</74> <75>housekeeping telemetry</75> <76>to</76> <77>become flooded</77> <78>with</78> <79>***a single repeated error***</79>.

Design Element: DPUSDS5.12.1.5.4

<100>In</100> <101>order</101> <102>to insure</102> <103>that</103> <104>**error counts**</104> <105>are</105> <106>not</106> <107>lost</107> <108>due to </108><109>rollover</109>, <110>ccmErrEnq()</110>, <111>checks to ensure</111> <112>that</112> <113>the count</113> <114>for</114> <115>***a given error***</115> <116>has</116> <117>not</117> <118>**gone above**</118> <119>*250*</119> <120>in</120> <121>one high rate housekeeping reporting period</121>. <122>If</122> <123>**the error count**</123> <124>**exceeds**</124> <125>*250*</125> <126>for</126> <127>a particular reporting period</127>, <128>ccmErrEnq()</128> <129>will enqueue</129> <130>*S_ccm_ERR_REPEAT error*</130> <131>with</131> <132> **the current error count**</132> <133>and</133> <134>will clear</134> <135>its</135> <136>error tracking mechanism</136>.

Figure 1.2. Sample Requirement and Design Element Satisfaction Assessment.

Satisfaction Assessment:

1

2

3 - 43 (***bold underline italic***)

4 - 33, 36, 45, 49, 66, 79, 115 (***bold italic***)

5

6 - 40, 64, 104, 123, 132 (**bold**)

7

8 - 33, 36, 45, 49, 66, 79, 115 (***bold italic***)

9 - 118, 124 (**bold underline**)

10 - 119, 125 (*underline italic*)

11 - 126

12 - 59, 121, 127 (underline)

13 - 33, 36, 45, 49, 66, 79, 115 (***bold italic***)

14

15

16 - 61, 130 (*italic*)

17

18

19 - 32, 51 (double underline)

20

21 - 40, 64, 104, 123, 132 (**bold**)

22 - 33, 36, 45, 49, 66, 79, 115 (***bold italic***)

23 - 52 (**bold double underline**)

Figure 1.2. Sample Requirement and Design Element Satisfaction Assessment (cont'd).

Satisfaction assessment (verb) is defined as the process of determining the satisfaction mapping of natural language textual requirements to natural language design elements. A satisfaction mapping is a way to encode a satisfaction decision that has been made about a set of requirements and a set of corresponding design elements. Satisfaction assessment is defined as the process of determining the satisfaction mapping of natural language textual requirements to natural language design elements. A satisfaction assessment (noun) is a set of satisfaction mappings for a given set of requirements and design elements.

Formally, satisfaction assessment and satisfaction mapping may be defined as follows. Suppose we are given a set of requirements, R, broken down into terms ($R = \{t_{r1}, t_{r2}, \ldots\}$) where t_{r1} is the first term in R, or phrases ($R = \{p_{r1}, p_{r2}, \ldots\}$), where p_{r1} is the first phrase in R. Suppose that we also have a set of design element terms, D, ($D = \{t_{d1}, t_{d2}, \ldots\}$) where t_{d1} is the first term in D, or phrases ($D = \{p_{d1}, p_{d2}, \ldots\}$), where p_{d1} is the first phrase in D. A satisfaction mapping or satisfaction match is a set of pairs of terms (t_{rn}, t_{dm}) where t_{rn} is a term in a set of requirements and t_{dm} is a term in the set of design elements, where t_{rn} is directly related to t_{dm}. A satisfaction mapping may also occur at the phrase level. In this case it will consist of a series of phrase pairs (p_{rn}, p_{dm}) with one phrase, p_{rn}, being a phrase in a requirement and p_{dm} being a phrase in a corresponding design element, where p_{dm} directly addresses p_{rn}. Satisfaction assessment as a verb is the process of determining all satisfaction mappings between a set of requirements and a set of design elements. A satisfaction assessment (noun form) is the collective set of satisfaction mappings or satisfaction matches between all requirements and all design elements within a system.

A sample requirement, corresponding design elements, and satisfaction assessment is provided in *Figure 1.2*. Each phrase in the requirement and each phrase in each of the design elements is tagged with a unique identifier. The phrases from the requirement that correspond to phrases from the design elements are shown in the satisfaction mapping given and by various combinations of textual formatting (bold, italic, underline, and double underline). Finally, in the satisfaction mapping given in *Figure 1.2*, the first number in each line represents a phrase tagged in the requirement. Numbers that follow indicate the identifier of related design element phrases. Comments appear in parentheses at the end of the line to indicate the formatting of the text in the corresponding requirements and design elements. For example, consider phrase 9 in the requirement, "exceeds." According to the given satisfaction mapping, this phrase is satisfied by phrases 118 and 124 in the design element text – "gone above" and "exceeds." These are shown in bold underlined text.

Satisfaction assessment is a two-sided problem. First, the problem of determining matches between portions of individual requirements and design elements must be addressed, as is described above. Next, results from the first problem may be used to investigate whether one can reduce the problem of requirements satisfaction to the previously mentioned matching problem. This work has focused on the first problem.

In order to determine satisfaction for this work, a four step process is applied. First, each textual requirement and design element is preprocessed. Preprocessing is a two stage process consisting of stemming and stopword removal. These will be described in detail in *Section 3.2.1.1* and *Section 3.2.1.2*. Second, a domain-specific thesaurus, which contains a set of synonym pairs for domain-specific vocabulary is applied. Thesaurus tagging will be described in *Section 3.2.1.5*. Next, each requirement and design element are tokenized into chunks based on parts of speech. Chunking and tokenization are described in *Sections 3.2.1.4* and *Section 3.2.1.3*. Each chunk consists of a phrase in a sentence. Chunking takes place by parsing sentences and then assigning each grammatical part of the sentence as an individual chunk. Finally, the degree of satisfaction is calculated between chunks of requirements and the chunks of design elements they are tied to in the project RTM. This provides a basis for the satisfaction assessment and limits satisfaction mappings to only those requirement-design element pairs that are at least minimally related. If no RTM is given, then all requirements are considered to be related to all design elements. In this case, the system treats the process of satisfaction assessment as if an RTM containing every possible link (every requirement chunk links to every design element chunk) has been given as input.

One may determine satisfaction between requirement and design element chunks by a variety of methods. These are described in *Section 3.3*. Algorithms to perform satisfaction assessment may involve applying a series of rules that determine satisfaction or applying a threshold value to a calculated similarity measure. As shown in *Figure 1.3*, in the overall satisfaction assessment process, requirements and design documents are given as input, a series of processing steps to determine satisfaction are performed, and a candidate satisfaction mapping, or assessment, is provided. An analyst can then verify this candidate satisfaction assessment and make changes to it as is necessary.

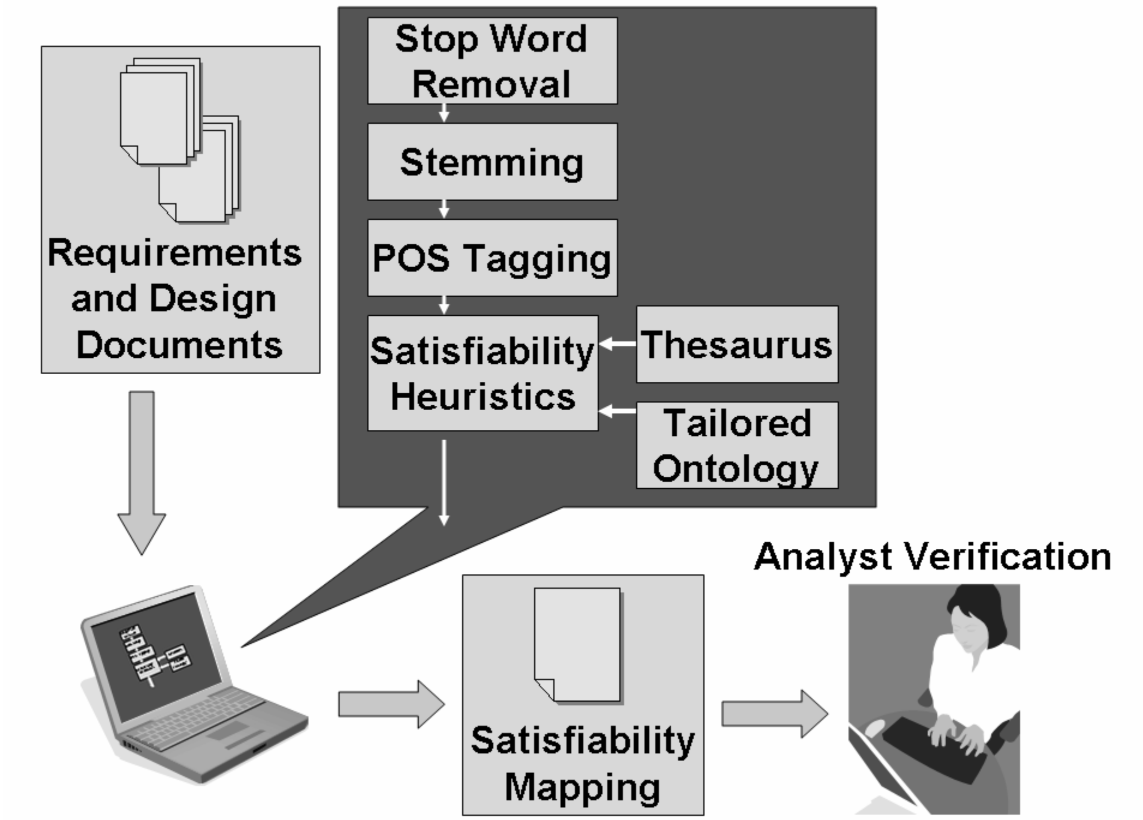

Figure 1.3. Satisfaction Assessment.

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1.3 The Importance of Requirement Satisfaction Assessment

It is critical that software behave as intended. This is particularly true when working on large-scale high assurance systems, such as those found in aerospace, when lives and years of work on a project are at stake. Unfortunately, the complexity and size of project artifacts from these systems make requirements validation – ensuring that requirements are satisfied by the design – a difficult and time-consuming task. In an ideal world, design documents would perfectly fulfill requirements and code would perfectly implement the design. Unfortunately, this is not the case. Defects are inevitable in large-scale projects. The sooner these defects are uncovered and corrected, however, the less devastating they are in terms of development time and project budget [10, 11]. For this reason, the research presented here focuses on early life cycle artifacts – ensuring that requirements are satisfied by design.

Once a traceability relationship is established between requirements and design elements, an analyst must determine whether the design elements correctly interpret and fully satisfy requirements. Requirements satisfaction assessment is a tedious task that can benefit greatly from automated techniques.

Satisfaction assessment of a set of requirements by design elements can offer several benefits. First, a satisfaction assessment can be thought of as a quality measure for the software project. Managers and stakeholders in a project can easily see which requirements have been fully or partially satisfied and, perhaps more importantly, they will be able to easily determine those requirements that have not yet been satisfied. This information is vital to ensure that all of the intended functionally is present within a software system.

Verification and Validation (V&V) or Independent Verification and Validation (IV&V) (the independent form of V&V performed by a third party) analysts often work to trace requirements to design elements and to ensure that these requirements are satisfied by the design and code. Providing a way to automate this task alleviates some of the analysts' workload. While one cannot ensure that an algorithmic technique will perfectly interpret requirements and design, providing an initial satisfaction assessment greatly benefits analysts. It is easier to search through an initial assessment to discover defects than to create the satisfaction assessment initially.

Second, a satisfaction assessment provides a useful tool for change impact analysis. Suppose we have a software system in which all requirements have been met by design elements. Later, a new set of requirements is levied on the system. Satisfaction assessment provides a way to see if the new requirements are met by any existing system elements and may indicate which design modules will be influenced by the newly introduced requirements.

Third, suppose that a software system is being considered for reuse. Suppose that the software system already has a set of requirements R1 and design elements D1 that satisfy those requirements and that the new project has a new set of requirements R2. One can perform satisfaction assessment using requirement set R2 and design element set D1 to see how well D1 addresses the needs of the new system. This information can help managers and stakeholders determine whether the reuse of a software system is a viable option or whether alternate options should be considered (i.e., reusing another system, building a new system, etc.).

This research will provide benefits to IV&V and V&V analysts who are determining whether a software design satisfies requirements. Automating the process to assess whether requirements are satisfied will ease the workload of analysts and provide valuable data about a project. Additionally, heuristics and algorithms developed will be of interest to those working in similar project domains.

1.4 Problem Statement

A large number of software projects exist and will continue to be developed that have textual requirements and textual design elements where the design elements should fully satisfy the requirements. Current techniques to assess the satisfaction of requirements by corresponding design elements are largely manual processes that lack formal criteria and standard practices. Software projects that require satisfaction assessment are often very large systems containing several hundred requirements and possibly thousands of design elements. Often these projects are within a high assurance project domain, where human lives and millions of dollars are at stake. Manual satisfaction assessment is expensive in terms of hours of human effort and project budget. Automated techniques are not currently applied to satisfaction assessment.

This dissertation addresses the problem of automated satisfaction assessment for English, textual documents and the generation of candidate satisfaction assessments that can then be verified by a human analyst with far less effort and time expenditure than is required to produce a manual satisfaction assessment. Validation results show that automated satisfaction methods produce candidate satisfaction assessments sufficient to greatly reduce the effort required to assess the satisfaction of textual requirements by textual design elements.

1.5 Research Thesis

The goal of this research is to improve the quality of English, textual requirements specifications and the resulting textual design documents for software projects. Specifically, we are interested in creating methods to assess the satisfaction of textual requirements by textual design documents in an automated fashion without introducing specific formats for the textual documents or requiring substantial effort on the part of analysts or requirement/design specification teams.

We present a new tool for automated satisfaction assessment, RESAT (REquirements SATisfaction), that implements several automated satisfaction assessment methods to create candidate satisfaction assessments that can then be easily verified by human analysts. The overall thesis of this research is that the current manual methods for satisfaction assessment can be improved in terms of time and effort required through automated satisfaction assessment tools and methods.

Four methods for automated satisfaction assessment have been fully implemented and validated. Validation has shown that the automated methods offer significant advantages over manual satisfaction assessment. Improvements in terms of analyst effort as measured by the number of requirement and design element phrase pairs that must be checked in order to verify or create a correct and complete satisfaction assessment have been validated.

1.6 Scope of the Research

This research focuses on English language textual documents for requirements and design elements. The text in these documents must contain proper grammar, punctuation, and spelling. Terms that are not frequently used in the English language, and thus are not found in a generic dictionary or thesaurus, should be included in a domain-specific thesaurus along with their synonyms in order to be processed correctly by the automated satisfaction assessment tool. In the most basic form, all sentences in requirements and design documents must be of the form:

<N><V>

where:

N can be:

n	A noun
NP	A noun phrase

V can be:

v	A verb
VP	A verb phrase

NP can be:

n	A noun
ADJn	An adjective phrase and noun
ADJnp	An adjective phrase, noun, and preposition

VP can be:

v	A verb
ADVv	An adverb phrase and a verb
vO	A verb and an object
ADVvp	An adverb phrase, verb, and preposition

An object O can be:

N	A noun
NP	A noun phrase.

This is a simplified grammar for the English language. In practice, RESAT is able to operate on any proper English sentence and operates best with input sentences that can be parsed in exactly one way. Such sentences will avoid potential ambiguity on parts of speech tagging, etc.

Chapter 2

Background and Related Work

In order to understand the approaches taken to address satisfaction assessment, additional background knowledge in related areas and knowledge of previous work in requirements validation is required. Background work presented here has served to pave the way toward automated satisfaction assessment.

2.1 Information Retrieval

First, one must examine the information retrieval (IR) domain. With the prevalence of search technology on the Internet, much research on information retrieval methods has been conducted. Information retrieval is the process of searching through a document collection, a corpus, in response to a query or search phrase and returning those documents that are relevant to the query.

For example, suppose we search for the query phrase "Computational Geometry" in Google [38]. A series of 12,800,000 documents, ranked by relevancy, are returned based on the text extracted from web pages indexed by the search engine (valid as of April 2007). Documents returned include directories of research publications on Computational Geometry, academic descriptions of algorithms in the field, and mathematical sites that provide a definition for Computational Geometry. These results are returned in sorted order based on relevancy to the search query. Many search engines attach a percentage relevancy value to each page returned to help users decide which pages are most applicable to their search topic. The underlying algorithms that support this framework are collectively known as information retrieval methods. While information retrieval methods are fundamental to search technology, these methods can also be applied to other areas, such as tracing and satisfaction assessment.

One of the most often used information retrieval methods is vector space retrieval [106, 4]. The vector space retrieval model is an algebraic model for ranking natural text documents. In vector space information retrieval, documents are represented as vectors of keyword weights. Document to query relevancy rankings are based on semantic similarity. That is, relevancy rankings are calculated based on the proximity and frequency of terms within a query and document collection.

Among vector space retrieval models, one of the most frequently used term weighting methods is term frequency-inverse document frequency, or TF-IDF [105, 4]. TF-IDF is a statistical measurement of the importance of a term within a document. Term frequency is the number of times a term appears within a document, and inverse document frequency is a way to measure term importance over a set of documents (document frequency, or the logarithm of the number of documents that have that term). Formally, TF-IDF weights are assigned to each term in each document:

$$\text{TF-IDF} = \frac{n_i}{\sum_k n_k} * \log \frac{|D|}{|\{d : d \ni t_i\}|}$$

where n_i is the number of occurrences of a term, $\Sigma_k n_k$ is the occurrences of all terms, $|D|$ is the total number of documents, and $|\{d:d \ni t_i\}|$ is the number of documents containing term t_i. Vectors containing these weights are constructed.

TF-IDF similarity scores between two vectors v_r and v_{rd} are calculated using the cosine between the two vectors:

$$sim = (v_r \times v_d) / (| v_r| \, | v_d |).$$

This yields a similarity score between 0 and 1, where 0 indicates that the two documents have no relevancy and 1 indicates that the documents are identical. This similarity score is useful in determining satisfaction relationships between textual documents.

In addition to vector space retrieval with TF-IDF weighting, several other algorithms are prevalent in information retrieval [4]. Some of these include:

a. LDA – Latent Dirichlet Allocation is a method to determine the topic or mixture of topics into which a phrase, paragraph, or document of text fits. LDA was introduced by Blei, Ng, and Jordan [9] and is a generative probabilistic model. That is, it is a model that randomly generates observed data based on probable word distributions and format. LDA is based on probability distributions from a hierarchical model of the Bayesian distribution:

$$f(x|y) = \frac{f(x,y)}{f(y)} = \frac{f(y|x)f(x)}{f(y)}$$

where f(x) is the probability that event x will occur, f(y) is the probability that event y will occur, and f(y|x) is the probability of y given x. As input, LDA requires the number of topics, k, and alpha and beta parameters indicating f(x) and f(y) that are used in determining topic distribution [9, 51, 78].

b. LSI/SVD – Latent Semantic Indexing (also known as LSA, Latent Semantic Analysis) uses a term-document matrix often built by singular value decomposition (SVD), the factorization of a matrix into three matrices UDV^T where $U^T * U = I$, $V^T * V = I$ and D is a diagonal matrix. This shows a relationship between terms and documents and can be used to compare documents, find term relationships (synonyms – multiple words with the same meaning, and polysemes – single words with multiple meanings), etc. [62].

c. MLS – The Maximum Likelihood Set (MLS) was introduced as a parameter-free technique for estimating a probability mass function (pmf) from sparse data (e.g., an RTM of size MxN with the number of recorded links being far fewer than MxN could be considered sparse). A probability mass function gives the probability that a discrete random variable is equal to a particular value. MLS utilizes the empirical distribution (a distribution over n events with each having a probability of 1/n) and Bayesian estimators [60].

d. NNM (Nonnegative Matrix Factorization) – NNM uses linear algebra and simultaneous analysis of multiple variables to factor a matrix. LSI is one variant of NNM, variations are based on possible ways to factor a particular matrix [65, 66].

Techniques to extract keywords from textual documents may also be useful for satisfaction assessment [64, 76].

2.2 Classification

Next, one should look beyond information retrieval to a related area, textual classification. Classification looks at how to group blocks of text. Much as in information retrieval, classification attempts to discover relationships between data. However, classification techniques do not rely on queries, but rather try to logically group all documents within a corpus or set of documents. Much research has been done on both the algorithms behind classification and on their application. Classification and information retrieval both belong to a larger research area: data mining. Data mining is the process of extracting information from a collection of data or documents.

One of the most frequently used tools for classification and data mining is Weka [123]. Weka is a collection of tools for data mining. Weka algorithms may be used to classify documents, define clusters of related documents, visualize classifications, and develop rules to help associate related documents with each other within a corpus. These methods require training before classifying a data set, but have achieved very good results when a training set of sufficient size that is closely related to a given data set is provided as input.

Previous work in the area of classification includes work on classification methods and their application to particular domains. Hertzum [52] examined classification schemes used during the refactoring of a nation-wide information system. Many refactored requirements of the system were difficult to discern, and the author used classification as a method to analyze changes made and control project scope. Cleland-Huang, Settimi, et al. worked to classify requirements into functional and non-functional (NFR) categories [19].

2.3 Natural Language Processing

Another research area that can be applied to the satisfaction problem is natural language processing (NLP). An understanding of natural language processing techniques, taken from the artificial intelligence area, is necessary. These techniques can be applied to free-form text. While this research focuses on natural language processing for the English language, similar algorithms exist for many other written languages.

Ratnaparkhi examined maximum entropy models for natural language processing applied to ambiguity resolution for his thesis research [95]. Specifically, he looked at POS tagging, parsing, sentence detection, prepositional phrase attachment, and text classification/categorization and found that some ambiguities regarding sentence boundary detection, parsing, POS tagging, and classification that were not handled by previous natural language processing techniques could be addressed with maximum entropy models. The primary limitation of this approach is that a maximum entropy solution does not exist under all circumstances (i.e., when diverging parameters, parameters that fail to converge, or certain combinations of ambiguous and non-ambiguous text are present).

Among the most frequently used tools for natural language processing are the OpenNLP projects [5]. OpenNLP is the name for a group of individual projects and a Java package for natural language processing. A natural language processing library that extends OpenNLP, OpenNLP MaxEnt, has been developed based on Ratnaparkhi's work [6].

The following techniques from the natural language processing domain apply to satisfaction assessment:

a. **Tokenization** – This is the process of splitting text into terms. While tokenization may appear to be a straightforward splitting operation on a string, one must handle hyphenation, decimal points, and punctuation appropriately. Granularity research has looked at ways to most effectively divide text for analysis. Earlier granularity work handled tokenization effectively, as does a tokenization library available in the OpenNLP library [108].

b. **Sentence Splitting** – Sentence splitting works much like tokenization, but on a sentence level rather than on a term level. Once again, care must be used in handling punctuation versus numerical decimal points, abbreviations, etc. [42].

c. **Parts-of-Speech Tagging** – Parts-of-Speech (POS) tagging provides a rudimentary classification of terms as nouns, verbs, adjectives, etc. [13, 21, 107]. This tagging may occur at a word level or may occur at a phrase level (i.e., noun phrase, subject/object of a sentence). Standard POS abbreviations exist and are used in several projects. POS libraries tested include LinkGrammar (JAVA) and OpenNLP (ported to C#). The tested parts of speech library that successfully tagged the most textual terms for this research with the greatest accuracy was the OpenNLP POS library.

d. **Chunking** – Chunking plays a key role in satisfaction work. Rather than simply performing tokenization or sentence splitting, chunking allows one to parse a sentence into meaningful pieces (that can be used for satisfaction assessment) [43]. Chunking libraries are additionally implemented in OpenNLP.

e. **Parsing** – Parsing and POS tagging are related, but not identical. Parsing generates constituent trees that show the grammatical structure of a sentence much like the grammar trees one learns in elementary school [107, 75]. These may or may not be tagged with the proper part of speech.

f. **Stemming –** Stemming increases the accuracy of information retrieval methods by stemming similar words to matching roots. For example, the words "method," "methods," and "methodology" would all stem to their root "method-" for ease in processing [99]. In this research, Porter's Stemming Algorithm is used [91].

g. **Stopword Removal –** Stopword removal is another preprocessing technique used in information retrieval that is useful in this work. Stopwords are words such as "a," "of," and "the" that occur frequently in text but do not add significant additional semantic information. For classification and analysis, these words may be removed in order to improve results [35].

h. **Thesaurus Tagging –** Another technique that is useful in basic text processing is the use of a thesaurus. A thesaurus may be generic or domain-specific. For a generic thesaurus, WordNet will be used [32]. A domain-specific thesaurus of terms has been built for each data set to handle terms that are not found in the generic thesaurus.

2.4 Ontologies

Ontologies from Artificial Intelligence may also be very useful within the satisfaction assessment domain. An ontology is a model of concepts or terms within a particular domain that are mapped to one another. Distance between distinct elements in an ontology provides a measurement of the similarity or relatedness of two elements. For example, if two elements in an ontology are immediately related (are not synonyms, i.e., "book" and "magazine"), but are related through mutual relationships with a common term (one link apart), a direct relationship still exists between the elements. This could mean the elements have an alternate relationship such as an "is-a" relationship (i.e., “vehicle” and “car” – a car “is a” vehicle). A class refers to a set of related elements in an ontology. Each element has a set of attributes (i.e., name, meaning, type, class memberships, etc.). Relations in an ontology show how elements are linked based on their attributes. Ontologies are often conceptualized as webs of elements, with each element being a node in a graph, and relationships being lines connecting nodes. Lines are often labeled with the relationship type.

Formal ontology languages are used to specify elements and relations. The most commonly used language is the OWL Web Ontology Language [23, 85, 110]. Other ontology languages include KIF (Knowledge Interchange Format) [36] and CycL (Cyc Language) [97]. KIF is based on first-order logic and CycL is based on first-order predicate calculus. Websites exist to search existing ontologies. These include Ontaria [84], Swoogle [117], and OntoSelect [14]. One of the most commonly used ontologies is WordNet Similarity [88]. Previous work in ontologies has examined how to measure semantic relatedness of terms and how to use ontologies to resolve ambiguities in word meanings within text [86, 87].

2.5 Ambiguity

A look at another textual area, the study of ambiguity, is useful. There are three basic types of ambiguity in natural language text. Lexical ambiguity occurs when there is insufficient context within the text to narrow its scope to one meaning. Syntactic ambiguity is found in sentences that may be parsed in multiple ways, leading to multiple meanings. Semantic ambiguity is found in sentences with concepts that may have multiple meanings based on the formality, surrounding text, or context of a situation. Semantic ambiguity is frequently called vagueness [122].

In the context of this work, lexical and semantic ambiguity seem to be the most difficult to detect. Syntactic ambiguity may be found when parsing a sentence. Lexical ambiguity relies on a well-thought out list of ambiguous terms and phrases and may be tackled in part by using a thesaurus or measuring relatedness of terms with an ontology. Semantic ambiguity is more difficult to detect, but approaches such as identifying common phrases with semantic ambiguity and building a list of these potentially ambiguous phrases as one provides satisfaction feedback may address semantic ambiguity concerns.

Research approaches to ambiguity have taken one of two primary directions: a) preventing ambiguity from arising by formalizing the requirement writing process (i.e., requirements for writing requirements, or formal language approaches), and b) discovering ambiguity in existing requirement documents with the aim of rewriting ambiguous requirements more clearly.

Rolland and Proix [101] introduced a case tool based on natural language specification with a rules-based approach and semantic net (relationships between phrases). A second similar approach by Rolland and Proix was based on use case creation rather than requirement specification [102]. Hindle attempted to tackle semantic ambiguity in "Acquiring Disambiguation Rules from Text," looking at parse tree structures and applying a rules-based approach [53]. Ratnaparkhi looked at parsing and POS tagging with maximum entropy models and statistical modeling to address syntactic ambiguity [95]. Denger, Berry, and Kamsties looked at using natural language patterns to avoid ambiguity in embedded systems requirements [25].

2.6 Constraint Solving

It is important to distinguish between the software engineering definition of satisfaction used in this research and the definition of satisfaction in another area of computer science – constraint solving. While the general meaning of satisfaction in both software engineering and constraint programming is very similar, the formality required and methods used in determining satisfaction vary widely. In the constraint solving sense, satisfaction occurs when a series of values for variables yields a true statement when substituted into a rule or series of rules [57, 58]. As a simple example, suppose there is a formula or set of formulas, Γ, where $\Gamma = (p \wedge !q)$. Then the truth assignment p = true, q = false would satisfy Γ because (true and not false) would evaluate to true.

Satisfaction in the context of this software engineering work, however, occurs when a set of textual requirements is determined to be fulfilled by a set of textual design elements. Satisfaction in this sense is not as rigid by definition. Text interpretations are subject to a level of ambiguity that is not found in formal constraint solving statements. This means that a confidence value must be attached to satisfaction decisions made in the software engineering satisfaction assessment area. Satisfaction in both senses may be thought of as a search problem over a specific domain. In constraint solving, this domain is the set of possible variable value combinations, but in the software engineering satisfaction assessment area it is the set of possible design element words or phrases that may satisfy words or phrases in a textual requirement.

Constraint solving is not a viable solution to satisfaction in the software engineering context due to the size of the search space in software engineering and the variety of possible words that may be used to describe requirements and design elements. It has been included to address potential confusion of the semantics of the term *satisfaction*. Natural language understanding is not a generally solvable problem.

2.7 Requirements Specification and Validation

Initial work on requirements validation includes research on formal specification. Spivey introduced the Z language for describing computer systems [114]. Z is based on Zermelo-Fraenkel set theory and first order predicate logic [127]. Robinson and Pawlowski examined using development goal monitors to track whether requirements have been met and determine inconsistencies in requirement specifications [100]. Greenspan, Mylopolous, and Borgida looked at requirements modeling language (RML) as a tool for modeling system requirements as objects [41]. Another rules-based approach was presented by Ben Achour in "Guiding Scenario Authoring" [8]. Formality was applied to modeling precise and correct scenarios. Formal methods may be used to verify that requirements have been met by design, but require an expert in formal methods to ensure that the translation from textual requirements to formal requirements and textual design elements to formal design elements is complete and correct. Errors may be made in this translation, leading to incorrect assumptions about the validation of requirements. Additionally, translation to formal methods can be a tedious task and may not scale well to larger projects.

In "Customizable Software Requirements Languages," Ohnishi looked at a visual (VRDL) and textual (X-JRDL) language for specifying requirements, imposing structure to writing requirements and offering visual ways to see whether ambiguity exists. Ohnishi continued his work by examining structured textual requirement writing [82.83]. Goldin and Berry used signal processing methods to identify abstractions without examining surrounding semantics in the AbstFinder program [37].

In addition to work on formal requirements validation, Rayson, Garside, and Sawyer introduced the REVERE tool to assist requirements engineers in exploring documentation and legacy requirements [96]. The tool looked at word frequencies to determine whether documents as a whole are related in a preliminary attempt at requirement understanding. Preliminary work on issues encountered when applying natural language processing (NLP) to requirements has been completed [104]. Ryan looked at the extent to which NLP could be used in requirements validation. He suggested that a rules-based approach could theoretically provide insights, but that NLP would have to serve only as a small step in a larger process.

Durán et al. used XSTL and requirements in XML to automatically verify requirement qualities [30]. To do so, they constructed a requirements management tool, REM. REM analyzed some syntactic quality attributes of requirements, but did not directly address satisfaction.

Related methods also include reading techniques such as scenario-based [116] and perspective-based reading [7, 109]. A variety of requirement defect detection techniques [90] have also been applied that help analysts discover requirements that cannot be satisfied (i.e., inconsistent and omitted) and inconsistencies between requirements and design. These techniques can be used manually by analysts to verify requirements. The manual requirements satisfaction assessment process is very tedious and boring. These techniques, through the use of role-playing and active reading, help analysts focus on potential weaknesses in requirements specification. These techniques, however, do not address the level of effort required or the time necessary to complete manual requirement satisfaction assessment.

Additionally, several researchers have examined requirement quality through design and requirement analysis. Diallo et al. used ScenarioML to create mappings between requirement-level scenarios and system architecture [28]. Alspaugh and Antón examined automation of requirement scenario analysis to determine requirement quality, looking at four primary traits: well-definedness, coverage, minimality, and coherence [3]. Robinson looked at rule-based requirements monitors to dynamically analyze requirements as a system is designed [100]. Letier and van Lamsweerde created a system to analyze partial goal satisfaction to help quantify the impact of partially met requirements due to design constraints [67].

2.8 Tracing

Tracing looks at the creation of a requirements traceability matrix (RTM) that relates requirements to design to code. The first tool that could be considered a tracing tool for requirements and design elements was developed by Pierce in 1978 [89]. This tool maintained a requirements database and could store and record links between requirements and other software documents. Ramesh and Dhar built a model that showed how process knowledge could be maintained throughout the software lifecycle. In this model, Representation and Maintenance of Process Knowledge (REMAP), information about decisions was recorded [93].

Gotel and Finkelstein addressed the requirements traceability problem by undertaking an extensive empirical study and literature review [39, 40]. Their empirical study showed that traceability lacked uniform understanding and the paper proposed a standard definition for traceability. Likewise, Watkins and Neal supported the importance of traceability [121]. Anezin extended this work by developing methods for analysts to use when performing tracing. She also created guidelines regarding the level of understanding and information needed by analysts who are tracing requirements [1].

Much recent work has been completed on information retrieval methods applied to tracing. Antoniol et al. [2] and Marcus and Maletic [73] applied IR methods (Latent Semantic Indexing) to the problem of tracing design to code. Cleland-Huang, et al. [16] used IR to trace non-functional requirements. Hayes et al. investigated the process of tracing and have built a special-purpose requirements tracing tool called RETRO (REquirements TRacing On-target) [44, 48, 50, 124]. Algorithmic techniques that are useful for both assessing requirement satisfaction and tracing include keyword extraction methods [45, 46] and vector space models.

2.9 Automated Grading

One area that is potentially related to the satisfaction assessment problem is automated grading. Automated grading programs check student submissions of homework, exams, etc. for correctness and completeness. Automated grading has typically been applied to questions that have clear solutions (i.e., basic mathematics problems, multiple choice questions, etc.). Taylor and Deever graded punch cards in a batch mode fashion for Oberlin College physics and mathematics courses [33]. In 1965, Forsythe and Wirth developed an automated grader for numerical analysis courses at Stanford University based on student submissions in the BALGOL language on punch cards. In 1983, Rottmann and Hudson developed a multiple choice grading system [103]. Additionally, Postaeraro, Blackwell, and Huddleston [92] used the TECHSCORE program and Lira, Bronfman, and Eyzaguirre [69] used Multitest II for multiple choice grading. Myers used specially formatted cards and a card reader to grade West Virginia Institute of Technology at Montgomery's chemistry lab experiments.

In "Automatic Grading of Student's Programming Assignments," Morris discussed the HoGG process that professors at Rutgers University use to develop and grade student assignments [81]. This system relied on very specific input of assignment and solution. Users of this system tried to develop an unambiguous assignment, gave the assignment to teaching assistants for the course, and refined it to remove the ambiguities as long as the teaching assistants disagreed on the solution.

Kassandra [120] is an automated grading system that was developed for students using Maple [15] and Matlab [80] programs in a scientific computing course along with the Oberon programming language [98]. The system uses syntax checking, but does not check for semantics of student solutions.

To verify the estimated quality of a student program submission in Computer Science and other areas of application, programs that attempt to determine runtime complexity have also been developed [63, 119, 77]. Edwards looked at simultaneously teaching programming and test case execution code, then using the test cases submitted by students to automatically grade assignments. This approach to automated grading alleviates workload on the course grader, but requires that student test suites are well-suited to the assignment. The proposed Web-cat system looked at test case coverage as a completeness measure of the test cases and the validity of results (whether test cases executed as expected) [31]. None of this research explicitly tackles textual satisfaction.

No technology that would be adequately suited to the satisfaction domain has been introduced for automated grading. The approaches taken to date by the automated grading domain require stringently formatted assignment specifications and exhibit many of the weaknesses of formal methods [81].

2.10 Existing Software

Existing programs for software engineering and requirements analysis offer some basic functionality that may be used to address requirement quality. The TIGER PRO tool allows users to maintain a requirements database [118]. Requirements may be assigned to team members, tagged with keywords, rationale, traceability (to parent-child and sibling trace links within a hierarchical data structure), priority, risk, cost, etc. TIGER PRO highlights various "poor words" within a requirement that could indicate ambiguity or other problems with the requirement. Users may also specify "poor words" of their own to highlight throughout the text. A grammar checking tool is present in the program and requirements that do not use the word "shall" are flagged. IBM's Rational Rose tool also enables users to filter requirements based on information contained in individual requirements and shows views of parent-child traceability relationships among documents [94].

Chapter 3

Satisfaction Assessment

Satisfaction assessment has been a manual process to date. The following sections describe the manual satisfaction assessment process and the methods implemented in this research to automate satisfaction assessment.

3.1 Manual Satisfaction Assessment

Human analysts performing satisfaction assessment for a set of requirements and design elements must examine and compare each individual requirement element to each design element. Mentally, analysts break the requirements and design elements into phrases, searching for design element phrases that match key phrases within each requirement. This is a time-consuming, tedious, and error-prone task.

Specifications for large projects, which are very often the projects that require satisfaction assessment, can be thousands of requirements long. Textual design elements may outnumber the requirement specifications they support and may contain much more text than corresponding requirements. One data set used in this research is the CM-1 Subset 1 data set [20]. It is a small subsection of 22 requirements and 52 design elements chosen randomly from the complete CM-1 data set, which contains 220 requirements and 235 design elements for a NASA scientific instrument. Each of the design elements for this particular data set is lengthy and often contains multiple ideas that could be further broken down into multiple individual design elements. Subset 1, when broken into phrases, contains 298 requirement phrases and 2,982 design element phrases. Comparing each requirement phrase to each design element phrase requires 888,636 total mental comparisons. Suppose a human analyst can make one comparison every second. The task would then take roughly 247 hours to complete. Easing this task through automated satisfaction assessment greatly reduces the time and expense required to determine the satisfaction assessment of a set of textual requirements and design elements.

3.2 Automated Satisfaction Assessment

Determining which design elements fully and partially satisfy requirements can be addressed through automated methods. An overview of this work was presented in [54]. Preprocessing steps and four such methods will be described in the following sections.

a) Original Text: The DPU CCM shall implement a mechanism whereby large memory loads and dumps can be accomplished incrementally.
b) Stopword Removal: dpu ccm implement mechanism whereby memory loads dumps accomplished incrementally
c) Stemming: dpu ccm implement mechanic whereby memori load dump accomplish increment
d) Tokenization: [The] [DPU] [CCM] [shall] [implement] [a] [mechanism] [whereby] [large] [memory] [loads] [and] [dumps] [can] [be] [accomplished] [incrementally].
e) Chunking: [The DPU CCM] [shall implement] [a mechanism] [whereby] [large memory loads and dumps] [can be accomplished] [incrementally].
f) Sample Domain-Specific Thesaurus Entries: collect|gather|accumulate memory|storage|disk implement|accomplish|code dpu_hk|housekeeping incrementally|periodically routine|call|function|operation|mechanism ccm|command|control|module
g) Thesaurus Tagging: dpu ccm|command|control|modul| implement|accomplish|code routine|call|funct|operat|mechani wherebi memori|stor|disk load dump accomplish increment|period

Figure 3.1. Textual Preprocessing.

3.2.1 Preprocessing

Preprocessing consists of four stages: stopword removal, stemming, tokenization, and/or chunking and thesaurus tagging. These steps prepare the text of requirements and design elements to be processed by satisfaction algorithms. *Figure 3.1* shows a sample requirement and each of the following preprocessing steps.

3.2.1.1 Stopword Removal. First, stopword removal is performed on all of the text of requirements and design elements. For this work, the Fox stopword list, a list of 841 common English terms, was used [34]. See *Figure 3.1b* for an example of stopword removal. In this example, words such as "a" and "can" have been removed. The Fox stopword list is provided in *Appendix A*.

3.2.1.2 Stemming. Next, stemming takes place. Porter's stemming algorithm is applied [21]. An example of a stemmed requirement is given in *Figure 3.1c*. In this example, words have been stemmed to their roots, i.e., "accomplished" has been stemmed to "accomplish."

3.2.1.3 Tokenization. After stopword removal and stemming, requirements and design elements are broken down into either individual words or phrases. *Figure 3.1d* shows an example of tokenization.

3.2.1.4 Chunking. Along with being broken down into individual tokens, requirements and design elements may be broken down into individual phrases or chunks. For this work, chunking is accomplished by first parsing a sentence and labeling it with parts of speech (parts of speech tags are also saved for later processing use). Based on parsing information, individual phrases can then be identified. For example, a phrase may consist of a noun and all of the adjectives that are used to describe the noun (i.e., "high-speed connection"). *Figure 3.1e* shows an example of a chunked requirement.

3.2.1.5 Thesaurus-Tagging. Finally, words remaining after stopword removal are tagged with synonyms and/or related terms. These may be gathered from one of two places. First, synonyms may be retrieved from a generic thesaurus included with the program. WordNet, a lexical database for the English language that is frequently used in artificial intelligence applications, is used for generic synonym tagging [32]. Additionally, a domain-specific thesaurus may be used. This may be built by users of the system and contains terms that are related within the particular domain. In some cases, the domain-specific thesaurus may contain terms that are not related within the generic thesaurus, but are within the specific domain of the data set (i.e., "spawn" and "boot"). The domain specific thesaurus may also contain domain-specific terms that are not found in the generic thesaurus and their synonyms or related words (i.e., "dpu-hk" and "housekeeping"). *Figure 3.1f* shows an example of a domain-specific thesaurus. Here "collect," "gather," and "accumulate" are synonyms. *Figure 3.1g* shows a requirement that has been tagged with thesaurus entries. For example, "dpu-ccm" is tagged with the synonyms "command," "control," and "module." These are stored in their stemmed form, "dpu ccm|command|control|modul|" (using Porter's stemming algorithm).

3.2.2 Overview of Satisfaction Assessment Methods

At this point, stopwords have been removed from requirements and design elements and stemming has been performed. Requirements and design elements have been broken down into logical components and individual words have been tagged with related and synonymous terms. With this information, it is now possible to make predictions as to which tokens or chunks in design elements satisfy requirements chunks or tokens. These decisions may be made in several ways. Four possible algorithms to determine satisfaction will be described in *Section 3.3*. Satisfaction can be addressed using textual matching (naïve satisfaction assessment), information retrieval techniques, and natural language processing with rules for assessment to calculate textual similarities. Percentage confidence values may be attached to each satisfaction relationship to assist analysts in interpreting and verifying the output of the satisfaction assessment process.

After running the automated satisfaction assessment process on requirements and design text, analysts are provided with a visualization and data on how particular requirements are satisfied. Each part of a requirement that is satisfied by a particular part of a design element is highlighted for ease of verification. Those requirements that do not map to design elements are flagged to be checked manually by an analyst and addressed.

From this point, analysts are in a position to verify the satisfaction assessment with relative ease and confidence. Feedback may be incorporated at this stage in order to improve the assessment automatically, or changes may be made manually. Analysts may perform feedback by correcting all or a subset of requirement-design element chunk pairs in the candidate satisfaction assessment or by adding new requirement-design element chunk pairs that they feel should be included in the satisfaction assessment. From this information, one can then reassess satisfaction of other requirement-design element chunk pairs within the satisfaction assessment and provide an improved candidate satisfaction assessment. Feedback has not yet been investigated and is left as future work.

3.3 Research Approach

The following sections describe possible research approaches to satisfaction assessment. Four algorithms are presented here: naïve satisfaction assessment, TF-IDF satisfaction assessment, the natural language processing rules-based approach, and a combination method using TF-IDF and natural language processing to determine satisfaction assessment.

In many methods for satisfaction assessment, a threshold value is used. These values are typically a numeric breakpoint where all requirement-design element pairs with a similarity score or ranking above or below the threshold are included in the satisfaction assessment returned by RESAT, also called the candidate satisfaction assessment. A similarity score is a measure of the degree to which a requirement and design element chunk pair are related. Similarity scores offer a confidence value for each decision within a satisfaction assessment and are dependent on which satisfaction method is used.

A second method to determine inclusion in a candidate satisfaction assessment is the Top-N method. In this approach, the top N matches in a list of all possible requirement-design element pairs ordered by the similarity score are included in the candidate satisfaction assessment. The Top-N method is frequently used in the tracing domain and is considered a good way to compare results when acceptable threshold values vary for two methods [24].

For satisfaction assessment, Top-N provides an objective measure for research purposes but is not practically useful due to a large number of false positive matches or omissions. The density of correct satisfaction match pairs varies widely for requirement and design element pairs within a given data set. As a result, the Top-N satisfaction match pairs for each requirement-design element pair will either contain a large number of false positives for sparsely matched pairs when the value of N is set to be high, or will omit a large number of correct candidate matches for densely matched pairs when the value of N is set to be low. For this work, threshold-based similarity measures were validated.

3.3.1 Satisfaction Method 1: Naïve Approach

3.3.1.1 Overview. The naïve satisfaction assessment method uses word-by-word comparisons of requirement and design element text to assign a similarity score between phrases within the requirements and design elements.

3.3.1.2 Algorithm. To assess the satisfaction of textual requirements by textual design elements using the naïve satisfaction assessment method, preprocessing steps described above are performed. Stopwords are removed from the text, stemming reduces each remaining word in the requirements and design elements to its root, text for each requirement is broken down into natural language chunks and tokens, and individual tokens are tagged with stemmed thesaurus entries from a generic thesaurus and/or a domain-specific thesaurus.

Naïve satisfaction assessment similarity scores are calculated between pairs of chunks, (cr1, cd2). In this case, cr1 is a requirement chunk in requirement 1, cd2 is a design element chunk that is in design element 2, and requirement 1 is mapped to design element 2 in the RTM for the data set. The similarity score for a requirement-design element chunk pair is calculated based on the number of tokens in stemmed and thesaurus-tagged form that match between the requirement and design element chunks. The similarity score will be the number of matching tokens divided by the total number of tokens. For the two chunks cr1 and cd2, the similarity score for naïve satisfaction is:

$$\text{sim} = \frac{\text{(number of common terms in cr1 and cd2)}}{\text{(number of terms in cr1 + number of terms in cd2)}}.$$

If the pair cr1 and cd2 have a similarity score above a given threshold value (ranging between 0 and 1), then the two are considered a satisfaction match and the pair (cr1, cd2) is included in the candidate satisfaction assessment produced by this method. The entire set of satisfaction match pairs that have similarity scores greater than the threshold value is considered to be a candidate satisfaction assessment for a given data set. For validation purposes, the candidate satisfaction assessment from this method is then compared to an analyst-created answer set (see *Sections 5.6 – 5.8* for more information on answer set construction and data analysis). The overall naïve satisfaction assessment process is shown in *Figure 3.2*. The overall algorithm for naïve satisfaction is as follows:

```
Naïve satisfaction( )
{
Load an RTM for the data set
Load requirement and design element text
Set a threshold for naïve satisfaction method, thresh

For each requirement and each design element
        {
        Perform stopword removal
        Perform stemming
        Chunk text into phrases
        Tokenize text into individual terms
        Tag each term with synonyms
        }

For each requirement i
{
        For each chunk m in requirement i
        {
                For each design element j that is mapped
                to requirement i in the RTM
                {
                        For each chunk n in design element j
                        {
                                Calculate number of terms, numMatches, that chunk
                                m has in common with chunk n
                        }

                        Calculate total number of terms in chunk m
                        and all chunks n, totalNumTerms

                        PercentageMatch = numMatches/totalNumTerms

                        if(PercentageMatch > thresh)
                        {
                                Mark chunk m and chunk n as a candidate
                                satisfaction mapping pair, with confidence
                                PercentageMatch
                        }
                }
        }
```

}
}

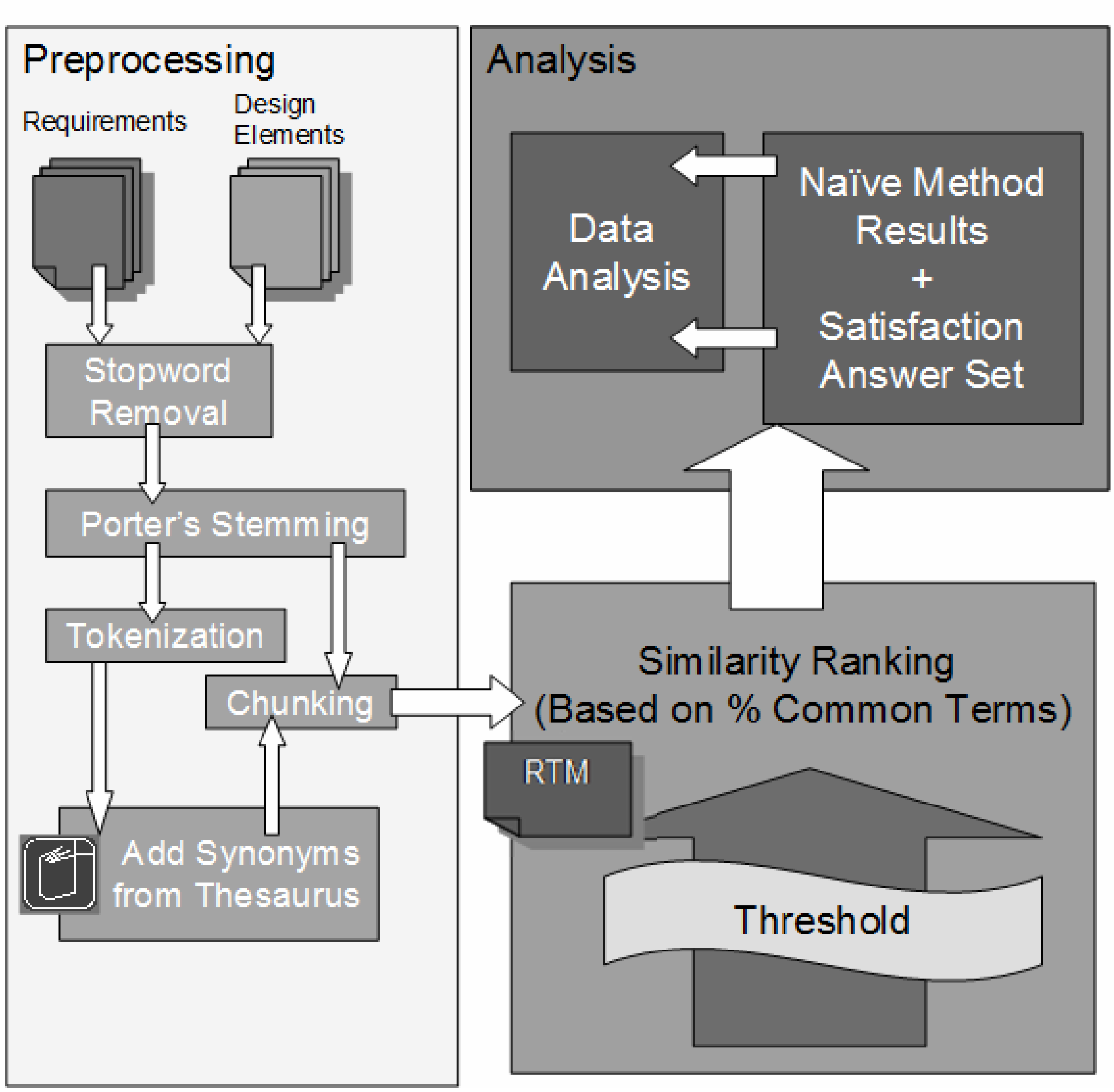

Figure 3.2. Naïve Satisfaction Assessment Process.

3.3.2 Satisfaction Method 2: Information Retrieval Approach

3.3.2.1 Overview. Vector space retrieval with TF-IDF weighting provides a method to measure the similarity between textual elements. This similarity score, along with threshold cutoff values, may be used to measure the degree to which chunks within a requirement are related to chunks within a design element.

3.3.2.2 Algorithm. Vector space retrieval with TF-IDF weighting provides a method to measure the similarity between textual elements. These rankings can be used in the satisfaction assessment process. To assess the satisfaction of textual requirements by textual design elements using vector space retrieval, one breaks the requirement text for each requirement into natural language chunks. For this research, chunks are determined using the OpenNLP chunking library, described earlier [5]. The same process is repeated with the corresponding design elements. Next, each chunk undergoes a series of preprocessing steps. First, stopwords are removed [35]. Next, Porter's stemming algorithm is applied [91]. Finally, words are tagged with thesaurus entries from a generic thesaurus and/or a domain-specific thesaurus. This process is shown in *Figure 3.3*.

Each requirement and design element chunk is considered an individual document within the document collection for TF-IDF. TF-IDF similarity scores are calculated between pairs of chunks, (cr1, cd2), where cr1 is a requirement chunk in requirement 1, and cd2 is a design element chunk that is in design element 2, where requirement 1 is mapped to design element 2 in the RTM for the data set. If the pair cr1 and cd2 have a similarity score above a given threshold value (ranging between 0 and 1), then the two are considered a satisfaction match and the pair (cr1, cd2) is included in the candidate satisfaction assessment produced by this method. The entire set of satisfaction match pairs that have similarity scores greater than the threshold value is considered to be a candidate satisfaction assessment for a given data set. This candidate satisfaction assessment may be compared to a true answer set for validation and data analysis purposes. See *Sections 5.6 – 5.8* for more information on answer set construction and data analysis. The algorithm for TF-IDF satisfaction assessment is as follows:

```
TF-IDF satisfaction( )
{
Load an RTM for the data set
Load requirement and design element text
Set a threshold for TF-IDF satisfaction method, thresh

For each requirement and each design element
        {
        Perform stopword removal
        Perform stemming
        Chunk text into phrases
        Tokenize text into individual terms
        Tag each term with synonyms
        }

For each requirement i
{
        For each chunk m in requirement i
        {
                For each design element j that is mapped
                to requirement i in the RTM
                {
```

```
                    For each chunk n in design element j
                    {
                            Calculate TF-IDF similarity measure between
                            chunk m and chunk n, sim

                            if(sim > thresh)
                            {
                                    Mark chunk m and chunk n as a candidate
                                    satisfaction mapping pair, with confidence
                                    sim
                            }
                    }

            }
        }
    }
}
```

3.3.3 Satisfaction Method 3: Natural Language Processing Rules-Based Approach

3.3.3.1 Overview. Natural language processing provides information about textual artifacts. Blocks of freeform text may be divided into individual sentences (sentence splitting), broken into individual terms (tokenization), or broken into individual phrases (chunking). The parts of speech of each term or token within a textual requirement or design element may be determined through parts of speech tagging algorithms. Parsing reveals information about sentence structure.

From this collection of information about text, one is able to determine a satisfaction assessment between a set of requirements and design elements. Rules may be created that help identify requirement-design element chunk pairs that should be included in a candidate satisfaction assessment.

For example, consider the requirement, "the system shall allow incremental processing of information from the DPU-CCM," and the design element "First, the DPU-CCM will transmit information to the TMALI CSC. Next, that information will be broken down into individual packets and transmitted to subsystems accordingly." The word "incremental" from the requirement may not map directly to the terms "first" and "next" within the design element, but a human analyst may notice this relationship. Through the application of natural language processing algorithms, one will see that "incremental" is an adjective describing processing. The terms "first" and "next" act as transitional phrases within the sentence. One example of an NLP rule that could be applied is: "If a requirement establishes that something is to be done or is described as incremental, piece-wise, step-by-step, or any synonym of these and subsequent design element(s) describe steps or contain a series of transitional phrases, then the incremental nature of the requirement is captured in the subsequent design element(s)." This would then return matches between "incremental" and "first," and between "incremental" and "next."

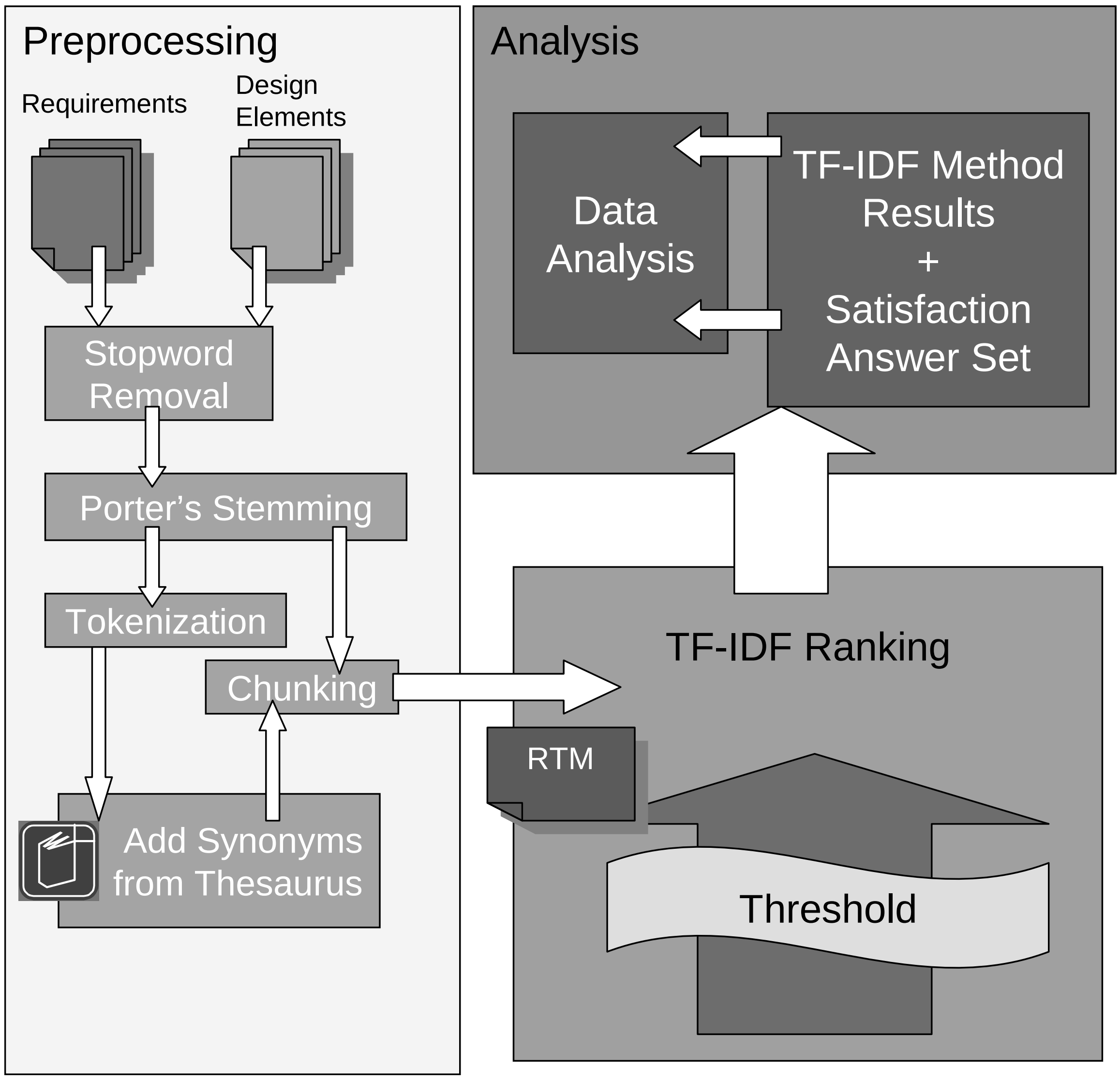

Figure 3.3. TF-IDF Satisfaction Assessment Process.

Many such rules exist within the English language. Through empirical analysis of a subset of requirements and design elements in a data set, one is be able to capture NLP rules that capture common relationships between requirements and design elements within a domain. As shown in *Figure 3.4*, in order to perform NLP rules-based satisfaction assessment, regular preprocessing steps are performed on requirements and design elements (stopword removal, stemming, tokenization, chunking, and thesaurus tagging). Then, the corresponding original text is parsed and tagged with parts of speech. NLP rules are applied and the resulting satisfaction assessment pairs are output for analysis. Finally, the candidate satisfaction assessment returned may be compared to a true satisfaction answer set for validation and data analysis. See *Sections 5.6 – 5.8* for more information on answer set construction and data analysis.

3.3.3.2 Rules. A rule specification interface was created within RESAT to create and maintain rule sets. Analysts may also create rule sets manually using a text editor. Rules sets may be processed individually or in batch mode. In batch rule processing mode, a file containing a list of rule sets is loaded. Each rule set is processed individually for each of the threshold values specified.

Rules can be based on any permutation of grammatical tagging and placement. A rule is specified in the following format:

> [Element1Position]|[Element1PartofSpeech]|[Element1Type]|[Element2Position]|
> [Element2PartofSpeech]|[Element2Type]|[MinSimilarity]|[Confidence]|[Enabled].

For example, the rule:

Any|NP|RE|First|VP|DE|45|20|True

corresponds to an active rule that specifies if any noun phrase in a requirement chunk is at least a 45 percent match with the first verb phrase in a design element, then the requirement chunk and design element chunk should be paired with 20% confidence.

Possible values for each of the elements listed above are:

> [Element{1,2}Position] = { Any, None, First, Second, …Nth }
>
> [Element{1,2}PartofSpeech] = {Noun Phrase (NP), Verb Phrase (VP), Adjective Phrase (ADJP), Adverb Phrase (ADVP), Conjunction (CONJP), Interjection (INTJ), List Marker (LST), Prepositional Phrase (PP), Particle (PRT), Word (WORD)}
>
> [Element{1,2}] = {RE, DE} where RE is a high-level element (requirement) and DE is a low-level element (design element).
>
> [MinSimilarity] = n, where n is a percentage value from 0.0 to 100.00.
>
> [Confidence] = n, where n is a percentage value from -100 to 100, including 0. If the user specifies a confidence of 0, the actual similarity value will be used as the confidence. If the user specifies a negative confidence (i.e., -1, -2, -n etc.), the recorded confidence will be |n|*the actual similarity value, where n is the confidence value specified by the user.
>
> [Enabled] = { True, False } where “False” indicates that a rule is disabled and “True” indicates that it is included in satisfaction assessment processing.

The parts of speech tagging provided by OpenNLP does not have a one-to-one correspondence to the tagging system used by RESAT. OpenNLP uses the University of Pennsylvania Penn Treebank Tagging system [75]. *Table 3.1* indicates the tagging correlations made for this research.

Table 3.1. RESAT and Penn Treebank Parts of Speech Tags.

Part of Speech (RESAT Tag)	**Penn Treebank Tags**
Noun Phrase (NP)	NN, NNP, NNPS, NNS, PRP, WP
Verb Phrase (VP)	VB, VBD, VBG, VBN, VBP, VBZ
Adjective Phrase (ADJP)	JJ, JJR, JJS
Adverb Phrase (ADVP)	RB, RBR, RBS
Conjunction (CC)	CC
Interjection (INTJ)	UH
List Marker (LST)	LS
Prepositional Phrase (PP)	IN
Particle (PRT)	RP
Word (WORD)	All

During testing phases of this research, 358 sets of rules at 18 threshold values were considered. These are specified in *Appendix F*. Rules were determined by manually inspecting a small subset of one of the data sets and by analyzing textual patterns in requirements and design elements that were not used as input data in this research.

3.3.3.3 Algorithm. To assess the satisfaction of textual requirements by textual design elements using the natural language processing rules-based approach, one breaks the requirement text for each requirement into natural language chunks. For this research, these are determined using the OpenNLP chunking library described above [5]. The same process is repeated with the corresponding design elements.

Next, each chunk undergoes a series of preprocessing steps. First, stopwords are removed [35]. Next, Porter's stemming algorithm is applied [91]. Finally, words are tagged with thesaurus entries from a generic thesaurus and/or a domain-specific thesaurus.

Each requirement and design element chunk pair (cr1, cd2), as defined above, is considered. Each defined rule is processed and the confidence value associated with that rule is added to a total similarity weight for the requirement-design element chunk pair. For similarity calculations, the Kuhn-Munkres algorithm with Levenshtein distance was used [68][70]. Options to use the TF-IDF and naïve similarity measures are also available.

Finally, the similarity weights for each of the pairs are compared to a global threshold value. If the weight for a requirement-design element chunk pair is greater than the threshold, that pair is included in the final candidate satisfaction assessment.

The algorithm for NLP rules-based satisfaction assessment is as follows:

```
NLP satisfaction( )
{
Load an RTM for the data set
Load requirement and design element text

For each requirement and each design element
        {
        Perform stopword removal
        Perform stemming
        Chunk text into phrases
        Tokenize text into individual terms
        Tag each term with synonyms
        Tag each term and chunk with parts of speech information
        }

Load or specify user-defined and standard rules for satisfaction assessment into a
rules set, rules

For each requirement i
{
        For each chunk m in requirement i
        {
                For each design element j that is mapped
                to requirement i in the RTM
                {
                        For each chunk n in design element j
                        {
                                For each rule r in rules
                                        {
                                                if(r holds true for chunks m and n)
                                                {
                                                        Mark chunk m and chunk n
                                                        as a candidate satisfaction
                                                        mapping pair, with
                                                        confidence provided by rules
                                                        assessment
                                                }

                                        }
```

```
                    }

                }
            }
        }

        For each requirement i
        {
            For each chunk m in requirement i
            {
                For each design element j that is mapped
                to requirement i in the RTM
                {
                    For each chunk n in design element j
                    {

                    If the weight for the requirement chunk-design element
                    chunk pair is greater than the threshold value specified, add
                    this pair to the candidate satisfaction assessment

                    }
                }
            }
        }

        }
```

3.3.3.4 Possible Rules and Rule Sets.

Extensive analysis beyond the results presented in this dissertation body has been performed on the rules-based approach for satisfaction assessment. The rules and rule sets validated are listed in *Appendix F*. These represent a subset of all possible rules that can be specified with RESAT.

3.3.3.4.1 The Rule Space. A RESAT rule can be created with 6 degrees of freedom (element 1 position, element 2 position, element 1 part of speech, element 2 part of speech, minimum similarity, and confidence). *Table 3.2* shows the possible input values for each of these degrees.

Table 3.2. Possible Rule Values.

Factor	Range of Values
Element 1 Position	{ Any, First, Second, … Nth}
Element 2 Position	{ Any, First, Second, … Nth}
Element 1 Part of Speech	{ NP, VP, ADJP, ADVP, CONJP, INTJ, LST, PP, PRT, WORD }
Element 2 Part of Speech	{ NP, VP, ADJP, ADVP, CONJP, INTJ, LST, PP, PRT, WORD }
Minimum Similarity	0.0 – 100.0
Confidence	-100.0 to 100.0, including 0

To calculate the size of the rule space, the following assumptions were made:

- A requirement or design chunk contains at most 10 tokens that have the same part of speech,
- Adequate similarity test coverage can be obtained if one looks at each percentile of similarity (1% similarity, 2% similarity… 100% similarity),
- A minimum similarity percentage of 0 is meaningless in assisting analysts with satisfaction assessment because all possible matches will be returned, and
- Adequate confidence test coverage can be obtained if one looks at each percentile of similarity (1% similarity, 2% similarity… 100% similarity) at the actual weight as the confidence value, and at "2,3,4…100x" the actual similarity (weighting confidence as n times the actual similarity is useful for weighting some rules more heavily).

Given these assumptions, *Table 3.3* shows the number of possible settings for each of the rule factors.

Table 3.3. Number of Possible Rules.

Factor	Number of Possible Values
Element 1 Position	11
Element 2 Position	11
Element 1 Part of Speech	10
Element 2 Part of Speech	10
Minimum Similarity	100
Confidence	200
Total Number of Possible Rules:	**242,000,000 rules**

Based on the assumptions listed above, there are 242,000,000 possible rules that one can specify through the RESAT interface.

3.3.3.4.2 The Rule Set Space. Given the information above about possible rules, one may also determine the rule set space. Rule sets consist of one or more rules. If one were to choose k rules from the set of all possible rules (where n is the size of the set of all possible rules or 242,000,000), then the number of possible k-sized rule sets would be:

$$\binom{n}{k} = \frac{n \cdot (n-1) \cdots (n-k+1)}{k \cdot (k-1) \cdots 1}.$$

Table 3.4. Number of Possible K-Element Rule Sets.

K	Number of Possible Rule Sets
1	242,000,000
2	2.9281999879e+16
3	2.36208130405133e+24
4	1.42905917123545e+32
5	6.91664627445483e+39
6	2.78971393972473e+47
7	9.64443938107287e+54
8	2.9174428283857e+62
9	7.84467934588663e+69
10	1.89841233110245e+77

Table 3.4 shows the number of possible rule sets of k size for various values of k. Each of these rule sets can also be tested against a threshold value ranging from 0 to n. The threshold is used to determine the total minimum weight required to include a requirement-design element chunk pair in the final candidate satisfaction assessment and is compared against the sum of all weights returned for all rules run on that requirement-design element chunk pair.

3.3.3.4.3 Rule Families. Results presented in the main body of this document are limited in scope to rule sets containing a single rule. Multiple-rule sets and other test runs are documented in *Appendix F*. These rules were divided into four rule families, based on the parts of speech they test. The four rule families are described in *Table 3.5*.

Table 3.5. Rule Families.

Rule Family	Description	Rules
RF1	Rules based on core parts of speech (noun phrases and verb phrases)	d_nounphrase r_nounphrase d_verbphrase r_verbphrase
RF2	Rules based on descriptive parts of speech (adjective phrases and adverb phrases)	d_adjectivephrase d_adverbphrase r_adjectivephrase r_adverbphrase
RF3	Rules based on combinatorial parts of speech (conjunctions and list markers)	d_conjunction d_list r_conjunction r_list
RF4	Rules based on auxiliary parts of speech (interjections, particles, and prepositions)	d_interjection d_particle d_preposition r_interjection r_particle

3.3.4 Satisfaction Method 4: Combination Satisfaction Assessment: Natural Language Processing Rules-Based and TF-IDF Approach

3.3.4.1 Overview. While no single rule set analyzed achieved the recall of the Information Retrieval approach, it was noted that the rules-based approach returned several correct answer set mappings that were not found through the Information Retrieval approach. Thus, a fourth method was developed that combined the TF-IDF and rules-based approaches.

The Combination Approach first determines the satisfaction assessment of a data set using TF-IDF (the Information Retrieval approach). Next, the satisfaction assessment of the data set is determined using the Rules-Based approach. Finally, the answer sets are combined to create a final answer set. See *Sections 5.6 – 5.8* for more information on answer set construction and data analysis. This process is shown in *Figure 3.5*.

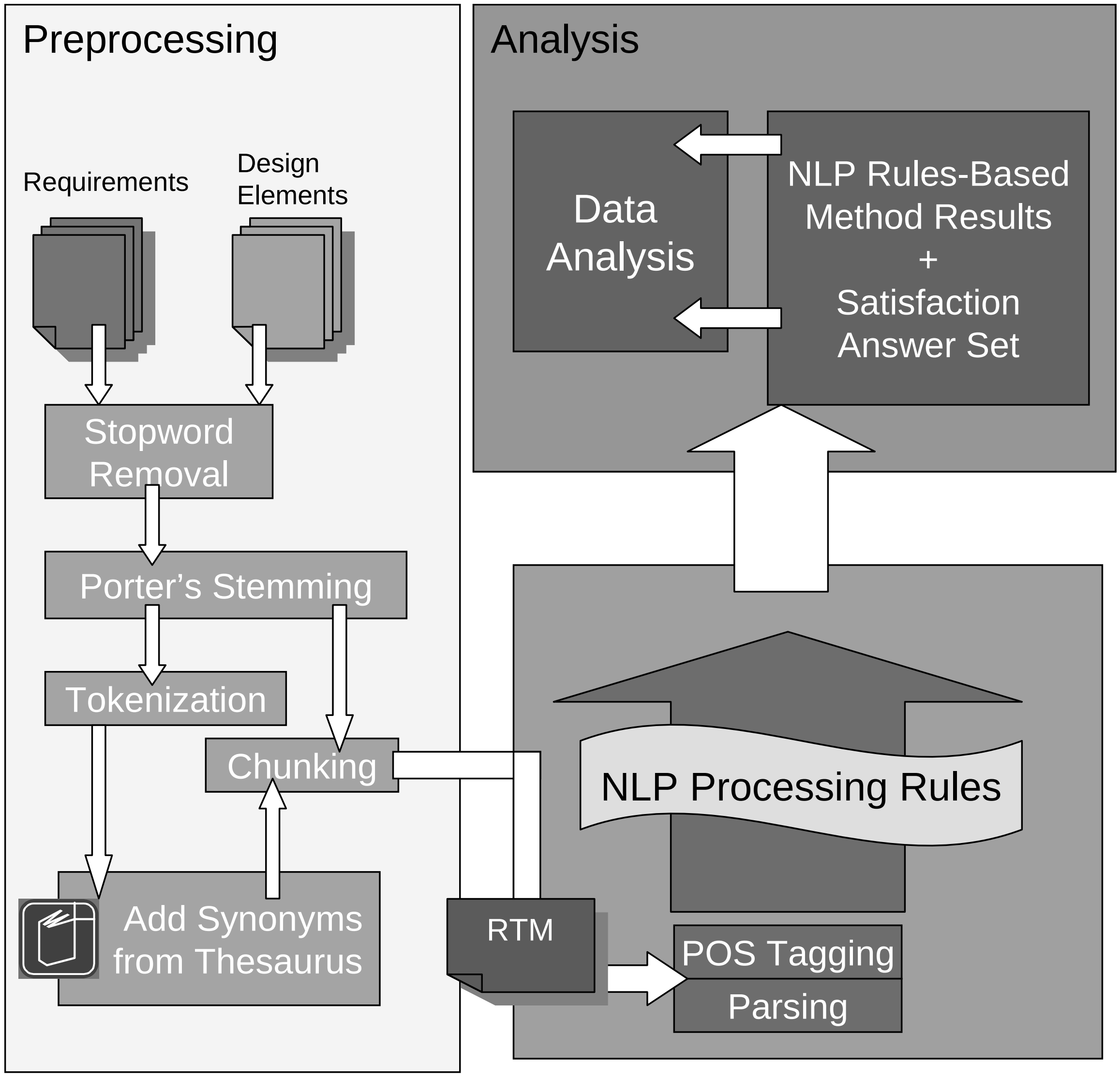

Figure 3.4. NLP Rules-Based Satisfaction Assessment Process.

3.3.4.2 Algorithm. The algorithm for the Combination Approach is as follows:

```
NLP+TF-IDF satisfaction( )
{
Load an RTM for the data set
Load requirement and design element text
Set a threshold for the TF-IDF method

For each requirement and each design element
        {
        Perform stopword removal
        Perform stemming
```

```
    Chunk text into phrases
    Tokenize text into individual terms
    Tag each term with synonyms
    Tag each term and chunk with parts of speech information
    }

Load or specify user-defined and standard rules for satisfaction assessment into a
rules set, rules

For each requirement i
{
    For each chunk m in requirement i
    {
        For each design element j that is mapped
        to requirement i in the RTM
        {
            For each chunk n in design element j
            {
                For each rule r in rules
                    {
                        if(r holds true for chunks m and n)
                        {
                            Mark chunk m and chunk n
                            as an NLP candidate
                            satisfaction mapping pair,
                            with confidence provided by
                            rules assessment
                        }

                    }

            }

        }
    }
}

For each requirement i
{
    For each chunk m in requirement i
    {
        For each design element j that is mapped
        to requirement i in the RTM
        {
            For each chunk n in design element j
            {
```

```
                        Calculate TF-IDF similarity measure between
                        chunk m and chunk n, sim

                        if(sim > thresh)
                        {
                                Mark chunk m and chunk n as a TF-IDF
                                candidate satisfaction mapping pair, with
                                confidence sim
                        }
                }

            }
        }
    }


    For each requirement i
    {
        For each chunk m in requirement i
        {
            For each design element j that is mapped
            to requirement i in the RTM
            {
                For each chunk n in design element j
                {

                If the weight for the requirement chunk-design element
                chunk pair is greater than the threshold value specified in
                either the NLP candidate answer set or the TF-IDF
                candidate answer set, add this pair to the candidate
                satisfaction assessment

                }
            }
        }
    }

}
```

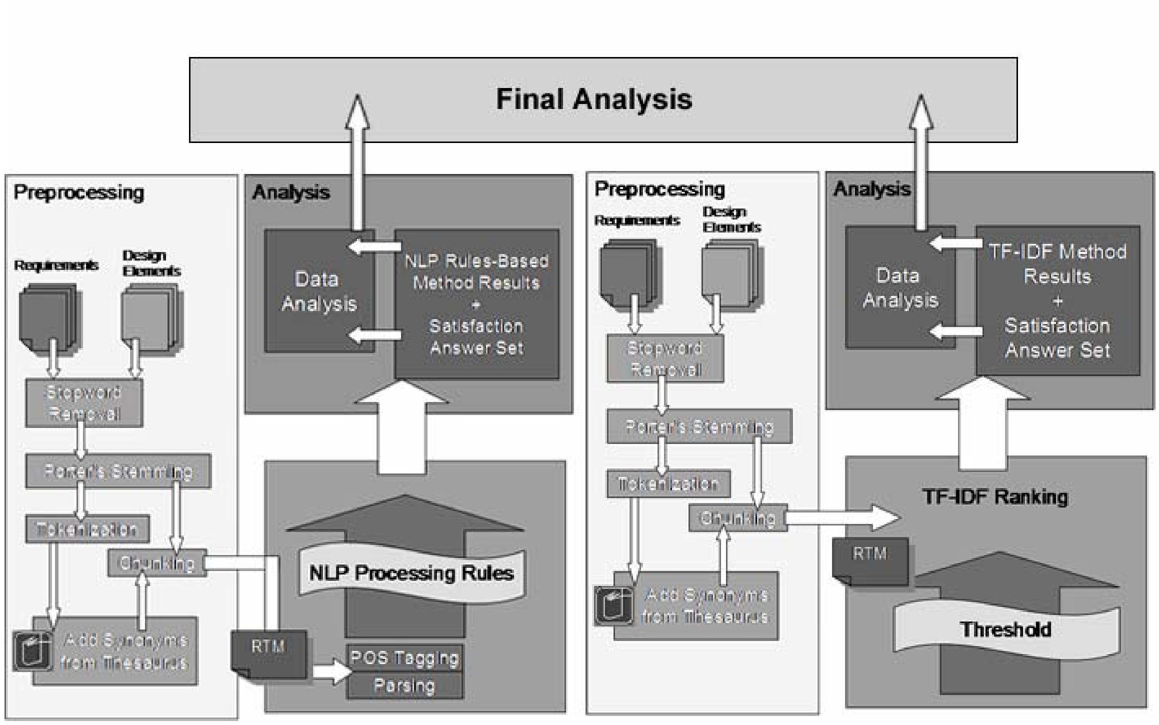

Figure 3.5. Combination Satisfaction Assessment Process.

Chapter 4

REquirements SATisfaction (RESAT)

The RESAT tool is described in this section.

4.1 RESAT Overview

To support the process of automated satisfaction assessment, a satisfaction assessment tool, RESAT (REquirements SATisfaction), has been developed (see *Appendix B* for screenshots). The tool offers various methods for satisfaction assessment, offers options to display candidate satisfaction assessments, and saves output for later verification.

RESAT currently has algorithms implemented to perform naïve and TF-IDF satisfaction assessment methods. The tool will allow users to show markup with sentence splitting, preprocessing, tokenization, chunking, and parts of speech tagging. Users may also choose to highlight orphan design elements (those without related requirements in a given RTM) or to highlight requirements that are not addressed by design elements. Users may display the provided RTM and display a candidate satisfaction assessment. Requirement-design element chunk pairs are highlighted in matching colors within the display. An answer set creation tool is integrated to help analysts create manual satisfaction assessment. RESAT also offers an analysis mode. In analysis mode, analysts can load a true answer set for a data set and compare various candidate answer sets. RESAT will perform analysis on the set and gather the metrics described in *Section 5.3* (Recall, Precision, Selectivity, Number of Corrections, F-measure, etc.). RESAT also operates in batch mode. In batch mode, analysts can create candidate answer sets for various threshold values and various rule sets without taking the time to set up each experiment individually.

The RESAT tool loads plaintext requirements and design elements and provides a series of options that enable users to perform preprocessing steps, natural language processing, and information retrieval techniques on the text. The final output is a version of the input with markup to indicate satisfaction assessment results. Internal data structures for primary data-holding classes within RESAT are shown in *Appendix C*. Screenshots of the RESAT tool are shown in *Appendix B*.

The RESAT tool was written in a combination of C# and Java and runs on the Windows platform. It contains roughly 10,500 lines of code, excluding external libraries.

4.2 RESAT Input Files

Numerous input file options are available for the RESAT tool. These are described in the following sections.

4.2.1 RTM File

The requirements traceability matrix, as defined above, indicates related high level and low level elements. For example, in the RTM shown in *Figure 4.1*, r1.txt is related to d1_1.txt, d1_2.txt, d1_3.txt, and d1_4.txt.

Figure 4.1. Example RTM File.

```
%
r1.txt   d1_1.txt   d1_2.txt   d1_3.txt   d1_4.txt
%
r2.txt   d2_1.txt   d2_2.txt   d2_3.txt
%
r3.txt   d3_1.txt   d3_2.txt   d3_3.txt
%
r5.txt   d5_1.txt   d5_2.txt   d5_3.txt   d5_4.txt
%
r7.txt   d7_1.txt   d7_2.txt   d7_3.txt
%
r9.txt   d9_1.txt   d9_2.txt   d9_3.txt   d9_4.txt
%
r11.txt   d11_1.txt   d11_2.txt   d11_3.txt
%
r13.txt   d13_1.txt   d13_2.txt   d13_3.txt   d13_4.txt
%
r15.txt   d15_1.txt   d15_2.txt
%
r17.txt   d17_1.txt   d17_2.txt   d17_3.txt   d17_4.txt
```

4.2.2 Batch Threshold File

A batch threshold file, as shown in *Figure 4.2*, can be loaded to process data sets at various threshold values. When a batch threshold file is loaded, RESAT is in batch threshold mode and all assessments will be calculated using each of the given threshold values. Batch threshold values may be cleared and RESAT may be returned to normal processing (non-batch) mode by selecting “File > Clear Batch Threshold Values” from the main RESAT menu bar.

Figure 4.2. Example Batch Threshold File.

```
.01
.02
.03
.04
.05
.06
.07
.08
.09
.1
.2
.3
.4
.5
.6
.7
.8
.9
```

4.2.3 Rule Set File

A rule set is a list of rules to be applied when determining a satisfaction mapping.

A rule is specified in the following format:

[Element1Position]||[Element1PartofSpeech]||[Element1Type]||[Element2Position]||[Element2PartofSpeech]||[Element2Type]||[MinSimilarity]||[Confidence]||[Enabled]

where each rule element is defined as follows:

> [ElementNPosition] specifies a required position for a token, relative to the beginning of the containing element chunk. These are indexed beginning with 0.
>
> [ElementNPartofSpeech] specifies the required part of speech as tagged by the NLP tagger for the token. This will take into consideration both the individual token tags and the tags of clauses/phrases containing the token. For example, suppose a noun phrase contains a noun and adjective. If a rule requires that the part of speech be a noun phrase, both the noun and adjective will be considered for satisfaction.
>
> [ElementNType] specifies whether this is a high level element (RE - Requirement Element) or a low level element (DE – Design Element).

[MinSimilarity] specifies the lowest similarity between two chunks, non-inclusive, that will be considered a match.

[Confidence] specifies the confidence value to record for matches.

[Enabled] specifies whether a rule will be considered when performing Rules-Based satisfaction assessments.

Possible values for each of the elements listed above are defined in *Section 3.3.3.4*. Rules are listed one rule per line to form rule sets.

In the example shown in *Figure 4.3*, the first rule specifies that if the first noun phrase in a requirement chunk is tagged as a noun phrase and the first element in a design element chunk is tagged as a noun phrase and the two chunks have a similarity measure of at least 30 percent, then a match with 25% confidence will be recorded. The rule is enabled. Rule sets are generated when users specify a set of rules from the RESAT rule specification interface and export the rules (*Appendix B*). Analysts may also edit and create rule sets as text files in the format shown in *Figure 4.3*.

Figure 4.3. Example Rule Set File.

```
0|NP|RE|0|NP|DE|30|25|True
0|VP|RE|0|VP|DE|30|25|True
0|VP|RE|0|NP|DE|30|25|True
0|NP|RE|0|VP|DE|30|25|True
0|ADJP|RE|0|ADJP|DE|30|25|True
0|VP|RE|0|VP|DE|30|25|True
0|VP|RE|0|ADJP|DE|30|25|True
0|ADJP|RE|0|VP|DE|30|25|True
0|ADJP|RE|0|ADJP|DE|30|25|True
0|ADVP|RE|0|ADVP|DE|30|25|True
0|ADVP|RE|0|ADJP|DE|30|25|True
0|ADJP|RE|0|ADVP|DE|30|25|True
0|NP|RE|0|NP|DE|30|25|True
0|ADVP|RE|0|ADVP|DE|30|25|True
0|ADVP|RE|0|NP|DE|30|25|True
0|NP|RE|0|ADVP|DE|30|25|True
```

4.2.4 Batch Rule Set File

Batch rule set files are used to run a group of rule set tests. As mentioned before, the rules contained in each of the filenames listed in the batch rule set file below would be run as a separate experiment at the preset threshold value or set of threshold values in batch threshold mode. *Figure 4.4* shows an example batch rule set file.

Figure 4.4. Example Batch Rule Set File.

```
C:\finalRulesets\sim_10percent\23.txt
C:\finalRulesets\sim_10percent\24.txt
C:\finalRulesets\sim_10percent\25.txt
C:\finalRulesets\sim_10percent\26.txt
C:\finalRulesets\sim_10percent\27.txt
C:\finalRulesets\sim_10percent\28.txt
C:\finalRulesets\sim_20percent\1.txt
C:\finalRulesets\sim_20percent\2.txt
C:\finalRulesets\sim_20percent\3.txt
C:\finalRulesets\sim_20percent\4.txt
C:\finalRulesets\sim_20percent\5.txt
C:\finalRulesets\sim_20percent\6.txt
C:\finalRulesets\sim_20percent\7.txt
C:\finalRulesets\sim_20percent\8.txt
C:\finalRulesets\sim_20percent\9.txt
C:\finalRulesets\sim_20percent\10.txt
C:\finalRulesets\sim_20percent\11.txt
C:\finalRulesets\sim_20percent\12.txt
C:\finalRulesets\sim_20percent\13.txt
C:\finalRulesets\sim_20percent\14.txt
C:\finalRulesets\sim_20percent\15.txt
C:\finalRulesets\sim_20percent\16.txt
C:\finalRulesets\sim_20percent\17.txt
C:\finalRulesets\sim_20percent\18.txt
C:\finalRulesets\sim_20percent\19.txt
C:\finalRulesets\sim_20percent\20.txt
C:\finalRulesets\sim_20percent\21.txt
```

4.2.5 RESAT Settings File

The RESAT settings file contains paths to various system directories and other input files. The settings file format are shown in *Figure 4.5* and an example settings file is shown in *Figure 4.6.*

Figure 4.5. RESAT Settings File Format.

```
Full Path to OpenNLP Models Directory
Full Path to Thesaurus File
Full Path to Stopword File
Full Path to High Level Element Directory
Full Path to Low Level Element Directory
Full Path to Requirements Traceability Matrix
```

Figure 4.6. Example RESAT Settings File.

```
C:\Users\Ashlee\Documents\ThesisProjects\Projects\RESAT008\bin\Debug\OpenNLP\Models\
C:\Users\Ashlee\Documents\ThesisProjects\Projects\RESAT008\bin\Debug\domainThesaurus.txt
C:\Users\Ashlee\Documents\ThesisProjects\Projects\RESAT008\bin\Debug\stopword_fox.dat
C:\Users\Ashlee\Documents\ThesisProjects\datasets\gantt\withoutMethod\high
C:\Users\Ashlee\Documents\ThesisProjects\datasets\gantt\withoutMethod\low
C:\Users\Ashlee\Documents\ThesisProjects\datasets\gantt\wenbin_rtm2.txt
```

4.2.6 Answer Set File

The answer set file contains the true satisfaction mapping, or answer set, for a given data set. It is given in the format shown in *Figure 4.7*.

Figure 4.7. Answer Set File Format.

```
NumberOfHighLevelElementChunks NumberOfLowLevelElementChunks

HighLevelChunkNumber – LowLevelChunkNumber
HighLevelChunkNumber – LowLevelChunkNumber LowLevelChunkNumber
HighLevelChunkNumber – LowLevelChunkNumber
```

The answer set file shown in *Figure 4.8* is for a data set containing 199 requirement element chunks and 355 design element chunks, and requirement chunk 0 maps to design element chunk 308.

Figure 4.8. Example Answer Set File.

```
199 355
0 - 308
1 - 309 324 331 340 347 356 363
2 -
3 -
4 -
5 - 329 345
6 -
7 - 309 324 331 340 347 356 363
8 -
9 -
10 -
11 - 321
12 - 321
13 -
14 - 361
15 - 199 202 207 210 218 219 223
16 -
17 -
18 -
19 - 202 210 223
20 -
21 -
22 - 228
23 -
24 -
25 -
26 -
27 -
28 - 215
29 - 216
30 -
31 - 199 207 218 219
32 - 251 256 261
33 - 252
```

4.2.7 RESAT Thesaurus File

The thesaurus file is used to indicate related terms. It is sometimes useful to insert antonyms as well as synonyms in the thesaurus file. For example, a requirement may be "subsystem 1 will send the log file to dram memory," and the corresponding design element may be "dram memory will receive the log file from subsystem 1." In this case, it would be useful if 'send' and 'receive' were matched through the thesaurus.

It may also be useful to include separate entries that contain the same thesaurus terms. For example, "human" might relate to "resource" for a project planning tool and "server" might relate to "resource." "Human" and "server" should not be linked, so the following two entries should be created:

human|resource
server|resource.

Thesaurus entries are delimited with the bar symbol ('|'). Thesaurus entries are communicative. That is, the following two entries are equivalent and redundant:

human|resource
resource|human.

The thesaurus may contain more than two terms per entry. In this case, the entry will be the equivalent of the set of all possible pairs of terms taken two at a time:

dependencies|assignment|relationship = { dependencies|assignment , assignment|relationship, dependencies|relationship }
and also implied by default are { dependencies|dependencies, assignment|assignment, and relationship|relationship }.

Figure 4.9 shows an example thesaurus file.

Figure 4.9. Example Thesaurus File.

```
complete|allocated
duration|time
change|use
accordingly|automatically
start|begin
date|time
task|subtask
indicate|display
indicated|evaluated
dependencies|assignment|relationship
```

4.3 RESAT Output

After an analyst runs RESAT on their data set, one or more candidate satisfaction assessments will be generated (with the number of candidate satisfaction assessments dependent upon batch settings). The candidate satisfaction assessment file contains a candidate satisfaction assessment for a given data set and input file set. The top of the file contains a header with commented information on how the candidate answer set was generated. The candidate satisfaction assessment file is given in the format shown in *Figure 4.10*.

Figure 4.10. Candidate Satisfaction Assessment File Format.

```
NumberOfHighLevelElementChunks NumberOfLowLevelElementChunks

HighLevelChunkNumber – LowLevelChunkNumber
HighLevelChunkNumber – LowLevelChunkNumber LowLevelChunkNumber
HighLevelChunkNumber – LowLevelChunkNumber
```

The candidate satisfaction assessment shown in *Figure 4.*11 indicates the RESAT settings file contents, the satisfaction assessment method (Rules-Based approach), the threshold value (0.2), the combination method setting (no combination method was used), the rules used for analysis and whether batch processing was used (this file was created through a batch run, using the threshold value set listed in C:\thresholdValues1.txt). The data set was built from a set of 199 requirement chunks and 355 design element chunks. Requirement chunk 0 maps to design element chunk 308, etc. in this satisfaction assessment.

Figure 4.11. Example Candidate Satisfaction Assessment File.

```
// RESAT Settings:
//
C:\Users\Ashlee\Documents\ThesisProjects\Projects\RESAT008\bin\Debug\OpenNLP\M
odels\
//
C:\Users\Ashlee\Documents\ThesisProjects\Projects\RESAT008\bin\Debug\domainThes
aurus_hakimgantt.txt
//
C:\Users\Ashlee\Documents\ThesisProjects\Projects\RESAT008\bin\Debug\stopword_fo
x.dat
// C:\Users\Ashlee\Documents\ThesisProjects\datasets\gantt\hakim\high
// C:\Users\Ashlee\Documents\ThesisProjects\datasets\gantt\hakim\low
// C:\Users\Ashlee\Documents\ThesisProjects\datasets\gantt\hakim_rtm.txt
// Satisfaction Assessment Method = rules
// Threshold = 0.2
//Rules Combo Method = None
//Rules:
//0|NP|RE|0|NP|DE|60|25|True|False|False
//0|VP|RE|0|VP|DE|60|25|True|False|False
//0|VP|RE|0|NP|DE|60|25|True|False|False
//0|NP|RE|0|VP|DE|60|25|True|False|False
//0|NP|RE|0|NP|DE|60|25|True|False|False
//0|VP|RE|0|VP|DE|60|25|True|False|False
//0|VP|RE|0|NP|DE|60|25|True|False|False
//0|NP|RE|0|VP|DE|60|25|True|False|False
// Batch Threshold Filename = C:\thresholdValues1.txt

199 355
0 - 308
1 - 309 321 324 326 331 340 342 347 356 358 363 369
2 -
3 -
4 -
5 - 309 310 321 325 326 329 337 341 342 345 353 358 369
6 - 310 325 329 337 341 345 353 369
7 - 309 318 324 331 336 340 347 352 356 363 368 369
8 - 319
9 -
10 -
11 - 321
12 - 308 319 328 344 360
```

Chapter 5

Plan for Empirical Research

In order to validate the RESAT tool and our approaches to automated satisfaction assessment, an empirical plan for evaluation is outlined below. The plan below includes research questions to be addressed, satisfaction assessment measures, information on data sets and answer set creation, research hypotheses, and plans for statistical analysis. Validation results are presented here.

5.1 Plan for Evaluation

After completing implementation of all satisfaction assessment methods outlined above, various data sets were used as input to the methods. The subsequent output was checked against analyst assessments of satisfaction on the same data to test the methods.

Based on the overlap in the two solution sets – one created by the satisfaction assessment tool and one by analysts – it is possible to determine how well the tool can create a candidate satisfaction assessment. Measures used for verification are outlined in *Section 5.3* below.

5.2 Research Questions

This research is an effort to create methods for automated satisfaction assessment and to validate each of those methods. Research questions that have been addressed include:

Which satisfaction method provides the greatest precision at a reasonable rate of recall? How can one ensure that satisfaction assessment methods are adequately selective in returning results? Which satisfaction assessment method provides the greatest level of recall? Which satisfaction assessment method requires the least correction effort by analysts reviewing results?

5.3 Measures

The satisfaction domain within software engineering is a new field, and thus does not have standard means of measurement in place. As such, measures have been taken from the classification, information retrieval, and tracing domains. New measures have also been created specifically for satisfaction assessment.

5.3.1 Precision and Recall

Precision and recall within the information retrieval and tracing domains are measures that show the number of correct matches that are determined or retrieved by a particular method and the number of incorrect values that are determined or retrieved. Matches in the requirement satisfaction assessment domain are the satisfaction mappings returned by a particular method for satisfaction assessment in a candidate satisfaction assessment. The true matches are those found within a satisfaction answer set for a particular domain. Specifically:

$$\text{Precision} = \frac{\text{\# True Matches}}{\text{Total \# Matches in the Candidate Satisfaction Assessment}}$$

and

$$\text{Recall} = \frac{\text{\# True Matches Determined}}{\text{\# True Matches in the Satisfaction Answer Set}}.$$

According to [115], recall values above 80% are excellent, above 70% are good, and between 60-70% are acceptable. Precision values from 20-30% are acceptable, from 30-50% are good, and 50% and above are excellent for tracing. Similar measures should be expected for satisfaction assessments.

5.3.2 Overall Precision and Overall Recall

When precision and recall are calculated collectively for a data set, then the calculated values are known as overall recall and overall precision. These values capture the quality of a candidate satisfaction assessment as a whole. Specifically:

$$\text{Overall Precision} = \frac{\text{True Matches in the Satisfaction Answer Set}}{\text{Total \# Matches Determined in the Candidate Answer Set}}$$

and

$$\text{Overall Recall} = \frac{\text{True Matches Determined in the Candidate Answer Set}}{\text{\# True Matches in the Satisfaction Answer Set}}.$$

5.3.3 Individual Precision and Individual Recall

When requirements are considered individually for a satisfaction mapping, individual recall and precision values may be calculated. These values capture the quality of a candidate satisfaction assessment for a single requirement. These are:

$$\text{Individual Precision} = \frac{\text{\# True Matches for Requirement X in the Satisfaction Answer Set}}{\text{Total \# Matches for Requirement X in the Candidate Satisfaction Assessment}}$$

and

$$\text{Individual Recall} = \frac{\text{\# True Matches for Requirement X in the Candidate Answer Set}}{\text{\# True Matches for Requirement X in the Satisfaction Answer Set}}.$$

5.3.4 Average Precision and Average Recall

Another type of recall and precision for the satisfaction assessment domain is in the form of average recall and average precision. These capture the average of all individual recall and individual precision values. Specifically:

$$\text{Average Precision} = (\sum_{i=1}^{n} Pi)/n$$

where P_i is the precision value of the i^{th} requirement in a candidate answer set with n requirements,

and

$$\text{Average Recall} = (\sum_{i=1}^{n} Ri)/n$$

where R_i is the recall value of the i^{th} requirement in a candidate answer set with n requirements.

5.3.5 Number of Corrections

Number of corrections (numCorr) is the minimal number of corrections necessary to transform a candidate satisfaction assessment into the correct answer set for a particular satisfaction assessment data set. To calculate this value, a correction may take two forms:

A. Omission Correction - An omission correction is the addition of a correct satisfaction match that should have been included in a satisfaction assessment, and
B. Commission Correction - A commission correction is the deletion of a satisfaction match that was returned in a candidate satisfaction assessment, but is not a true satisfaction assessment match.

For the number of corrections measurement, omission corrections and commission corrections are equally weighted. Number of corrections is:

Number of Corrections = (# Omission Corrections) + (# Commission Corrections).

A low number of corrections indicates that there will be less effort required to correct the candidate satisfaction assessment. However, bear in mind that commission corrections are generally much easier and faster for human analysts to handle than are omission corrections.

5.3.6 Normalized Number of Corrections

The number of corrections measure above captures a cumulative value. It is also useful to normalize this to the data set size. Thus, the normalized number of corrections, nNumCorr, is:

$$\text{Normalized Number of Corrections} = \frac{\text{Number of Corrections}}{\text{\# Satisfaction Mappings in the Answer Set}}.$$

5.3.7 Analyst Verification Effort

When using feedback approaches to improve an initial satisfaction assessment, it is useful to determine the rate of improvement normalized with an effort measurement. A human analyst verifies each individual satisfaction mapping, so an analyst verification effort measure was created to calculate an estimate of effort needed before the effort is expended. Such a normalized result is useful to software engineering project managers to determine whether there will be an adequate return on investment for analyst feedback effort (in the case of non-safety critical project domains; in safety critical domains, the assessment must be verified). A measure of analyst verification may be defined as follows:

$$\text{Analyst Verification Effort} = \left(\sum_{i=1}^{n} Wi\right)$$

where

$Wi =$ (# Words in the i^{th} Requirement) + (# Words in each Design Element mapped to the i^{th} requirement)

in a candidate answer set with n requirements.

5.3.8 Normalized Analyst Verification Effort

As with number of corrections and normalized number of corrections above, a normalized version of the analyst verification effort is useful. This is:

$$\text{Normalized Analyst Verification Effort} = \frac{\text{Analyst Verification Effort}}{\text{\# Requirements in the Satisfaction Answer Set}}.$$

5.3.9 Selectivity

Selectivity is a measure of the percentage of possible matches that are returned by a particular method. Selectivity is defined as:

$$\text{Selectivity} = \frac{\text{Number of Matches Returned}}{\text{Total Number of Possible Matches}}.$$

If selectivity is high for a method, then recall values will be inflated because a large number of *all* possible matches are returned, rather than a large portion of the *correct* matches. If selectivity is low, but recall values remain high, precision for the method being analyzed will be high. Note that for this work, the number of total possible matches for selectivity is defined based on the number of chunk pairs between requirements and design elements that are linked within a data set's corresponding requirements traceability matrix (RTM). This value for total number of possible matches is often lower than the total number of matches between all requirement and design element chunk pairs.

5.3.10 F-Measure

F-Measure is the weighted harmonic mean of precision and recall. It combines recall and precision and is a measure of the quality of an information retrieval candidate answer set. F-measure is defined as:

$$\text{F-Measure} = \frac{2 * \text{Precision} * \text{Recall}}{(\text{Precision} + \text{Recall})}.$$

5.3.11 Analysis and Reporting

Satisfaction assessments may be analyzed within the RESAT tool. In order to use RESAT for candidate satisfaction assessment analysis, a true answer set must be provided to the tool by an analyst. The analyst can then load a set of candidate satisfaction assessments and compare these with the true answer set. RESAT will calculate the number of links in the answer set and the following values for each candidate satisfaction assessment: number of links returned, number of correct links, number of incorrect links, recall, precision, selectivity, f-measure, and number of corrections.

Analysts can also load a baseline file to perform comparative analysis between methods. In this case, an analyst loads both the answer set file and a specified baseline candidate satisfaction assessment. For example, suppose an analyst would like to compare the TF-IDF candidate satisfaction assessment with the highest recall to a set of rules-based candidate satisfaction assessments. The analyst can load the TF-IDF candidate satisfaction assessment as the baseline file and then load the list of rules-based candidate satisfaction assessments into the RESAT tool. Results returned will include how many satisfaction mappings each rules-based candidate satisfaction assessment found that were not included in the TF-IDF candidate satisfaction assessment, the number of links shared by each pair of satisfaction assessments, and the number of links that were missed by each pair of satisfaction assessments.

All results returned by RESAT can be exported in comma separated value (.csv) format. See *Appendix B* for a screenshot of the RESAT satisfaction assessment interface.

5.4 Variables

In empirical studies conducted on automated satisfaction assessment methods, the method used, the level of human involvement in providing feedback, threshold or cutoff values for a given method, or the data set given as input will be the independent variable. Dependent variables will be all or a subset of the measures described above. Research efforts will focus on increasing the precision of the candidate satisfaction assessment provided by RESAT, while maintaining low selectivity, low number of corrections, and high recall.

The independent variable for this research was the satisfaction assessment method used (Naïve Method, TF-IDF Method, Rules-Based Method and Combination Method). The dependent variables were recall, precision, number of corrections, selectivity, and F-measure.

5.5 Expected Results

Based on prior work in requirements tracing, an initial supposition on the quality of results obtained from the satisfaction methods introduced in *Section 3* was made. The following were expected results of this research:

a) TF-IDF satisfaction assessment will have better precision than the naïve method.
b) TF-IDF satisfaction assessment will have better recall than the naïve method.

c) TF-IDF satisfaction assessment will have a lower number of corrections than the naïve method.
d) TF-IDF classification will have worse recall than the combined TF-IDF and rules-based method using rules from family 1 (see *Section 3.3.3.4* for definitions of rule families).
e) TF-IDF classification will have worse recall than the combined TF-IDF and rules-based method using rules from family 2 (see *Section 3.3.3.4* for definitions of rule families).
f) TF-IDF classification will have better precision than the combined TF-IDF and rules-based method using rules from family 1 (see *Section 3.3.3.4* for definitions of rule families).
g) TF-IDF classification will have better precision than the combined TF-IDF and rules-based method using rules from family 2 (see *Section 3.3.3.4* for definitions of rule families).
h) The rules-based method using rules from family 1 will have greater recall and precision than the rules-based method using rules from family 2 (see *Section 3.3.3.4* for definitions of rule families).
i) The rules-based method using rules from family 2 will have greater recall and precision than the rules-based method using rules from family 3 (see *Section 3.3.3.4* for definitions of rule families).
j) The rules-based method using rules from family 3 will have greater recall and precision than the rules-based method using rules from family 4 (see *Section 3.3.3.4* for definitions of rule families).

Formal hypotheses and results are presented in *Section 6* below. In each empirical study performed, the null hypothesis was a two-tailed hypothesis in the form:

> H_n: Method X will perform the same as Method Y in terms of measurement Z.
>
> and the alternative hypothesis was posed in the form:
>
> H_A: There will be a difference in Method X and Method Y's performance in terms of measurement Z.

Tests have been completed to examine all possible method X, method Y, and measurement Z combinations for each of the methods presented in *Section 3.3* for the Gannt and CM-1 data sets.

5.6 Data Sets

During the course of this research, three primary data sets were used. For initial prototyping and testing, the CM-1 Subset 1 data set was used. This is a subset of the larger NASA CM-1 data set for a NASA scientific instrument. Next, the Gantt data set was examined. The Gantt data set is based on an open source project management tool, GanttProject. Finally, the entire NASA CM-1 data set was analyzed. All methods were validated with both the Gantt and full CM-1 data sets.

5.6.1 CM-1 Subset 1 Data Set

During initial research phases, a pilot data set was used. CM-1 Subset 1 was extracted from a larger data set for a NASA scientific instrument. The NASA CM-1 data set is available through our research lab and the PROMISE repository [20]. The data set contains plaintext requirements, design elements, and code along with tracing and fault data for each. The entire CM-1 data set contains 235 high-level elements (requirements) and 220 low-level elements (design elements). From CM-1, twenty-two requirements and fifty-two design elements were randomly selected to form CM-1 Subset 1. An RTM was constructed that contains 95 links. An average of 4.318 design elements link to each requirement in the RTM.

The requirement text for the 22 requirements was chunked into 298 individual chunks. The design element text for the 52 design elements was chunked into 2,982 individual chunks. From these, using the RTM, there were 82,138 requirement-design chunk element pairs to be analyzed. Without the RTM, considering every possible requirement-design element chunk pair, there would have been 888,636 comparisons to be made. The analyst verification effort is 82,138 units, and the normalized analyst verification effort for this data set is 3733.545 units. Information on this data set is contained in *Appendix E*.

5.6.2 Gantt Data Set

The second data set is based on an open source program called GanttProject. GanttProject is an open source graphical Java tool used for project planning and scheduling. With the tool, users can create Gantt charts and utilize a rich feature set [35]. The Gantt data set consists of 17 requirement elements and 78 design elements. The RTM for the Gantt data set contains 68 links. An average of 4.0 design elements link to each requirement.

The requirement text for the 17 requirements was chunked into 314 individual chunks. The design element text for the 52 design elements was chunked into 876 individual chunks. From these, using the RTM, there were 15,430 requirement-design element pairs to be analyzed. Without the RTM, considering every possible requirement-design element pair, there would have been 275,064 comparisons to be made. The analyst verification effort is 15,430 units, and the normalized analyst verification effort is 907.647 units for this data set. Information on this data set is contained in *Appendix E*.

5.6.3 CM-1 Data Set

The NASA CM-1 [20] data set consists of the entire requirement specification and the entire design document for a NASA scientific instrument. There are 235 requirements and 220 design documents. After the data set was chunked based on grammatical structure, there were a total of 2,780 requirement chunks and 10,490 design element chunks. The RTM for this data set contains 362 links between requirements and design elements, with a density of 1.54 design elements per requirement. The RTM is sparse, meaning that not all requirements in the data set have corresponding design elements.

Using the RTM there were 205,696 requirement-design element pairs to be analyzed. Without the RTM, considering every possible requirement-design element pair, there would have been 29,162,200 comparisons to be made. The analyst verification effort for this data set is 205,696 units, and the normalized analyst verification effort is 875.302 units for this data set. Information on this data set is contained in *Appendix E*.

5.7 Answer Set Creation

For this work, three answer sets were created by analysts other than the author. First, the analysts independently developed requirements traceability matrices (RTMs) for the data sets. The analysts then met and discussed differences in the RTMs. When a consensus was reached, the final RTM was then verified by a third individual.

Requirements and design elements contained in the data sets were chunked into logical phrases based on parts of speech tagging and the OpenNLP chunking model. Requirement text was matched with design element text for each design element that a requirement mapped to within the RTM. The same analysts mentioned above created a satisfaction assessment.

5.7.1 CM-1 Subset 1 Answer Set

For CM-1 Subset 1, with paper printouts and pencil markups, the analysts estimated that the task would take between 10-12 hours to complete for the 22x52 data set. The process appeared to be very tedious. A tool that displayed matching requirements and design elements and allowed the analysts to select matches by clicking on text and pressing a shortcut key was developed. This reduced the time required to build the answer set to roughly 3 hours for each analyst.

After using the tool to create satisfaction assessment answer sets independently, the analysts then met and followed the same process of discussion to create a final answer set. The satisfaction answer set has 885 correct requirement and design element chunk pairs based on 82,138 possible matches. A third individual verified the process (but did not verify the final answer set). Data obtained from pilot studies of CM-1 Subset 1 is available in *Appendix G*.

5.7.2 Gantt Subset 1 Answer Set

For the Gantt data set, analysts used paper printouts to construct a satisfaction answer set. Two analysts divided the work. Analyst 1 created the initial satisfaction answer set for ten of the requirements, and analyst 2 created the initial satisfaction answer set for the remaining seven requirements. Then, the two analysts traded results and verified the other analyst's answer set. In cases where there was disagreement, the two analysts discussed the difference and came to consensus. A third individual verified the process (but did not verify the final answer set). The satisfaction answer set for this data set has 885 correct requirement and design element chunk pairs.

It took the analysts a combined total of 15 hours to create the initial Gantt answer set, and another 4 hours for verification.

5.7.3 CM-1 Answer Set

For the CM-1 data set, analysts used paper printouts to construct a satisfaction answer set. Analyst 1 created the initial satisfaction answer set for the entire data set, then analyst 2 verified the initial answer set. In cases where there was disagreement, the two analysts discussed the difference and came to consensus. A third individual verified the process (but did not verify the final answer set).

It took analyst 1 120 hours to create the initial CM-1 answer set, and it took analyst 2 another 40 hours for verification.

5.8 Statistical Analysis

For each test performed, paired T-tests were used to determine statistical significance. The data analyzed exhibits normal distribution and equality of variances.

5.9 Threats to Validity

The algorithms presented here as methods for automated satisfaction assessment are domain-specific solutions and use a domain-specific thesaurus, so there is a threat to external validity. Results may not apply to other domains or projects. The satisfaction problem is not generally solvable, so the domain constraint is reasonable in this case. No human subjects were used in this study, so validity threats based on human interaction, training, etc. are avoided.

This study avoids problems with conclusion validity in the sense that a satisfaction mapping returned will be based solely on the preprocessing and the results returned by a particular satisfaction assessment method. The grammatical complexity, conformity, and language used in the data sets may influence the results. Additionally, results may not transfer to satisfaction assessment in other languages as results are dependent on underlying algorithms specifically tailored to the distribution of words and relationship between words in the English language (i.e., stemming, stopword removal, parsing, etc.).

There is the potential for bias to be introduced when creating rules to use with the rules-based and combination methods. This was mitigated by looking only at a small subset of the data sets (<20%) before creating rules and not creating additional rules after examining the full data sets.

Due to the complexity and domain specific terms, the answer sets used for analysis may not be completely accurate and precise. The answer sets used were created by human analysts that are familiar with the traceability research domain, so there was the potential for bias. Creating a unified answer set from two independent answer sets and having more than one analyst assist in the creation and review of answer sets helped address this concern. The quality of the domain-specific thesauri created may have also had influence on study results; however, the same thesaurus was used for all methods tested to reduce the impact of this as much as possible. These threats are intrinsic to the problem studied, not to the experimental design.

Chapter 6

Results

Results for each of the methods described above are presented next. The purpose of this study was to test the naïve, TF-IDF satisfaction, rules-based, and combination satisfaction assessment methods. Each of these methods was tested against both the Gantt and the CM-1 data sets. Measurements collected include recall, precision, selectivity, number of corrections, and f-measure.

6.1 Hypotheses

The null and alternative hypotheses evaluated in this study are listed and evaluated here.

6.1.1 Experiment 1. Naïve Satisfaction Method (NSM) vs. the TF-IDF Satisfaction Method (TFSM) Hypotheses

- **H_{01}**: There will be no difference in precision (P) for the Naïve Satisfaction Method (NSM) and the TF-IDF Satisfaction Method (TFSM).

  $$P_{NSM} = P_{TFSM}$$

- **H_{A1}**: There will be a difference in precision for the Naïve Satisfaction Method and the TF-IDF Satisfaction Method.

  $$P_{NSM} \neq P_{TFSM}$$

- **H_{02}**: There will be no difference in recall (R) for the Naïve Satisfaction Method and the TF-IDF Satisfaction Method.

  $$R_{NSM} = R_{TFSM}$$

- **H_{A2}**: There will be a difference in recall for the Naïve Satisfaction Method and the TF-IDF Satisfaction Method.

  $$R_{NSM} \neq R_{TFSM}$$

- **H_{03}**: There will be no difference in the number of corrections (numCorr) for the Naïve Satisfaction Method and the TF-IDF Satisfaction Method.

  $$numCorr_{NSM} = numCorr_{TFSM}$$

- **H_{A3}**: There will be a difference in the number of corrections for the Naïve Satisfaction Method and the TF-IDF Satisfaction Method.

  $numCorr_{NSM} \neq numCorr_{TFSM}$

- **H_{04}**: There will be no difference in selectivity (S) for the Naïve Satisfaction Method and the TF-IDF Satisfaction Method.

  $S_{NSM} = S_{TFSM}$

- **H_{A4}**: There will be a difference in selectivity for the Naïve Satisfaction Method and the TF-IDF Satisfaction Method.

  $S_{NSM} \neq S_{TFSM}$

- **H_{05}**: There will be no difference in F-measure (F) for the Naïve Satisfaction Method and the TF-IDF Satisfaction Method.

  $F_{NSM} = F_{TFSM}$

- **H_{A5}**: There will be a difference in F-measure for the Naïve Satisfaction Method and the TF-IDF Satisfaction Method.

  $F_{NSM} \neq F_{TFSM}$

6.1.2 Experiment 2. TF-IDF Satisfaction Method (TFSM) vs. the Rule-Based Satisfaction Method (RBSM) Hypotheses

- **H_{06}**: There will be no difference in precision (P) for the Rules-Based Satisfaction Method (RBSM) and the TF-IDF Satisfaction Method (TFSM).

  $P_{RBSM} = P_{TFSM}$

- **H_{A6}**: There will be a difference in precision for the Rules-Based Satisfaction Method and the TF-IDF Satisfaction Method.

  $P_{RBSM} \neq P_{TFSM}$

- **H_{07}**: There will be no difference in recall (R) for the Rules-Based Satisfaction Method and the TF-IDF Satisfaction Method.

  $R_{RBSM} = R_{TFSM}$

- **H_{A7}**: There will be a difference in recall for the Rules-Based Satisfaction Method and the TF-IDF Satisfaction Method.

  $R_{RBSM} \neq R_{TFSM}$

- **H_{08}**: There will be no difference in the number of corrections (numCorr) for the Rules-Based Satisfaction Method and the TF-IDF Satisfaction Method.

  $numCorr_{RBSM} = numCorr_{TFSM}$

- **H_{A8}**: There will be a difference in the number of corrections for the Rules-Based Satisfaction Method and the TF-IDF Satisfaction Method.

  $numCorr_{RBSM} \neq numCorr_{TFSM}$

- **H_{09}**: There will be no difference in selectivity (S) for the Rules-Based Satisfaction Method and the TF-IDF Satisfaction Method.

  $S_{RBSM} = S_{TFSM}$

- **H_{A9}**: There will be a difference in selectivity for the Rules-Based Satisfaction Method and the TF-IDF Satisfaction Method.

  $S_{RBSM} \neq S_{TFSM}$

- **H_{10}**: There will be no difference in F-measure (F) for the Rules-Based Satisfaction Method and the TF-IDF Satisfaction Method.

  $F_{RBSM} = F_{TFSM}$

- **H_{A10}**: There will be a difference in F-measure for the Rules-Based Satisfaction Method and the TF-IDF Satisfaction Method.

  $F_{RBSM} \neq F_{TFSM}$

6.1.3 Experiment 3. TF-IDF Satisfaction Method (TFSM) vs. the Combination Satisfaction Method (CSM) Hypotheses

- **H_{11}**: There will be no difference in precision (P) for the Combination Satisfaction Method (CSM) and the TF-IDF Satisfaction Method (TFSM).

  $P_{CSM} = P_{TFSM}$

- **H_{A11}**: There will be a difference in precision for the Combination Satisfaction Method and the TF-IDF Satisfaction Method.

  $P_{CSM} \neq P_{TFSM}$

- **H_{12}**: There will be no difference in recall (R) for the Combination Satisfaction Method and the TF-IDF Satisfaction Method.

  $R_{CSM} = R_{TFSM}$

- **H_{A12}**: There will be a difference in recall for the Combination Satisfaction Method and the TF-IDF Satisfaction Method.

  $R_{CSM} \neq R_{TFSM}$

- **H_{13}**: There will be no difference in the number of corrections (numCorr) for the Combination Satisfaction Method and the TF-IDF Satisfaction Method.

  $numCorr_{CSM} = numCorr_{TFSM}$

- **H_{A13}**: There will be a difference in the number of corrections for the Combination Satisfaction Method and the TF-IDF Satisfaction Method.

  $numCorr_{CSM} \neq numCorr_{TFSM}$

- **H_{014}**: There will be no difference in selectivity (S) for the Combination Satisfaction Method and the TF-IDF Satisfaction Method.

  $S_{CSM} = S_{TFSM}$

- **H_{A14}**: There will be a difference in selectivity for the Combination Satisfaction Method and the TF-IDF Satisfaction Method.

  $S_{CSM} \neq S_{TFSM}$

- **H_{015}**: There will be no difference in F-measure (F) for the Combination Satisfaction Method and the TF-IDF Satisfaction Method.

  $F_{CSM} = F_{TFSM}$

- **H_{A15}**: There will be a difference in F-measure for the Combination Satisfaction Method and the TF-IDF Satisfaction Method.

  $F_{CSM} \neq F_{TFSM}$

Experiments 2 and 3 were conducted independently on the four families of rules defined in *Section 3.3.3.4*.

Table 6.1. T-Tests, Mean, and Standard Deviation for Recall, Precision, Number of Corrections, Selectivity, and F-Measure for Naïve and TF-IDF Satisfaction Assessment Methods.

		Recall	Precision	Number of Corrections	Selectivity	F-Measure
T-Test	**Gantt**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**
	CM-1	**0.005**	**0.004**	**0.002**	**0.002**	0.428
Mean	**Gantt (NSM)**	61.780 %	31.279%	540.778	0.005	0.412
	Gantt (TFSM)	47.072 %	68.747%	390	0.003	0.538
	CM-1 (NSM)	67.505 %	29.892%	3229	0.000	0.413
	CM-1 (TFSM)	50.017 %	37.444%	2442.333	0.000	0.401
Standard Deviation	**Gantt (NSM)**	7.653%	2.181%	63.525	0.001	0.005
	Gantt (TFSM)	12.466 %	11.187%	21.915	0.001	0.053
	CM-1 (NSM)	5.072%	1.414%	263.708	0.000	0.004
	CM-1 (TFSM)	18.032 %	6.503%	678.830	0.000	0.043

6.1.4 Experiment 1 Results. Naïve Satisfaction Method (NSM) vs. the TF-IDF Satisfaction Method (TFSM)

Hypotheses Tested: $H_{01/}$ $H_{A1,}$ $H_{02/}$ $H_{A2,}$ $H_{03/}$ $H_{A3,}$ $H_{04/}$ $H_{A4,}$ and $H_{05/}$ $H_{A5.}$

Table 6.1 depicts the means, standard deviation, and t-test results for Experiment 1. As evidenced by the t-test results, differences in recall, precision, number of corrections, and selectivity are statistically significant at the 0.05 level for both the Gantt and CM-1 data sets (bold-faced entries). The TF-IDF satisfaction assessment method outperformed the Naïve method in terms of precision (mean precision of 68.747% for Gantt dataset versus 31.279% for Naïve method for Gantt dataset), number of corrections (only 2442 for CM-1 versus 3229 for Naïve for CM-1), selectivity (0.002 for Gantt versus 0.04 for Naïve for Gantt), and F-measure (Here, the Naïve method slightly outperformed TF-IDF for the CM-1 dataset.) for both the Gantt and CM-1 data sets. The null hypothesis is rejected in favor of the alternative when the probability that observed results are due to chance is 0.05 or less, so the null hypotheses $H_{01,}$ $H_{03,}$ $H_{04,}$ and H_{05} were rejected in favor of $H_{A1,}$ $H_{A3,}$ $H_{A4,}$ and H_{A5} and H_{02} was accepted. H_{02} examines recall. The selectivity values were significantly lower for the Naïve method than they were for the TF-IDF method. This means that significantly more candidate satisfaction mappings were returned for Naïve than for TF-IDF. In this case, those additional satisfaction mapping contained enough correct mappings to skew recall in the favor of the Naïve method. However, the TF-IDF method would still be preferred as it greatly reduced workload required by analysts to check the results. All of the raw data from Experiment 1 can be found in *Appendix H*. *Figures 6.1* and *6.2* show recall and precision for the Naïve method with the Gantt and CM-1 data sets respectively. Recall was slightly higher for the CM-1 data set than for the Gantt data set, whereas precision values for both data sets were consistent. Number of corrections for the Gantt data set and CM-1 data set with Naïve method are shown in *Figures 6.3* and *6.4*, and selectivity is shown in *Figures 6.5* and *6.6*. Number of corrections was higher for the CM-1 data set, as was selectivity. F-measure, the weighted harmonic mean of recall and precision, for the two data sets for the Naïve method is shown in *Figures 6.7* and *6.8. Figures 6.9* and *6.10* show recall and precision for the TF-IDF method for the Gantt and CM-1 data sets respectively. As with the Naïve method, recall was higher for the CM-1 data set than for the Gantt data set. Precision was higher for the Gantt data set. Number of corrections for the Gantt data set and CM-1 data set with TF-IDF method are shown in *Figures 6.11* and *6.12,* and selectivity is shown in *Figures 6.13* and *6.14*. Number of corrections were lower for the Gantt data set than for the CM-1 data set, and selectivity was lower for the CM-1 data set than for the Gantt data set for TF-IDF. F-measure, the weighted harmonic mean of recall and precision, for the two data sets with the TF-IDF method is shown in *Figures 6.15* and *6.16.*

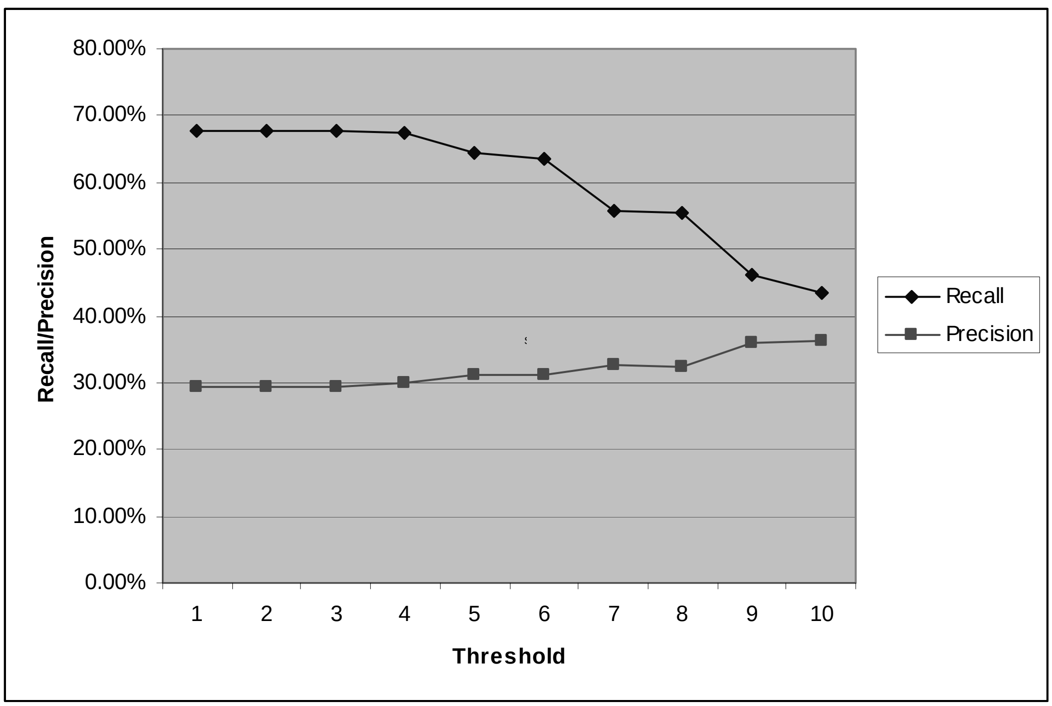

Figure 6.1. Recall and Precision for Naïve Satisfaction Method and Gantt Data Set.

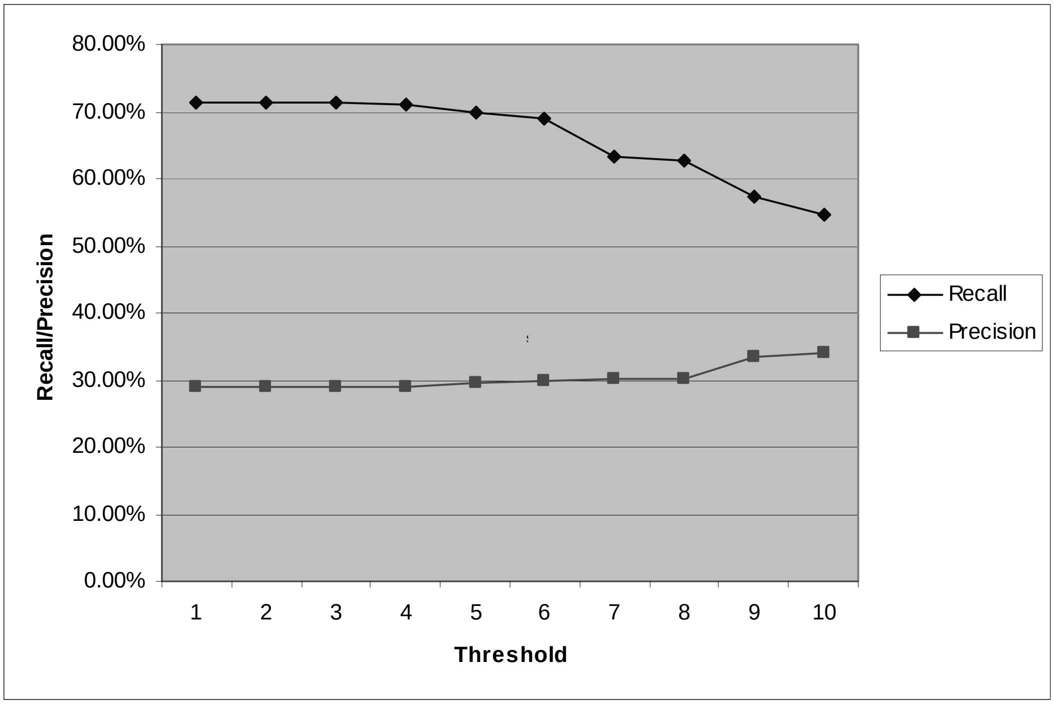

Figure 6.2. Recall and Precision for Naïve Satisfaction Method and CM-1 Data Set.

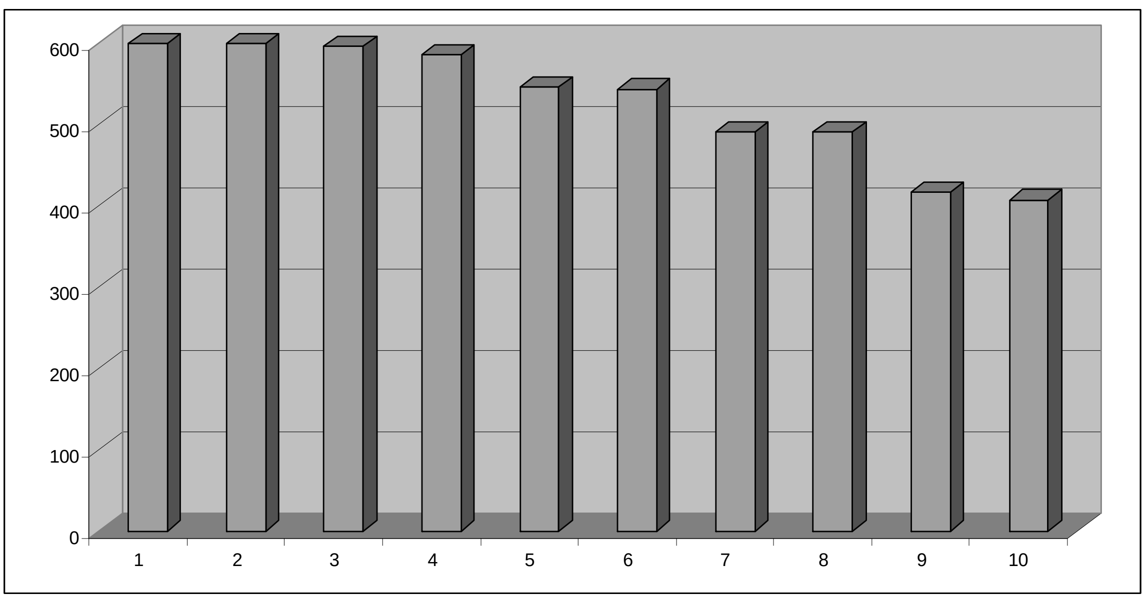

Figure 6.3. Number of Corrections for Naïve Method and Gantt Data Set.

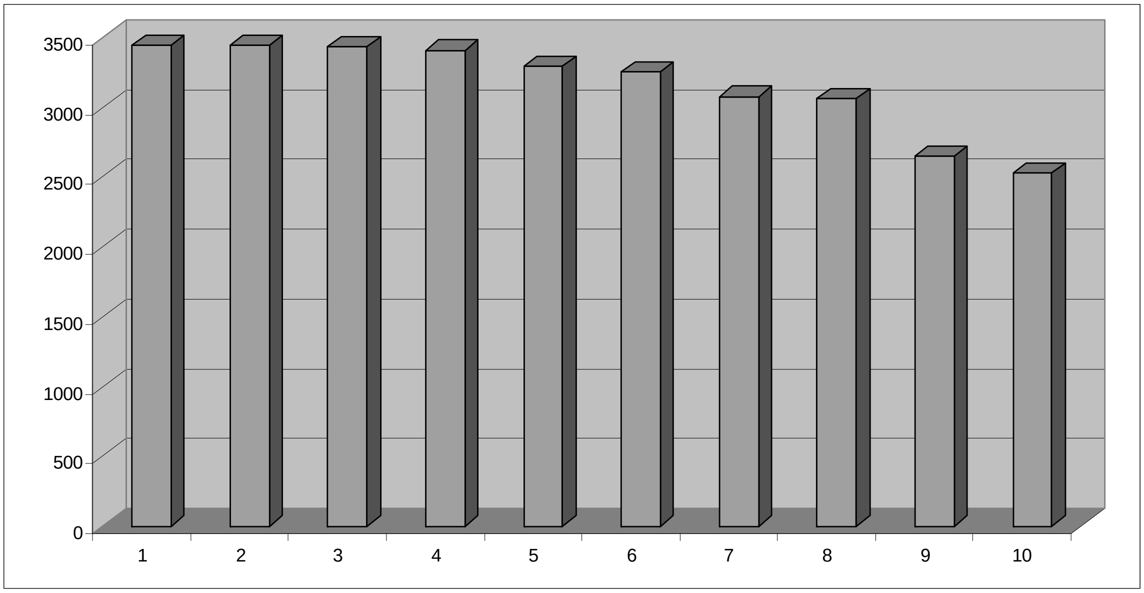

Figure 6.4. Number of Corrections for Naïve Method and CM-1 Data Set.

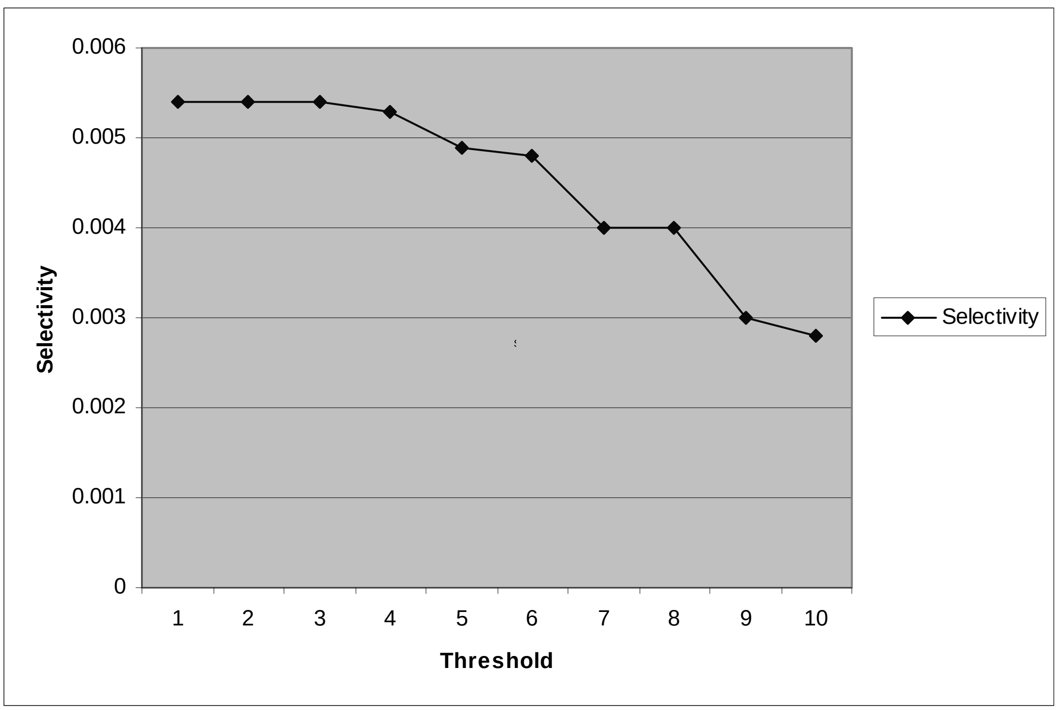

Figure 6.5. Selectivity for Naïve Method and Gantt Data Set.

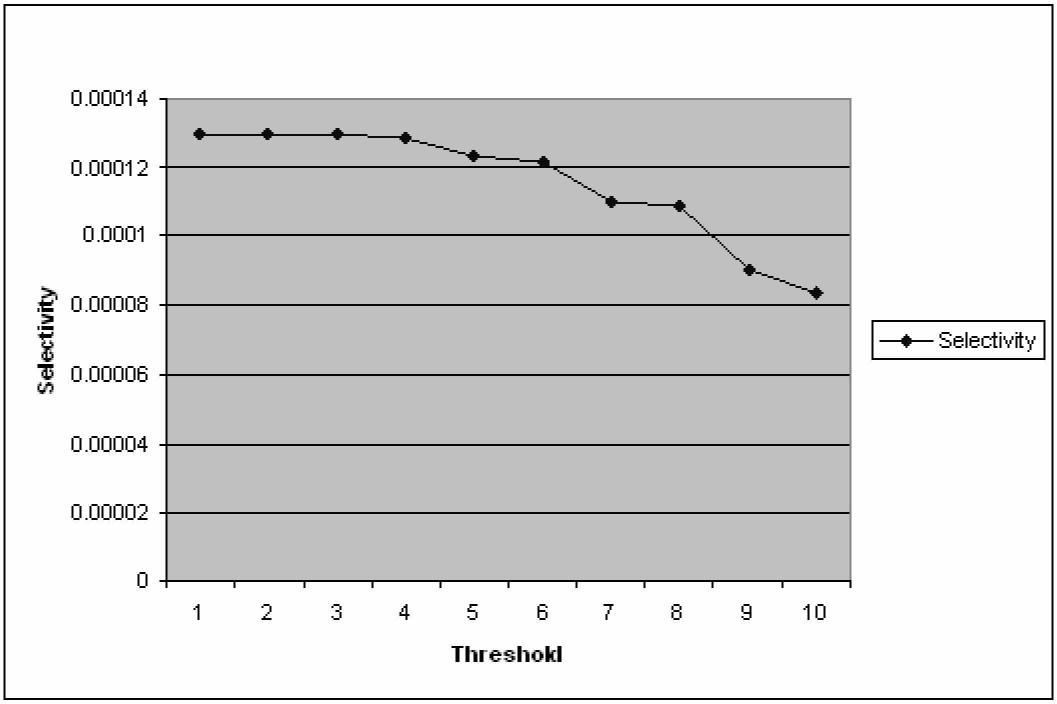

Figure 6.6. Selectivity for Naïve Method and CM-1 Data Set.

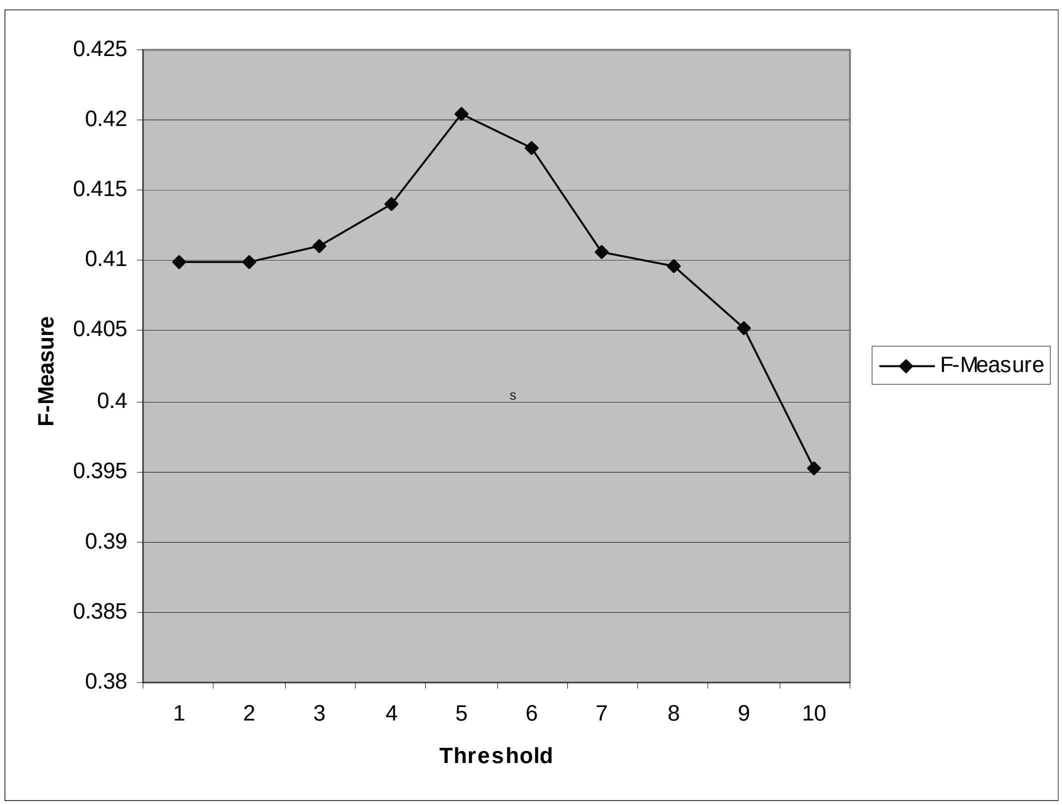

Figure 6.7. F-Measure for Naïve Method and Gantt Data Set.

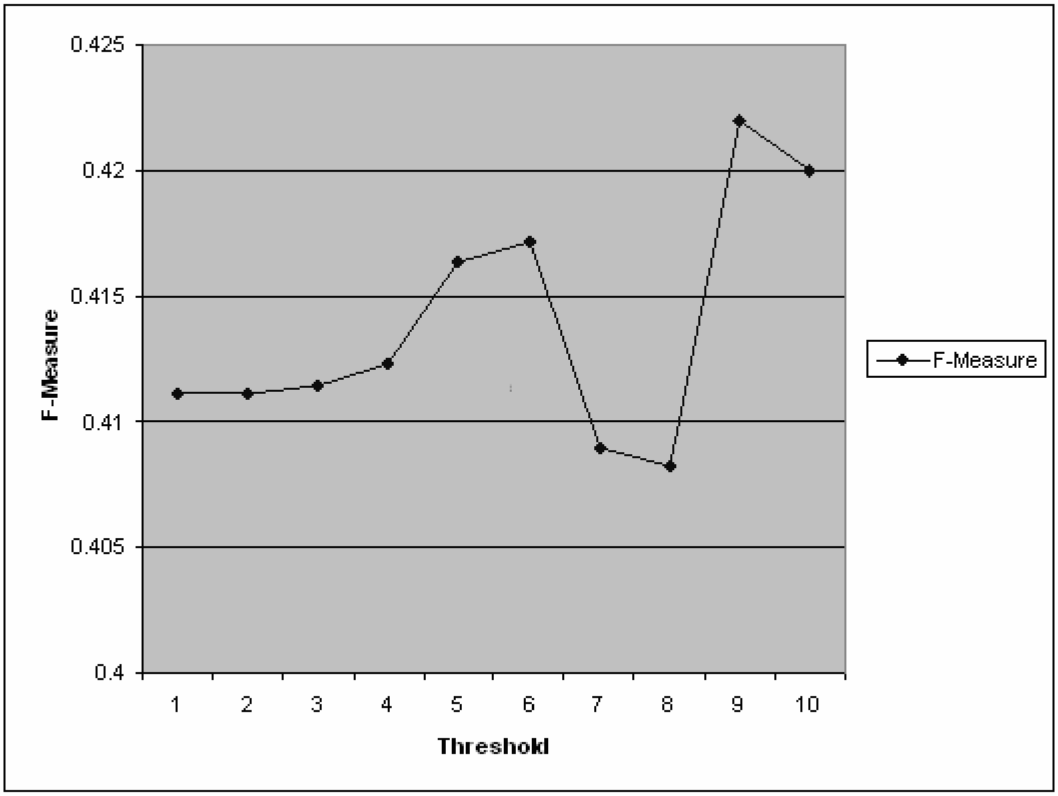

Figure 6.8. F-Measure for Naïve Method and CM-1 Data Set.

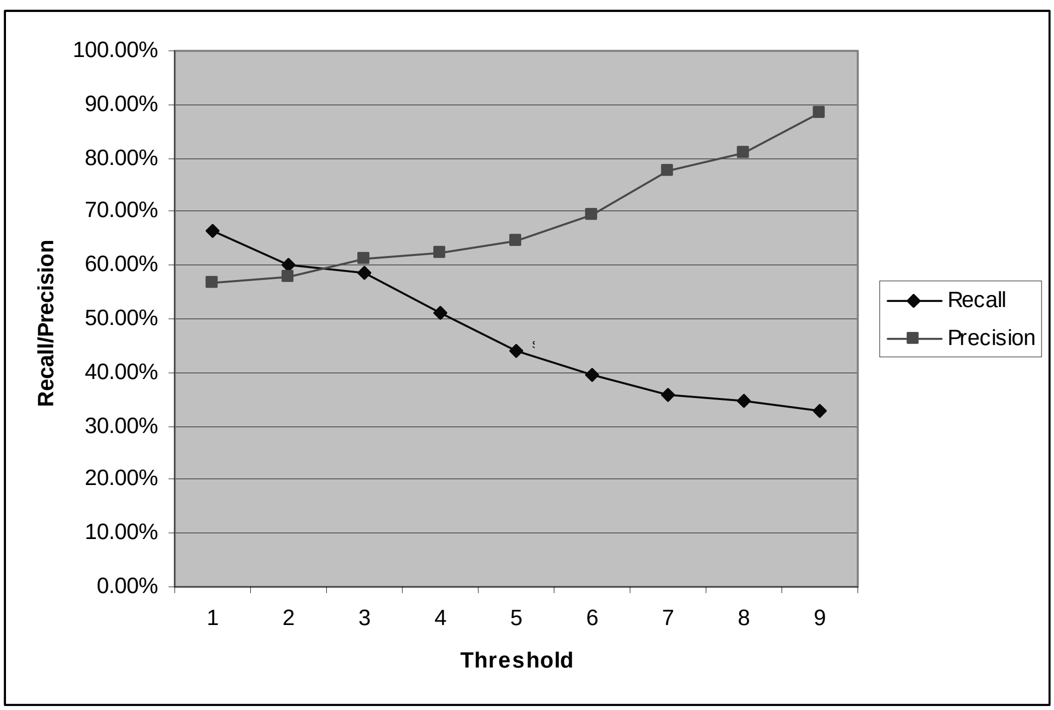

Figure 6.9. Recall and Precision for TF-IDF Satisfaction Method and Gantt Data Set.

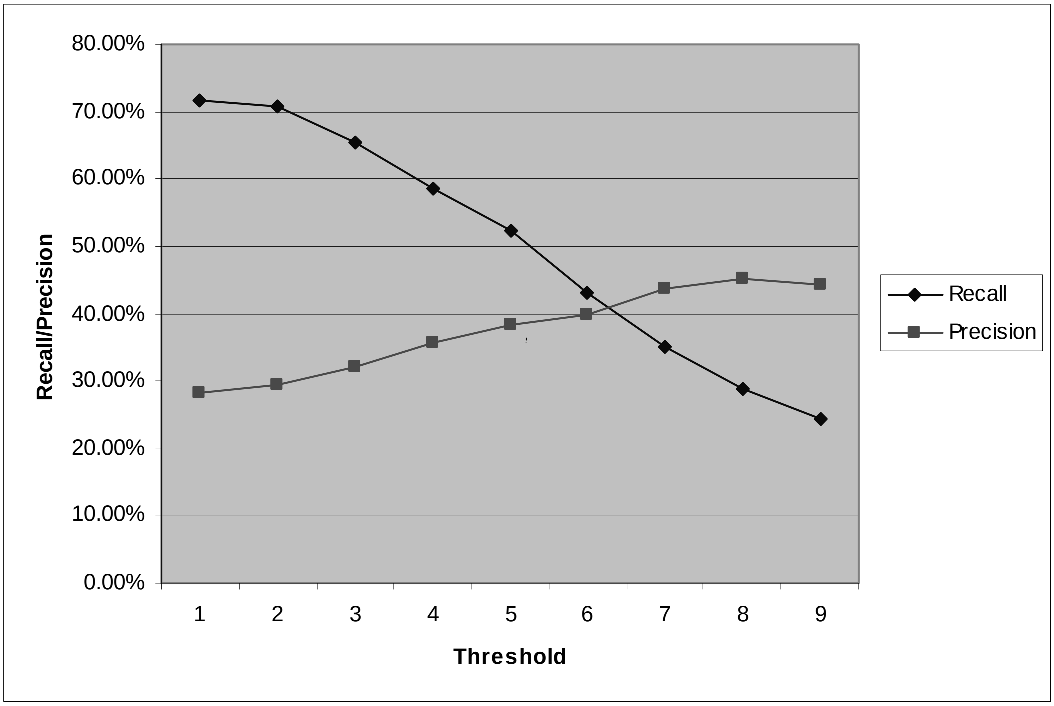

Figure 6.10. Recall and Precision for TF-IDF Satisfaction Method and CM-1 Data Set.

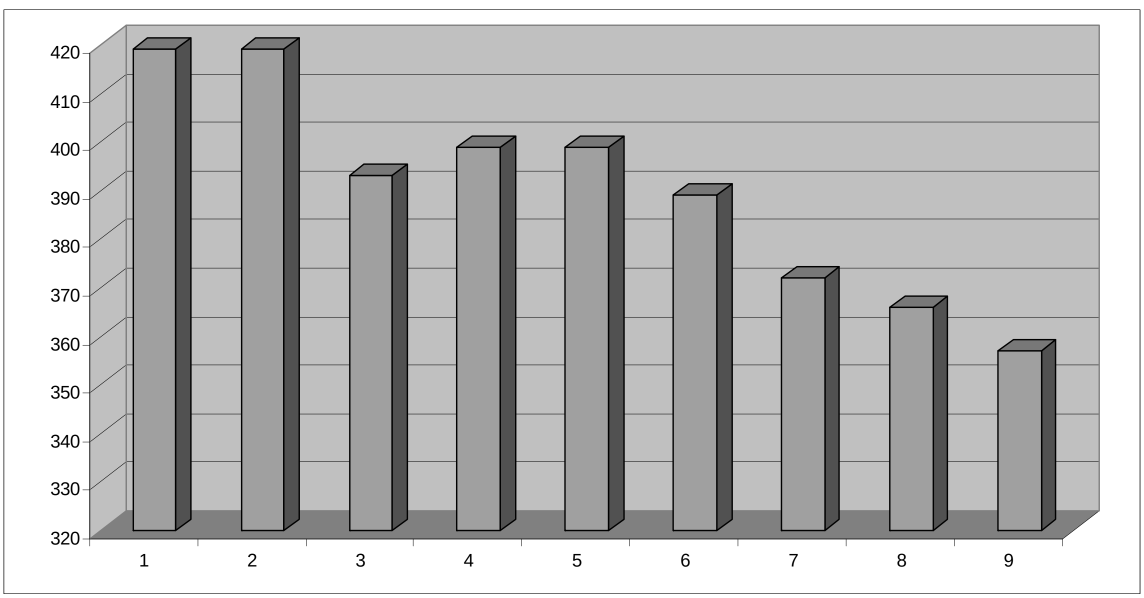

Figure 6.11. Number of Corrections for TF-IDF Method and Gantt Data Set.

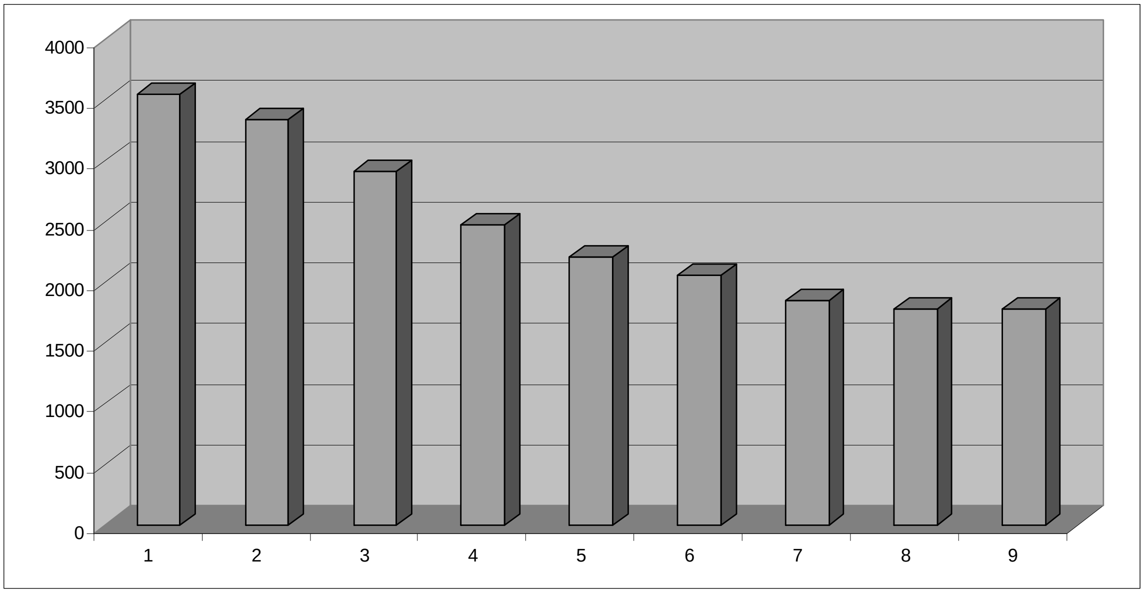

Figure 6.12. Number of Corrections for TF-IDF Method and CM-1 Data Set.

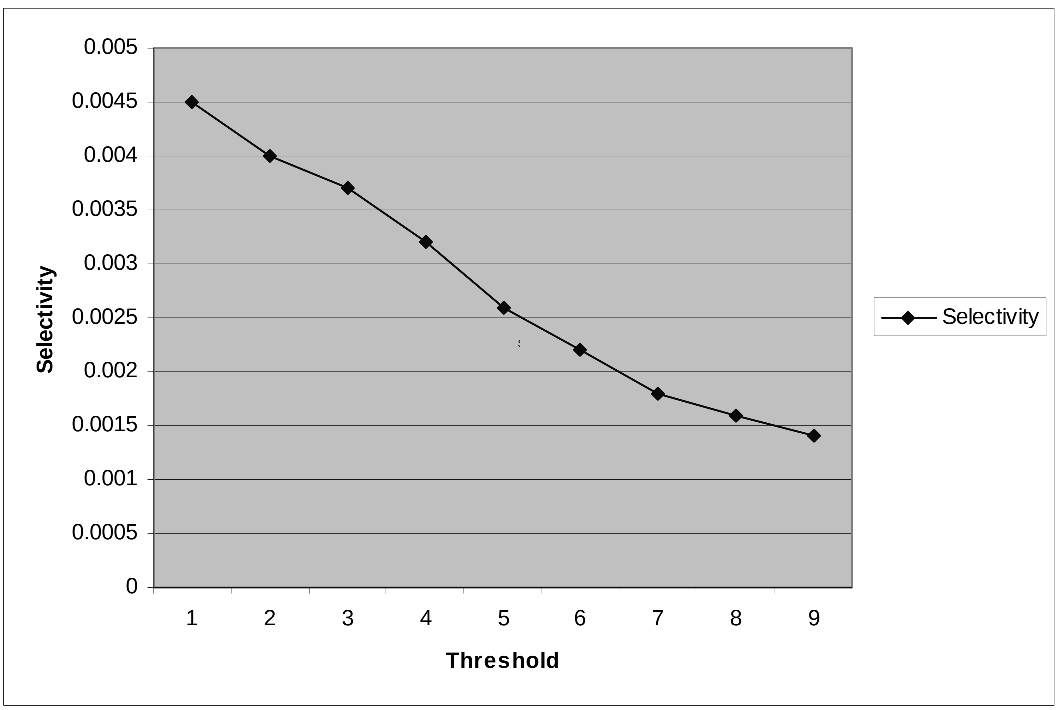

Figure 6.13. Selectivity for TF-IDF Method and Gantt Data Set.

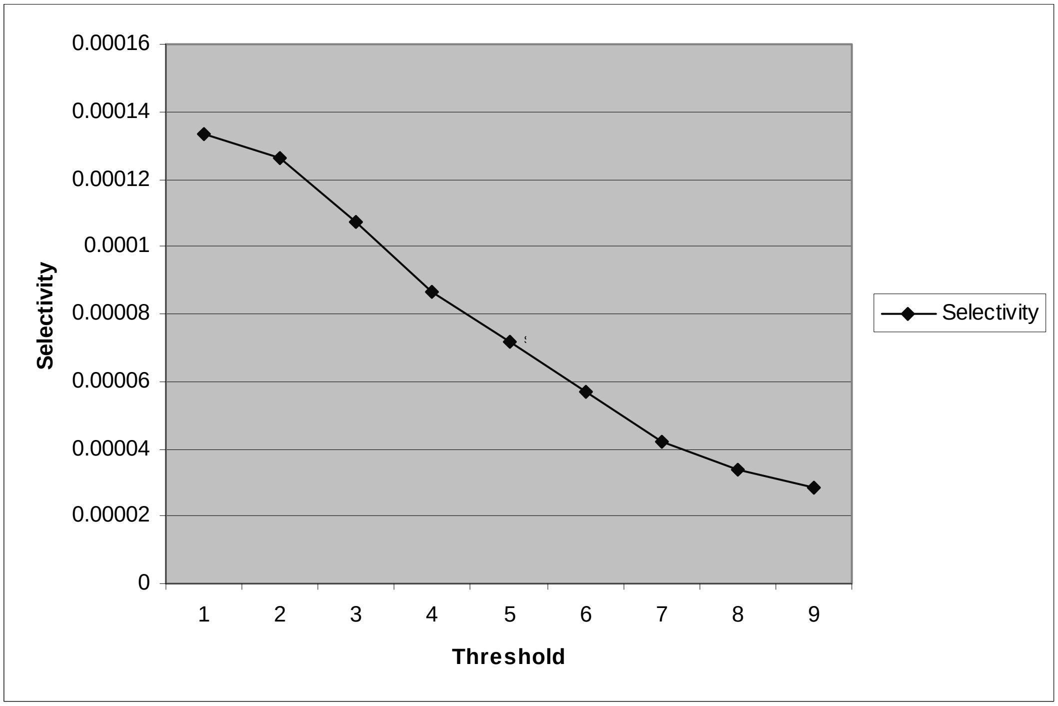

Figure 6.14. Selectivity for TF-IDF Method and CM-1 Data Set.

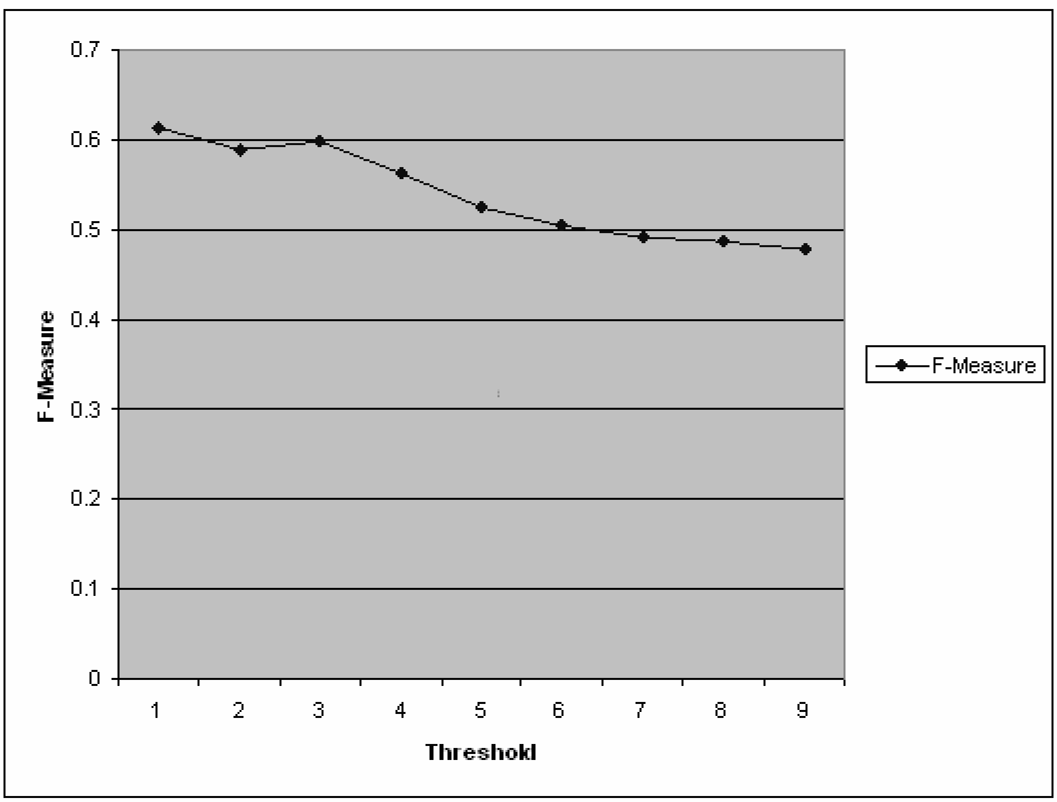

Figure 6.15. F-Measure for TF-IDF Method and Gantt Data Set.

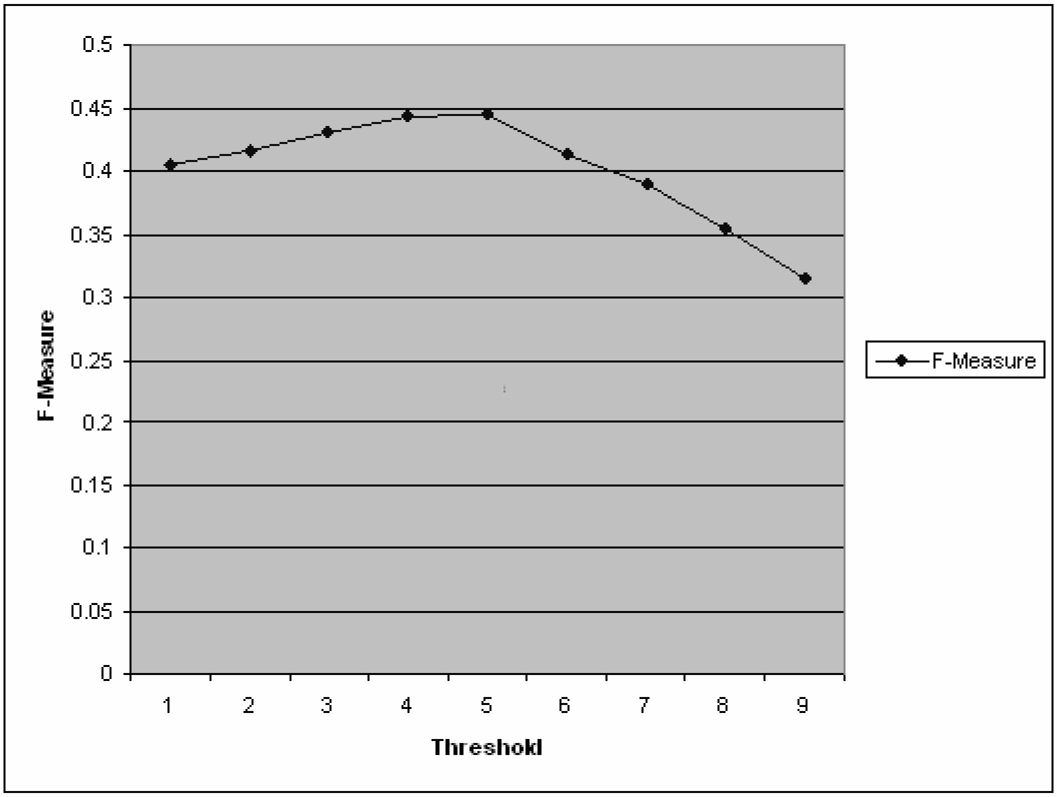

Figure 6.16. F-Measure for TF-IDF Method and CM-1 Data Set.

6.1.5 Experiment 2 Results. TF-IDF Satisfaction Method (TFSM) vs. the Rule-Based Satisfaction Method (RBSM)

Results for each of the rule families will be discussed. *Figures 6.17* and *6.18* show recall and precision for the Rules-Based satisfaction assessment method for the Gantt and CM-1 data sets respectively. For Family 1 rules, recall and precision were higher for the CM-1 data set than for the Gantt data set. For rules in Families 2 and 3 recall and precision were higher with the Gantt data set than with the CM-1 data set. For Rule Family 4, recall was higher for the Gantt data set, but precision was higher for the CM-1 data set. In both cases, Family 4 had low values of recall and precision. Number of corrections for the Gantt data set and CM-1 data set with the Rules-Based satisfaction assessment method are shown in *Figures 6.19* and *6.20*, and selectivity is shown in *Figures 6.21* and *6.22*. For all rule families, the number of corrections was lower for the Gantt data set than for the CM-1 data set. For Rule Family 1, selectivity was better with the Gantt data set. For Rule Families 2 and 3, selectivity was better for the CM-1 data set. The selectivity difference for Rule Family 4 was negligible. F-Measure for the two data sets with the Rules-Based satisfaction assessment method is shown in *Figures 6.23* and *6.24.*

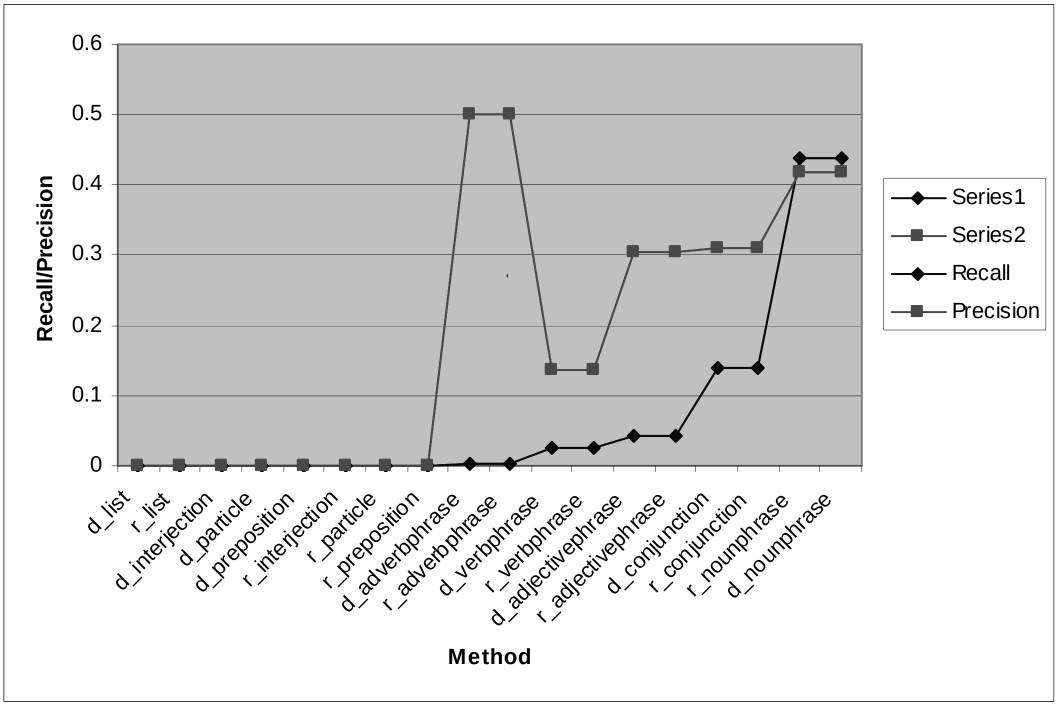

Figure 6.17. Recall and Precision for Rules-Based Satisfaction Method and Gantt Data Set.

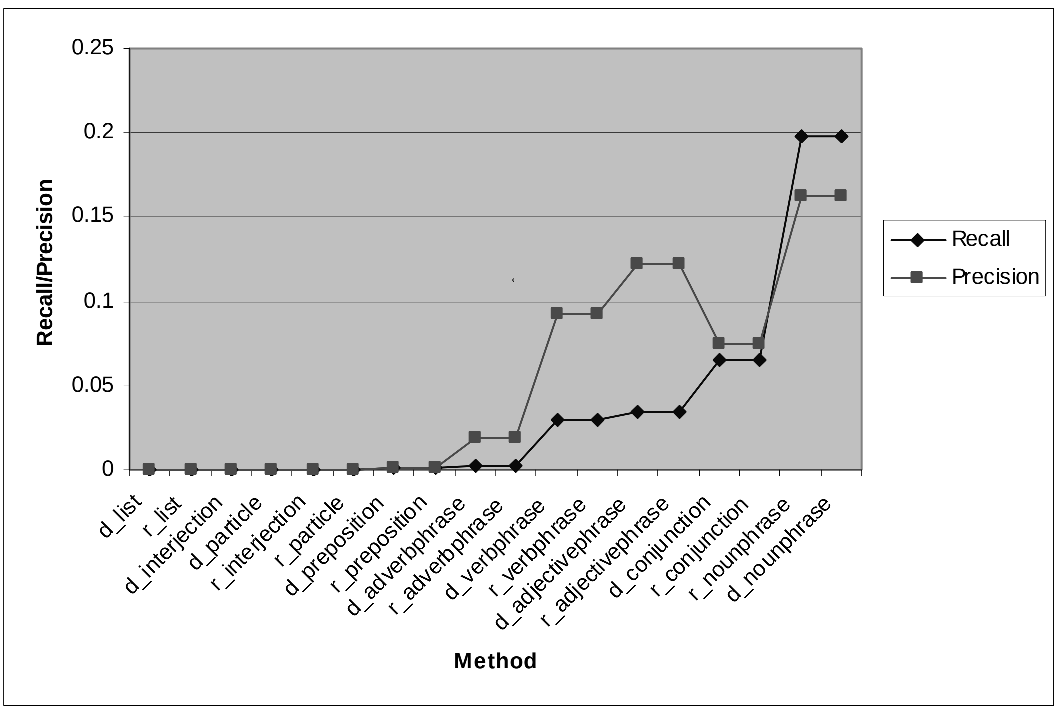

Figure 6.18. Recall and Precision for Rules-Based Satisfaction Method and CM-1 Data Set.

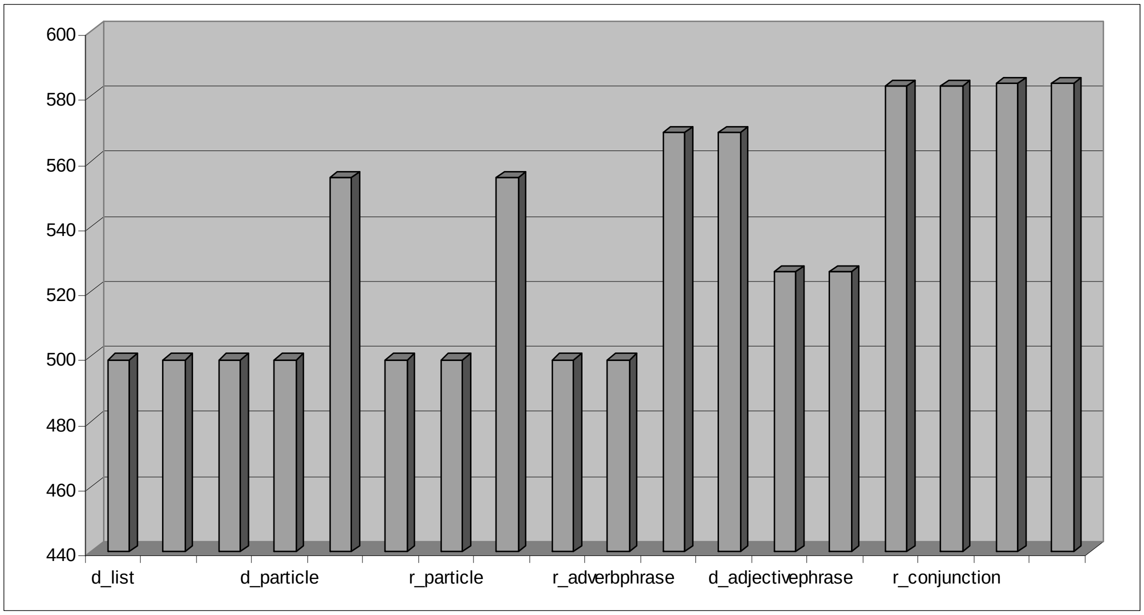

Figure 6.19. Number of Corrections for Rules-Based Method and Gantt Data Set.

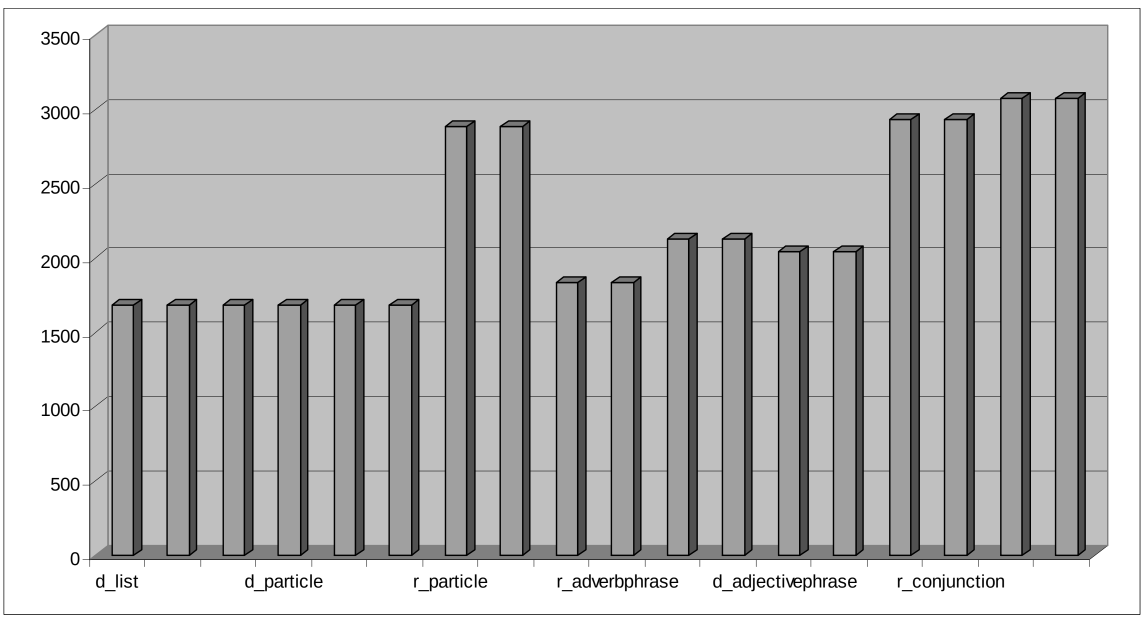

Figure 6.20. Number of Corrections for Rules-Based Method and CM-1 Data Set.

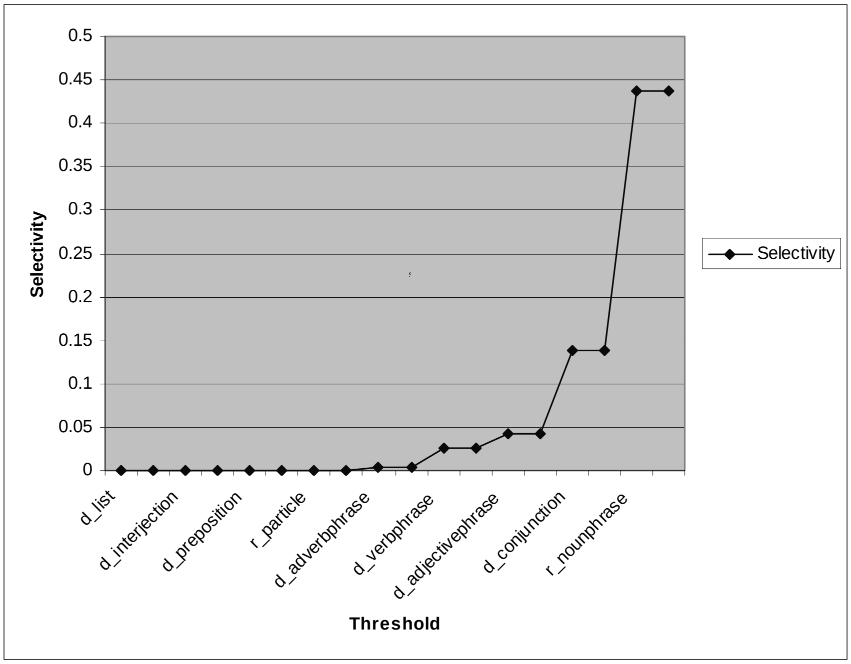

Figure 6.21. Selectivity for Rules-Based Method and Gantt Data Set.

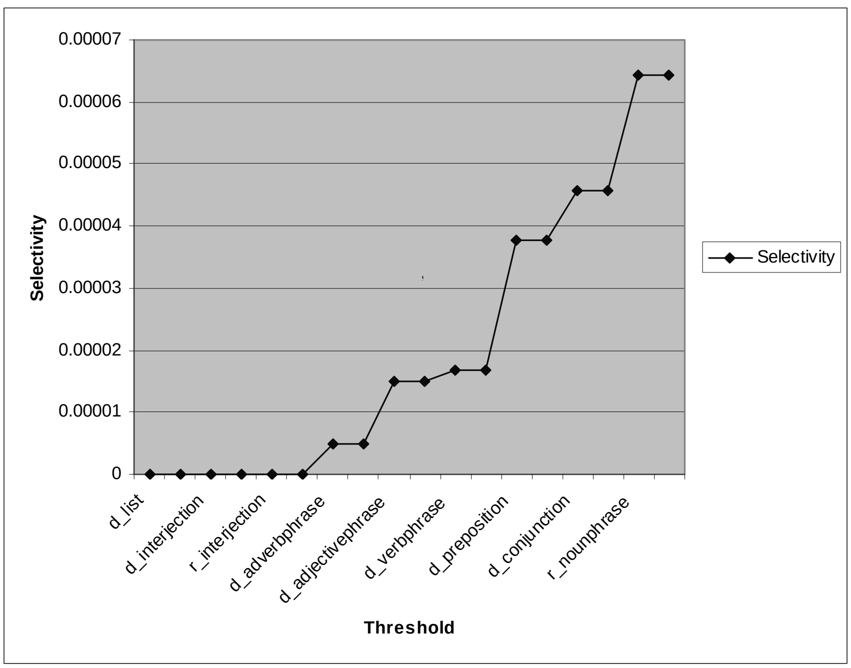

Figure 6.22. Selectivity for Rules-Based Method and CM-1 Data Set.

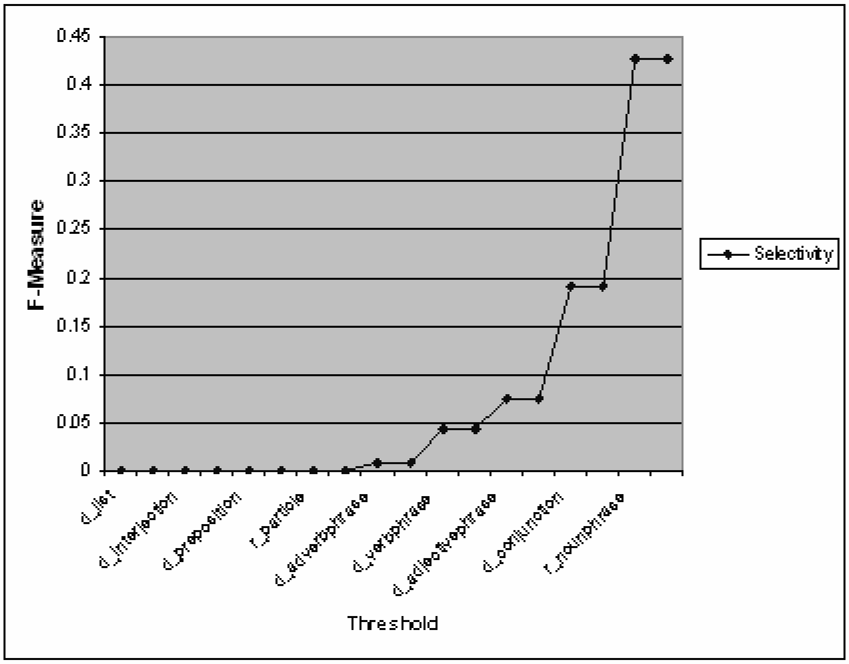

Figure 6.23. F-Measure for Combination Method and Gantt Data Set.

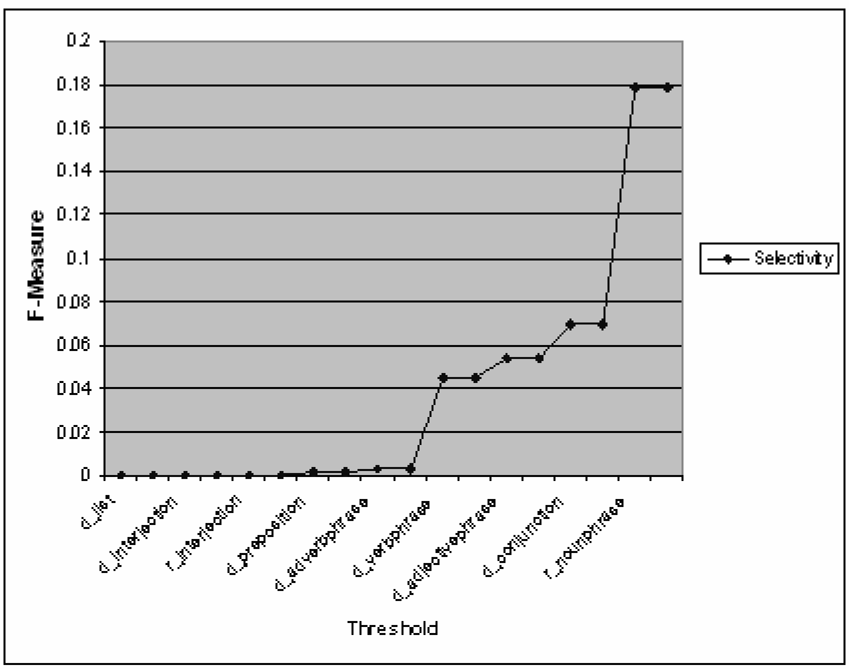

Figure 6.24. F-Measure for Rules-Based Method and CM-1 Data Set.

6.1.5.1 Rule Family 1.

Hypotheses Tested: H_{06}/ H_{A6}, H_{07}/ H_{A7}, H_{08}/ H_{A8}, H_{09}/ H_{A9}, H_{10}/ H_{A10}.

Table 6.2 depicts the means, standard deviation, and t-test results for Experiment 2 with Rule Family 1. As evidenced by the t-test results, differences in recall, precision, selectivity, number of corrections and F-measure are statistically significant at the 0.05 level for the Gantt data set, and differences in recall, selectivity, number of corrections and F-measure are statistically significant at the 0.05 level for the CM-1 data set (bold-faced entries). The TF-IDF satisfaction assessment method outperformed the Rules-Based method in terms of recall, precision, number of corrections, and F-measure for both the Gantt and CM-1 data sets. The Rules-Based method had better selectivity than the TF-IDF method. This is expected because the rules tested here are targeted at specific language patterns and will not find all satisfaction mappings.

The null hypothesis is rejected in favor of the alternative when the probability that observed results are due to chance is 0.05 or less, so the null hypotheses $H_{07,}$ $H_{08,}$ $H_{09,}$ and H_{10} were rejected in favor of $H_{A7,}$ $H_{A8,}$ $H_{A9,}$ and H_{A10} for both data sets. For the Gantt data set, null hypothesis H_{06} was also rejected in favor of H_{A6}. For the CM-1 data set, null hypothesis H_{06} was accepted. CM-1 is a much larger data set than the Gantt data set, so the fact that the Rules-Based method with Family 1 rules performs well in terms of precision on this data set indicates that, in general, this method will yield high precision. This was expected because Family 1 rules concentrate on noun phrases and verb phrases, which are often the keywords an analyst will scan for when creating a candidate satisfaction assessment manually. The raw data from Experiment 2 can be found in *Appendix H*.

Table 6.2. T-Tests, Mean, and Standard Deviation for Recall, Precision, Number of Corrections, Selectivity, and F-Measure for TF-IDF and Rule-Based Satisfaction Assessment Methods - Family 1.

		Recall	Precision	Number of Corrections	Selectivity	F-Measure
T-Test	**Gantt**	**0.003**	**0.000**	**0.000**	**0.000**	**0.006**
	CM-1	**0.025**	0.081	**0.000**	**0.010**	**0.000**
Mean	**Gantt (TFSM)**	47.072 %	68.747%	390.333	0.003	0.538
	Gantt (RBSM)	14.995 %	15.948%	576.500	0.000	0.257
	CM-1 (TFSM)	50.017 %	37.444%	2442.333	0.000	0.401
	CM-1 (RBSM)	23.146 %	27.692%	2600.500	0.231	0.112
Standard Deviation	**Gantt (TFSM)**	0.125	0.112	21.915	0.001	0.053
	Gantt (RBSM)	0.137	0.103	822.775	0.000	0.202
	CM-1 (TFSM)	0.180	0.065	678.830	0.000	0.043
	CM-1 (RBSM)	0.205	0.142	7.500	0.205	0.067

6.1.5.2 Rule Family 2.

Hypotheses Tested: $H_{06/}$ $H_{A6,}$ $H_{07/}$ $H_{A7,}$ $H_{08/}$ $H_{A8,}$ $H_{09/}$ $H_{A9,}$ $H_{10/}$ $H_{A10.}$

Table 6.3 depicts the means, standard deviation, and t-test results for Experiment 2 with Rule Family 2. As evidenced by the t-test results, differences in recall, precision, selectivity, number of corrections and F-measure are statistically significant at the 0.05 level for the Gantt data set, and differences in recall, precision, selectivity, and F-measure are statistically significant at the 0.05 level for the CM-1 data set (bold-faced entries). The TF-IDF satisfaction assessment method outperformed the Rules-Based method in terms of recall, precision, selectivity, and F-measure for both the Gantt and CM-1 data sets. The Rules-Based method required a fewer number of corrections than the TF-IDF method.

The null hypothesis is rejected in favor of the alternative when the probability that observed results are due to chance is 0.05 or less, so the null hypotheses $H_{06,}$ $H_{07,}$ $H_{09,}$ and H_{10} were rejected in favor of $H_{A6,}$ $H_{A7,}$ $H_{A9,}$ and H_{A10} for both data sets. For the Gantt data set, null hypothesis H_{08} was also rejected in favor of H_{A8}. For the CM-1 data set, null hypothesis H_{08} was accepted. For both methods, the number of corrections exceeded the number of correct satisfaction mappings for the CM-1 data set. This indicates that numerous false positives were returned (errors of commission), but the difference in the number of false positives returned is not statistically significant. Rule Family 2 looks at adjective and adverb phrases. The same adjective or adverb phrase may be a modifier on multiple noun and verb phrases, and thus may be tagged as a candidate satisfaction mapping erroneously during analysis.

6.1.5.3 Rule Family 3.

Hypotheses Tested: $H_{06/}$ $H_{A6,}$ $H_{07/}$ $H_{A7,}$ $H_{08/}$ $H_{A8,}$ $H_{09/}$ $H_{A9,}$ $H_{10/}$ $H_{A10.}$

Table 6.4 depicts the means, standard deviation, and t-test results for Experiment 2 with Rule Family 3. As evidenced by the t-test results, differences in recall, precision, selectivity, number of corrections and F-measure are statistically significant at the 0.05 level for the Gantt data set, and differences in recall, precision, selectivity, and F-measure are statistically significant at the 0.05 level for the CM-1 data set (bold-faced entries). The TF-IDF satisfaction assessment method outperformed the Rules-Based method in terms of recall, precision, selectivity, and F-measure for both the Gantt and CM-1 data sets. The Rules-Based method required a fewer number of corrections than the TF-IDF method.

The null hypothesis is rejected in favor of the alternative when the probability that observed results are due to chance is 0.05 or less, so the null hypotheses $H_{06,}$ $H_{07,}$ $H_{09,}$ and H_{10} were rejected in favor of $H_{A6,}$ $H_{A7,}$ $H_{A9,}$ and H_{A10} for both data sets. For the Gantt data set, null hypothesis H_{08} was also rejected in favor of H_{A8}. For the CM-1 data set, null hypothesis H_{08} was accepted. For both methods, the number of corrections exceeded the number of correct satisfaction mappings for the CM-1 data set. This indicates that numerous false positives were returned (errors of commission), but the difference in the

Table 6.3. T-Tests, Mean, and Standard Deviation for Recall, Precision, Number of Corrections, Selectivity, and F-Measure for TF-IDF and Rule-Based Satisfaction Assessment Methods - Family 2.

		Recall	Precision	Number of Corrections	Selectivity	F-Measure
T-Test	**Gantt**	**0.001**	**0.000**	**0.000**	**0.012**	**0.000**
	CM-1	**0.000**	**0.000**	0.054	**0.001**	**0.000**
Mean	**Gantt (TFSM)**	47.072%	68.747%	390.333	0.003	0.538
	Gantt (RBSM)	6.903%	40.398%	520.444	0.023	0.084
	CM-1 (TFSM)	50.017%	37.444%	2442.333	0.000	0.401
	CM-1 (RBSM)	1.812%	7.035%	1939.000	0.000	0.028
Standard Deviation	**Gantt (TFSM)**	0.125	0.112	21.915	0.001	0.053
	Gantt (RBSM)	0.139	0.098	27.391	0.019	0.133
	CM-1 (TFSM)	0.180	0.065	678.830	0.000	0.043
	CM-1 (RBSM)	0.016	0.051	105.000	0.000	0.025

number of false positives returned was not statistically significant. Rule Family 3 focuses on lists and sets, which were not prevalent in the data sets used in this research.

6.1.5.4 Rule Family 4.

Hypotheses Tested: $H_{06/}$ $H_{A6,}$ $H_{07/}$ $H_{A7,}$ $H_{08/}$ $H_{A8,}$ $H_{09/}$ $H_{A9,}$ $H_{10/}$ $H_{A10.}$

Table 6.5 depicts the means, standard deviation, and t-test results for Experiment 2 with Rule Family 4. As evidenced by the t-test results, differences in recall, precision, selectivity, number of corrections and F-measure are statistically significant at the 0.05 level for the Gantt data set, and differences in recall, precision, selectivity, and F-measure are statistically significant at the 0.05 level for the CM-1 data set (bold-faced entries). The TF-IDF satisfaction assessment method outperformed the Rules-Based method in terms of recall, precision, selectivity, and F-measure for both the Gantt and CM-1 data sets. The Rules-Based method required a fewer number of corrections than the TF-IDF method.

Table 6.4. T-Tests, Mean, and Standard Deviation for Recall, Precision, Number of Corrections, Selectivity, and F-Measure for TF-IDF and Rule-Based Satisfaction Assessment Methods - Family 3.

		Recall	Precision	Number of Corrections	Selectivity	F-Measure
T-Test	**Gantt**	**0.000**	**0.000**	**0.000**	**0.020**	**0.000**
	CM-1	**0.000**	**0.000**	0.646	**0.005**	**0.000**
Mean	**Gantt (TFSM)**	47.072 %	68.747%	390.333	0.003	0.538
	Gantt (RBSM)	6.914%	15.541%	541.000	0.069	0.096
	CM-1 (TFSM)	50.017 %	37.444%	2442.333	0.000	0.401
	CM-1 (RBSM)	3.238%	3.713%	2308.000	0.000	0.035
Standard Deviation	**Gantt (TFSM)**	0.125	0.112	21.915	0.001	0.053
	Gantt (RBSM)	0.069	0.155	42.000	0.069	0.096
	CM-1 (TFSM)	0.180	0.065	678.830	0.000	0.043
	CM-1 (RBSM)	0.032	0.037	625.000	0.000	0.035

The null hypothesis is rejected in favor of the alternative when the probability that observed results are due to chance is 0.05 or less, so the null hypotheses $H_{06,}$ $H_{07,}$ $H_{09,}$ and H_{10} were rejected in favor of $H_{A6,}$ $H_{A7,}$ $H_{A9,}$ and H_{A10} for both data sets. For the Gantt data set, null hypothesis H_{08} was also rejected in favor of H_{A8}. For the CM-1 data set, null hypothesis H_{08} was accepted. For both methods, the number of corrections exceeded the number of correct satisfaction mappings for the CM-1 data set. This indicates that numerous false positives were returned (errors of commission), but the difference in the number of false positives returned was not statistically significant. Rule family 4 focuses on particles and unique terms. Neither of these were prevalent in the data sets used for this research.

6.1.6 Experiment 3 Results. TF-IDF Satisfaction Method (TFSM) vs. the Combination Satisfaction Method (CSM)

Results for the Combination method with each rule family will be discussed. *Figures 6.25* and *6.26* show recall and precision for the Combination satisfaction assessment method for the Gantt and CM-1 data sets respectively. For the Combination satisfaction assessment method using rules from Rule Family 1, recall was better for the CM-1 data set versus the Gantt data set. For rules from Rule Families 2, 3 and 4, recall was better for the Gantt data set versus the CM-1 data set. Number of corrections for the Gantt data set and CM-1 data set with the Combination satisfaction assessment method are shown in *Figures 6.27* and *6.28*, and selectivity is shown in *Figures 6.29* and *6.30*. For the Combination satisfaction assessment method for all rule families number of corrections was lower for the Gantt data set versus the CM-1 data set and selectivity was lower for the Gantt data set versus the CM-1 data set for Rule Families 2, 3, and 4. The difference in selectivity was negligible for Rule Family 1. F-Measure for the two data sets with the Combination satisfaction assessment method is shown in *Figures 6.31* and *6.32*.

Table 6.5. T-Tests, Mean, and Standard Deviation for Recall, Precision, Number of Corrections, Selectivity, and F-Measure for TF-IDF and Rule-Based Satisfaction Assessment Methods - Family 4.

		Recall	Precision	Number of Corrections	Selectivity	F-Measure
T-Test	**Gantt**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**
	CM-1	**0.000**	**0.000**	0.321	**0.004**	**0.000**
Mean	**Gantt (TFSM)**	47.072%	68.747%	390.333	0.003	0.538
	Gantt (RBSM)	0.038%	0.052%	1978.805	0.000	0.000
	CM-1 (TFSM)	50.017%	37.444%	2442.333	0.000	0.401
	CM-1 (RBSM)	0.044%	0.040%	2190.797	0.000	0.000
Standard Deviation	**Gantt (TFSM)**	0.125	0.112	21.915	0.001	0.053
	Gantt (RBSM)	0.000	0.001	527.268	0.000	0.000
	CM-1 (TFSM)	0.180	0.065	678.830	0.000	0.043
	CM-1 (RBSM)	0.001	0.001	580.607	0.000	0.001

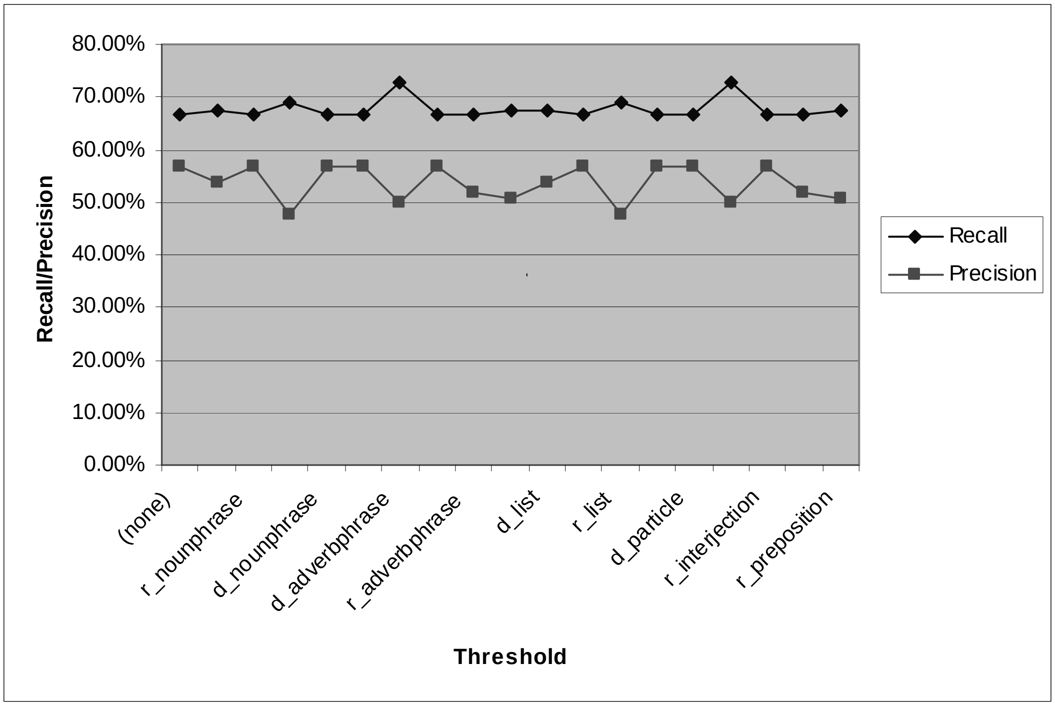

Figure 6.25. Recall and Precision for Combination Satisfaction Method and Gantt Data Set.

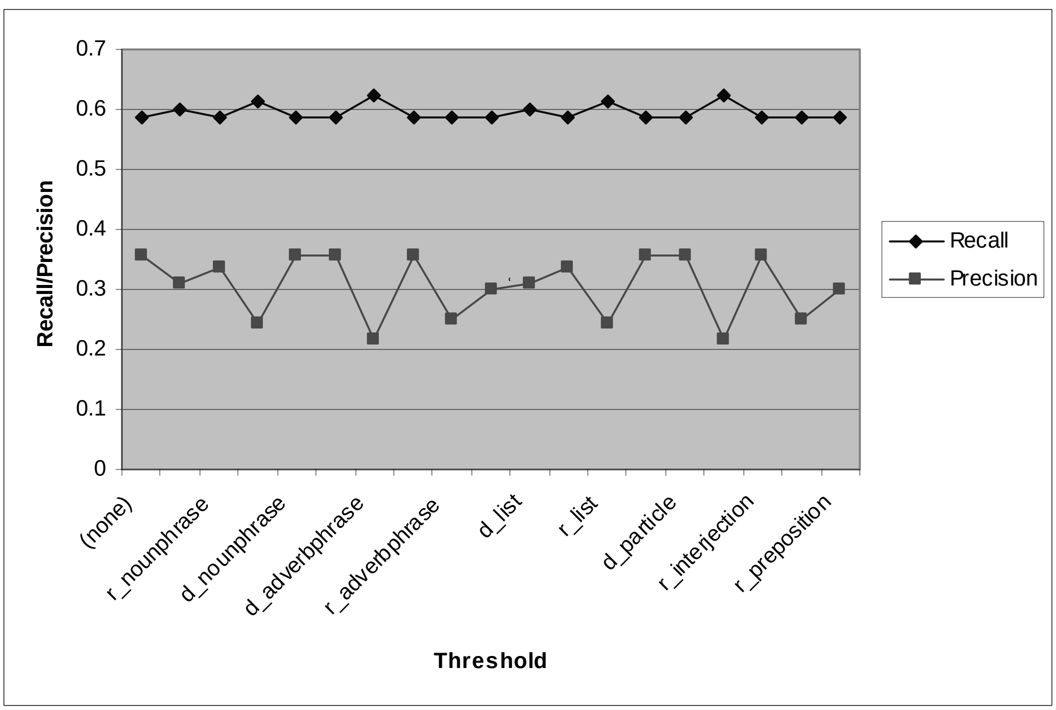

Figure 6.26. Recall and Precision for Combination Satisfaction Method and CM-1 Data Set.

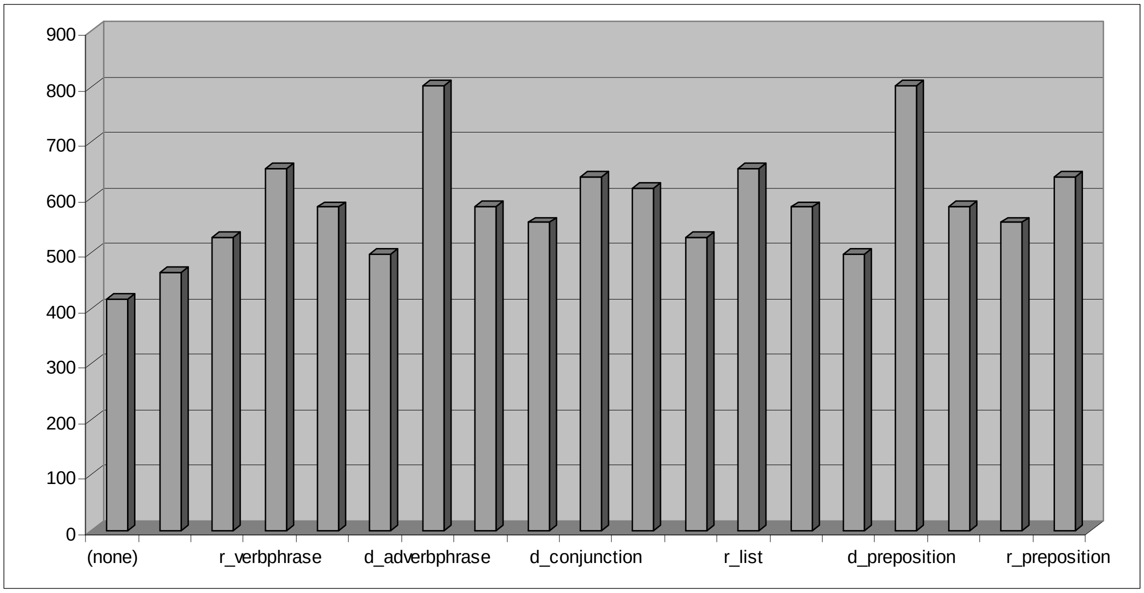

Figure 6.27. Number of Corrections for Combination Method and Gantt Data Set.

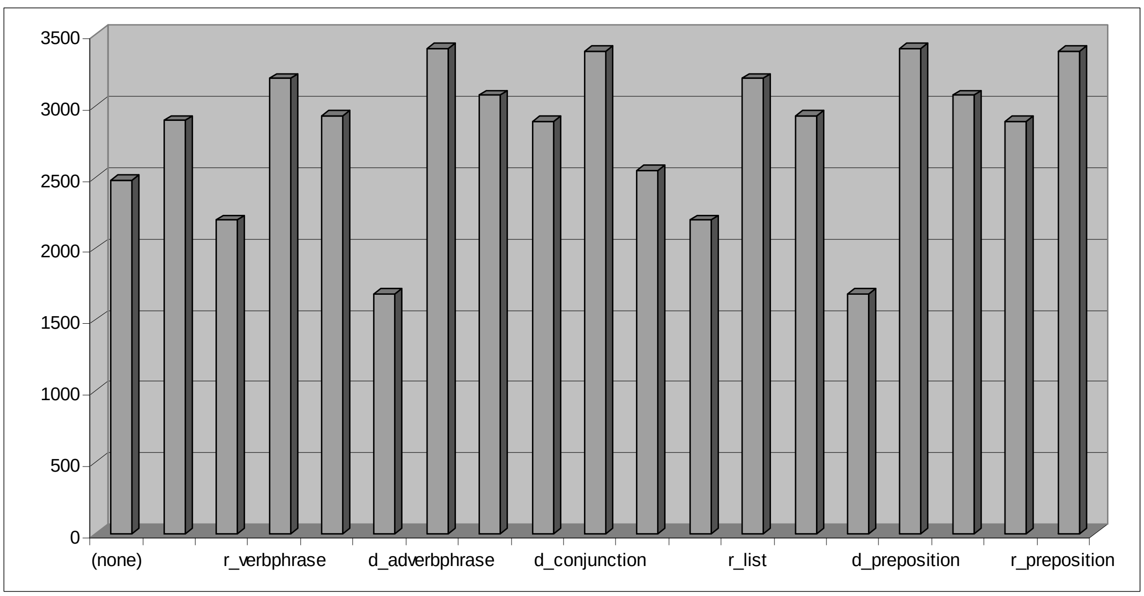

Figure 6.28. Number of Corrections for Combination Method and CM-1 Data Set.

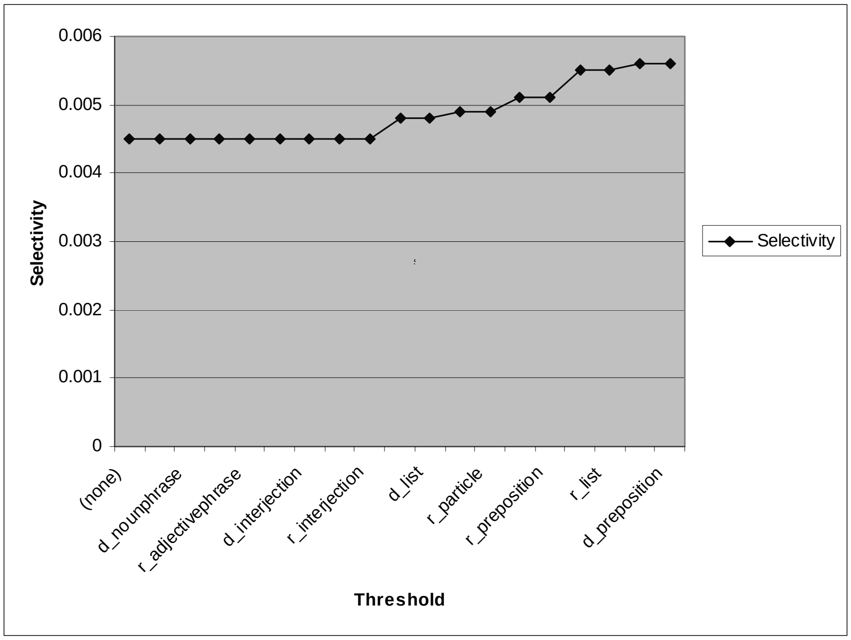

Figure 6.29. Selectivity for Combination Method and Gantt Data Set.

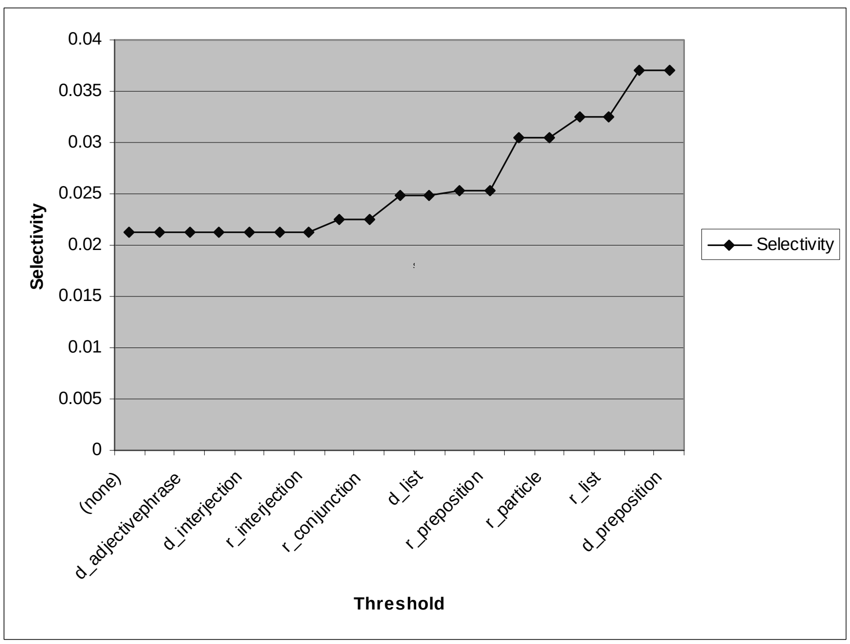

Figure 6.30. Selectivity for Combination Method and CM-1 Data Set.

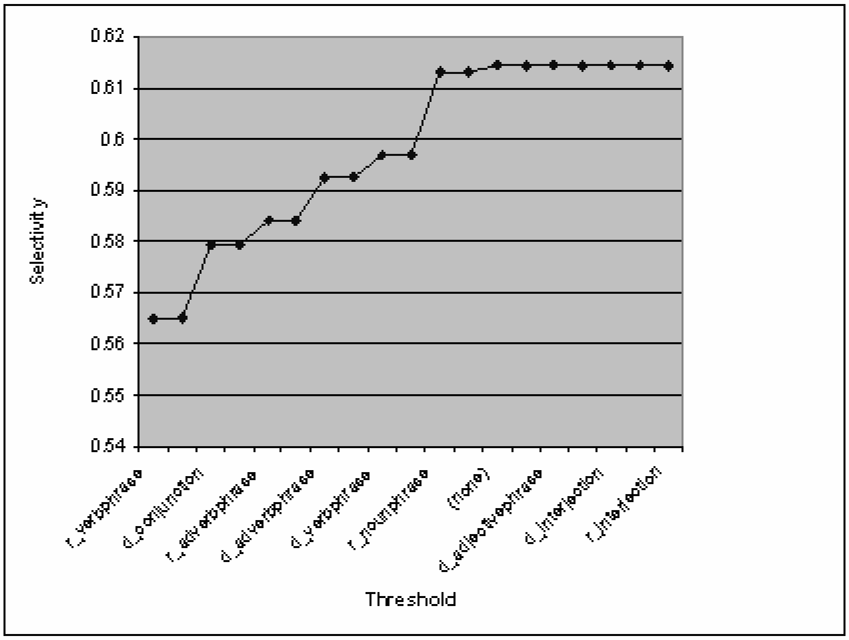

Figure 6.31. F-Measure for Rules-Based Method and Gantt Data Set.

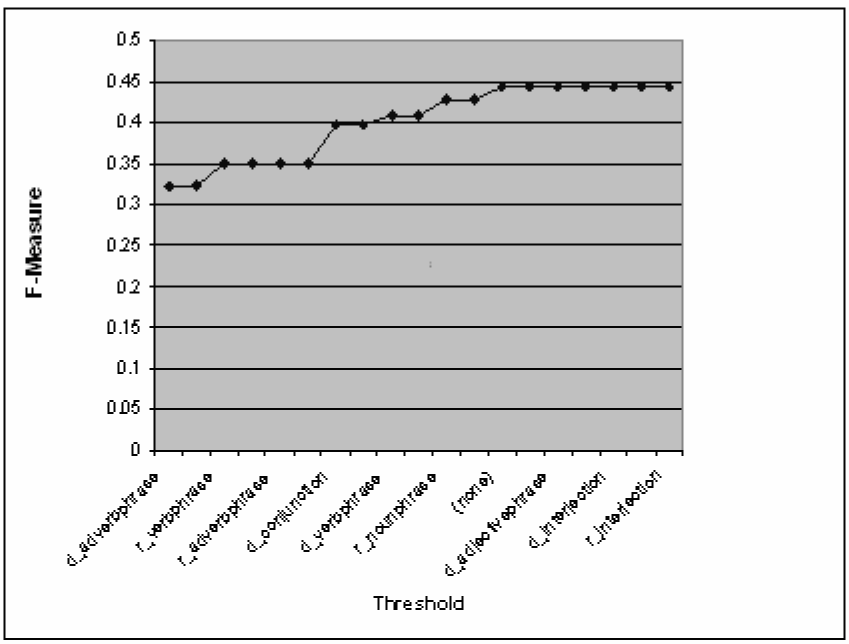

Figure 6.32. F-Measure for Combination Method and CM-1 Data Set.

6.1.6.1 Rule Family 1.

Hypotheses Tested: H_{011}/H_{A11}, H_{12}/H_{A12}, H_{13}/H_{A13}, H_{14}/H_{A14}, H_{15}/H_{A15}.

Table 6.6 depicts the means, standard deviation, and t-test results for Experiment 3 with Rule Family 1. As evidenced by the t-test results, differences in recall, precision, selectivity, and number of corrections were statistically significant at the 0.05 level for the Gantt data set, and differences in precision and selectivity are statistically significant at the 0.05 level for the CM-1 data set (bold-faced entries). The Combination satisfaction assessment method outperformed the TF-IDF method in terms of recall and F-measure for both the Gantt and CM-1 data sets.

The null hypothesis is rejected in favor of the alternative when the probability that observed results are due to chance is 0.05 or less, so the null hypotheses H_{11} and H_{14} were rejected in favor of H_{A11} and H_{A14} for both data sets. For the Gantt data set, null hypotheses H_{12} and H_{13} were also rejected in favor of H_{A12} and H_{A13}. For the CM-1 data set, null hypotheses H_{12} and H_{13} were accepted. The Family 1 rule set targets specific satisfaction assessment mappings that may be missed by the TF-IDF method, so it is expected to see gains in recall with the combination method.

Table 6.6. T-Tests, Mean, and Standard Deviation for Recall, Precision, Number of Corrections, Selectivity, and F-Measure for TF-IDF and Combination Satisfaction Assessment Methods - Family 1.

		Recall	Precision	Number of Corrections	Selectivity	F-Measure
T-Test	**Gantt**	**0.002**	**0.011**	**0.000**	**0.001**	0.091
	CM-1	0.148	**0.040**	0.225	**0.000**	0.736
Mean	**Gantt (TFSM)**	47.072 %	68.747%	390.333	0.003	0.538
	Gantt (CSM)	64.841 %	52.432%	560.222	0.005	0.579
	CM-1 (TFSM)	50.017 %	37.444%	2442.333	0.000	0.401
	CM-1 (CSM)	59.641 %	31.203%	2805.250	0.025	0.407
Standard Deviation	**Gantt (TFSM)**	0.125	0.112	21.915	0.001	0.053
	Gantt (CSM)	0.080	0.054	69.175	0.000	0.060
	CM-1 (TFSM)	0.180	0.065	678.830	0.000	0.043
	CM-1 (CSM)	0.011	0.043	368.728	0.004	0.036

6.1.6.2 Rule Family 2.

Hypotheses Tested: $H_{011/}$ $H_{A11,}$ $H_{12/}$ $H_{A12,}$ $H_{13/}$ $H_{A13,}$ $H_{14/}$ $H_{A14,}$ $H_{15/}$ $H_{A15.}$

Table 6.7 depicts the means, standard deviation, and t-test results for Experiment 3 with Rule Family 2. As evidenced by the t-test results, differences in recall, precision, selectivity, number of corrections and F-measure were statistically significant at the 0.05 level for the Gantt data set, and differences in precision and selectivity were statistically significant at the 0.05 level for the CM-1 data set (bold-faced entries). The Combination satisfaction assessment method outperformed the TF-IDF method in terms of recall for both the Gantt and CM-1 data sets and in terms of F-measure for the Gantt data set.

The null hypothesis is rejected in favor of the alternative when the probability that observed results are due to chance is 0.05 or less, so the null hypotheses H_{11} and H_{14} were rejected in favor of H_{A11}, H_{A14} for both data sets. For the Gantt data set, null hypotheses H_{12}, H_{13}, and H_{A15} were also rejected in favor of H_{A12}, H_{A13}, and H_{A15}. For the CM-1 data set, null hypotheses H_{12}, H_{13}, and H_{A15} were accepted. The Family 2 rule set targets specific satisfaction assessment mappings that may be missed by the TF-IDF method, so it is expected to see gains in recall with the combination method.

Table 6.7. T-Tests, Mean, and Standard Deviation for Recall, Precision, Number of Corrections, Selectivity, and F-Measure for TF-IDF and Combination Satisfaction Assessment Methods - Family 2.

		Recall	Precision	Number of Corrections	Selectivity	F-Measure
T-Test	**Gantt**	**0.002**	**0.011**	**0.000**	**0.001**	**0.006**
	CM-1	0.149	**0.035**	0.377	**0.000**	0.622
Mean	**Gantt (TFSM)**	47.072 %	68.747%	390.333	0.003	0.538
	Gantt (CSM)	65.553 %	52.573%	607.111	0.005	0.601
	CM-1 (TFSM)	50.017 %	37.444%	2442.333	0.000	0.401
	CM-1 (CSM)	59.551 %	29.452%	2764.250	0.027	0.389
Standard Deviation	**Gantt (TFSM)**	0.125	0.112	21.915	0.001	0.053
	Gantt (CSM)	0.086	0.051	115.311	0.000	0.013
	CM-1 (TFSM)	0.180	0.065	678.830	0.000	0.043
	CM-1 (CSM)	0.015	0.063	651.380	0.007	0.055

6.1.6.3 Rule Family 3.

Hypotheses Tested: H_{011}/ H_{A11}, H_{12}/ H_{A12}, H_{13}/ H_{A13}, H_{14}/ H_{A14}, H_{15}/ H_{A15}.

Table 6.8 depicts the means, standard deviation, and t-test results for Experiment 3 with Rule Family 3. As evidenced by the t-test results, differences in recall, precision, selectivity, number of corrections and F-measure were statistically significant at the 0.05 level for the Gantt data set, and differences in precision and selectivity were statistically significant at the 0.05 level for the CM-1 data set (bold-faced entries). The Combination satisfaction assessment method outperformed the TF-IDF method in terms of recall for both the Gantt and CM-1 data sets and in terms of F-measure for the Gantt data set.

The null hypothesis is rejected in favor of the alternative when the probability that observed results are due to chance is 0.05 or less, so the null hypotheses H_{11} and H_{14} were rejected in favor of H_{A11}, H_{A14} for both data sets. For the Gantt data set, null hypotheses H_{12}, H_{13}, and H_{A15} were also rejected in favor of H_{A12}, H_{A13}, and H_{A15}. For the CM-1 data set, null hypotheses H_{12}, H_{13}, and H_{A15} were accepted. The Family 3 rule set targets specific satisfaction assessment mappings that may be missed by the TF-IDF method, so it is expected to see gains in recall with the combination method.

Table 6.8. T-Tests, Mean, and Standard Deviation for Recall, Precision, Number of Corrections, Selectivity, and F-Measure for TF-IDF and Combination Satisfaction Assessment Methods - Family 3.

		Recall	Precision	Number of Corrections	Selectivity	F-Measure
T-Test	**Gantt**	**0.001**	**0.003**	**0.000**	**0.001**	**0.025**
	CM-1	0.152	**0.020**	0.186	**0.000**	0.765
Mean	**Gantt (TFSM)**	47.072 %	68.747%	390.333	0.003	0.538
	Gantt (CSM)	67.635 %	52.233%	608.750	0.005	0.589
	CM-1 (TFSM)	50.017 %	37.444%	2442.333	0.000	0.401
	CM-1 (CSM)	59.685 %	29.764%	2829.250	0.026	0.396
Standard Deviation	**Gantt (TFSM)**	0.125	0.112	21.915	0.001	0.053
	Gantt (CSM)	0.009	0.033	48.256	0.000	0.018
	CM-1 (TFSM)	0.180	0.065	678.830	0.000	0.043
	CM-1 (CSM)	0.011	0.034	478.544	0.004	0.029

6.1.6.4 Rule Family 4.

Hypotheses Tested: H_{011}/H_{A11}, H_{12}/H_{A12}, H_{13}/H_{A13}, H_{14}/H_{A14}, H_{15}/H_{A15}.

Table 6.9 depicts the means, standard deviation, and t-test results for Experiment 3 with Rule Family 3. As evidenced by the t-test results, differences in recall, precision, selectivity, and number of corrections were statistically significant at the 0.05 level for the Gantt data set, and differences in precision and selectivity are statistically significant at the 0.05 level for the CM-1 data set (bold-faced entries). The Combination satisfaction assessment method outperformed the TF-IDF method in terms of recall for both the Gantt and CM-1 data sets and in terms of F-measure for the Gantt data set.

The null hypothesis is rejected in favor of the alternative when the probability that observed results are due to chance is 0.05 or less, so the null hypotheses H_{11} and H_{14} were rejected in favor of H_{A11}, H_{A14} for both data sets. For the Gantt data set, null hypotheses H_{12}, and H_{13} were also rejected in favor of H_{A12}, and H_{A13}. For the CM-1 data set, null hypotheses H_{12}, H_{13}, and H_{A15} were accepted, and for the Gantt dataset H_{15} was accepted. The Family 3 rule set targets specific satisfaction assessment mappings that may be missed by the TF-IDF method, so it is expected to see gains in recall with the combination method.

Table 6.9: T-Tests, Mean, and Standard Deviation for Recall, Precision, Number of Corrections, Selectivity, and F-Measure for TF-IDF and Combination Satisfaction Assessment Methods - Family 4.

		Recall	Precision	Number of Corrections	Selectivity	F-Measure
T-Test	**Gantt**	**0.001**	**0.009**	**0.000**	**0.001**	0.060
	CM-1	0.249	**0.044**	0.341	**0.000**	0.335
Mean	**Gantt (TFSM)**	47.072 %	68.747%	390.333	0.003	0.538
	Gantt (CSM)	64.423 %	51.165%	579.182	0.005	0.569
	CM-1 (TFSM)	50.017 %	37.444%	2442.333	0.000	0.401
	CM-1 (CSM)	56.269 %	29.005%	2748.146	0.025	0.379
Standard Deviation	**Gantt (TFSM)**	0.125	0.112	21.915	0.001	0.053
	Gantt (CSM)	0.065	0.056	99.421	0.001	0.056
	CM-1 (TFSM)	0.180	0.065	678.830	0.000	0.043
	CM-1 (CSM)	0.055	0.056	565.553	0.006	0.056

6.2 Evaluation of Expected Results

Revisiting our expected results from *Section 5.5*, we see that, on average, the TF-IDF satisfaction assessment method had better precision than the Naïve method (*Section 5.5, Item a*), but that it did not exceed the Naïve method in recall (*Section 5.5, Item b*) for both data sets. The TF-IDF method resulted in a lower number of corrections than Naïve for both data sets as expected (*Section 5.5, Item c*). As expected, the Combination satisfaction assessment method had greater recall than the TF-IDF method when using Rule Families 1 and 2 for both data sets (*Section 5.5, Items d and e*). Precision for the TF-IDF method was greater than precision for the Combined method with Rule Families 1 and 2 for both data sets as expected (*Section 5.5, Items f and g*). Results using Rule Family 1 had greater recall and precision than Rule Family 2 for the CM-1 data set and had greater precision than Rule Family 2 for the Gantt data set (*Section 5.5, Item h*). However, for the Gantt data set, results with Rule Family 2 had better precision than Rule Family 1. This is because the text in the Gantt data set used more adjectives and adverbs than the CM-1 data set and thus favored rules from Rule Family 2. Rule Family 2 had better recall and precision than Rule Family 3 for the Gantt data set, and Rule Family 2 had better precision than Rule Family 3 for the CM-1 data set (*Section 5.5, Item i*). However, for the CM-1 data set, Rule Family 3 had better recall than Rule Family 2.

Rule Family 3 targets requirement and design element chunk pairs that describe lists and sets. The CM-1 data set contains more true satisfaction mappings related to lists and sets than the Gantt data set. Finally, Rule Family 3 had better recall and precision than Rule Family 4 for both data sets, as expected (*Section 5.5, Item j*).

6.3 Trends

In general, it has been found that recall is higher and precision is lower for larger data sets (such as CM-1) when applying the Naive and TF-IDF satisfaction assessment methods. These methods return results based on textual similarity. With a larger data set, it is more likely that textual patterns will emerge and similar terms will be used in multiple locations. Larger data sets tend to have better selectivity for the TF-IDF and Rules-Based satisfaction assessment methods. This is due to the weighting of potential matches based on term frequency and inverse document frequency. Terms that occur frequently in large data sets count less in determining satisfaction mappings, whereas in smaller data sets the frequency that a term appears in the overall data set may not be filtered out due to small document size. Normalized selectivity (selectivity over the number of true answer set satisfaction mappings) also shows this trend.

For the Rules-Based and Combination methods, recall is higher on average for the Gantt data set than for the CM-1 data set. The Gantt data set uses fewer domain-specific terms and these terms are more likely to be found by the rules-based approach than many of the terms found in the CM-1 data set.

For all methods, the number of corrections was lower for the Gantt data set. This is due to the smaller data set size. In smaller data sets, there are generally fewer links in the answer set and there are fewer possible satisfaction mappings to select from when creating a candidate satisfaction answer set, so the number of corrections will be lower. Normalized number of corrections (shown in *Appendix H, Tables H2, H3, H11, H12,H19, H20, H25,* and *H26*) accounts for data set size by dividing by the number of true answer set satisfaction mappings. The normalized number of corrections was also greater for the CM-1 data set than for the Gantt data set. This is due to reduced precision for larger data sets as described above.

Looking at method performance, the Naïve satisfaction assessment method captured links based solely on textual similarity. This yielded a lower level of selectivity than the other methods as well as lower precision. The recall for the Naïve satisfaction assessment method was slightly higher than other methods, but this was due to the low selectivity. The TF-IDF satisfaction assessment method showed reasonable performance overall, with strong recall and precision for both data sets. The TF-IDF method was selective and has a relatively low number of corrections for both data sets. The Rules-Based satisfaction assessment method was highly selective. While no single rule set has the recall and precision values of TF-IDF, the Rules-Based satisfaction assessment method captured candidate satisfaction mappings that were not caught by other satisfaction assessment methods. Finally, the Combination satisfaction assessment method achieved a higher recall than the TF-IDF method alone with a reasonable tradeoff in precision. The Combination method was still highly selective and had a low number of corrections and normalized number of corrections.

Chapter 7

Conclusions and Future Work

Determining whether requirements are fully or partially satisfied by design elements in general terms is an unsolvable problem. When this problem is focused on a particular domain, however, much can be discovered about the process used to assess requirement satisfaction. Automated techniques have been implemented to assist analysts in assessing which design elements satisfy requirements, reducing the time and effort required for verification. Four satisfaction assessment methods have been proposed and evaluated: Naïve satisfaction assessment, TF-IDF satisfaction assessment, Rules-Based satisfaction assessment, and Combination satisfaction assessment.

It was found that the TF-IDF satisfaction assessment method outperformed the Naïve satisfaction assessment method in terms of precision, selectivity and number of corrections. Using the TF-IDF satisfaction assessment method instead of the Naïve satisfaction assessment method will result in a candidate satisfaction assessment that requires less analyst effort to verify. The Rules-Based satisfaction assessment method has shown promise in discovering candidate satisfaction mappings that are not found by other methods. The Combination satisfaction assessment method, which uses both TF-IDF and Rules-Based satisfaction assessment approaches, has a higher level of recall than either method alone and can further reduce analyst time required for satisfaction assessment verification.

Trends in data sets were also described. In general, when satisfaction assessment is performed on larger data sets, the resulting candidate satisfaction assessments will have higher recall, lower precision and better selectivity, including normalized selectivity. Larger data sets also tend to exhibit higher number of corrections, including normalized number of corrections.

Future work on this project includes completing additional methods for satisfaction assessment and empirically validating these methods. Future studies could focus on improving the precision, and number of corrections for larger data sets. Also, future work includes further mining of the rule space for high-precision rules and rules that return unique satisfaction mappings. Additional Rules-Based method rule sets could be evaluated in an effort to match or exceed the recall provided by the Combination method. Mechanisms could also be implemented to allow analysts to offer feedback on candidate satisfaction mappings and incorporate that feedback into future satisfaction assessment experiments.

Appendices

Appendix A: Fox Stopword List

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all
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members
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might
more
most
mostly
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much
must
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need
needed
needing
needs
never
new
newer
newest
next
no
non
not
nobody
noone
nothing
now
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places
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points
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presenting
presents
problem
problems
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puts
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say
says
second
seconds
see
sees
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seeming
seems
several
shall
she
should
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showed
showing
shows
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sides
since
small
smaller
smallest
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somebody
someone
something
somewhere
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states
still
such
sure
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taken
than
that
the
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then
there
therefore
these
they
thing
things
think
thinks
this
those
though
thought
thoughts
three
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thus
to
today
together
too
took
toward
turn
turned
turning
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until
up
upon
us
use
uses
used
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IO0
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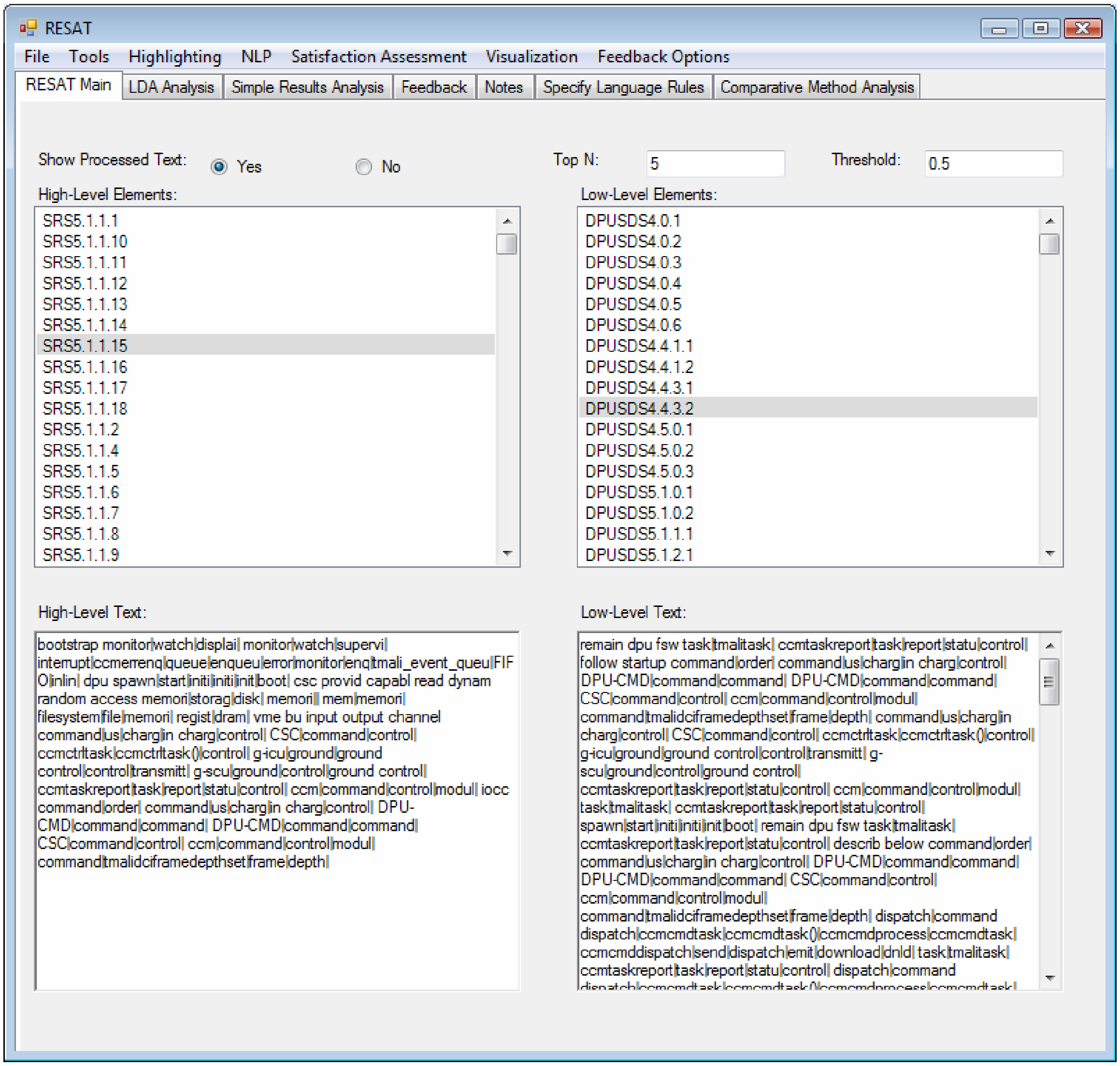
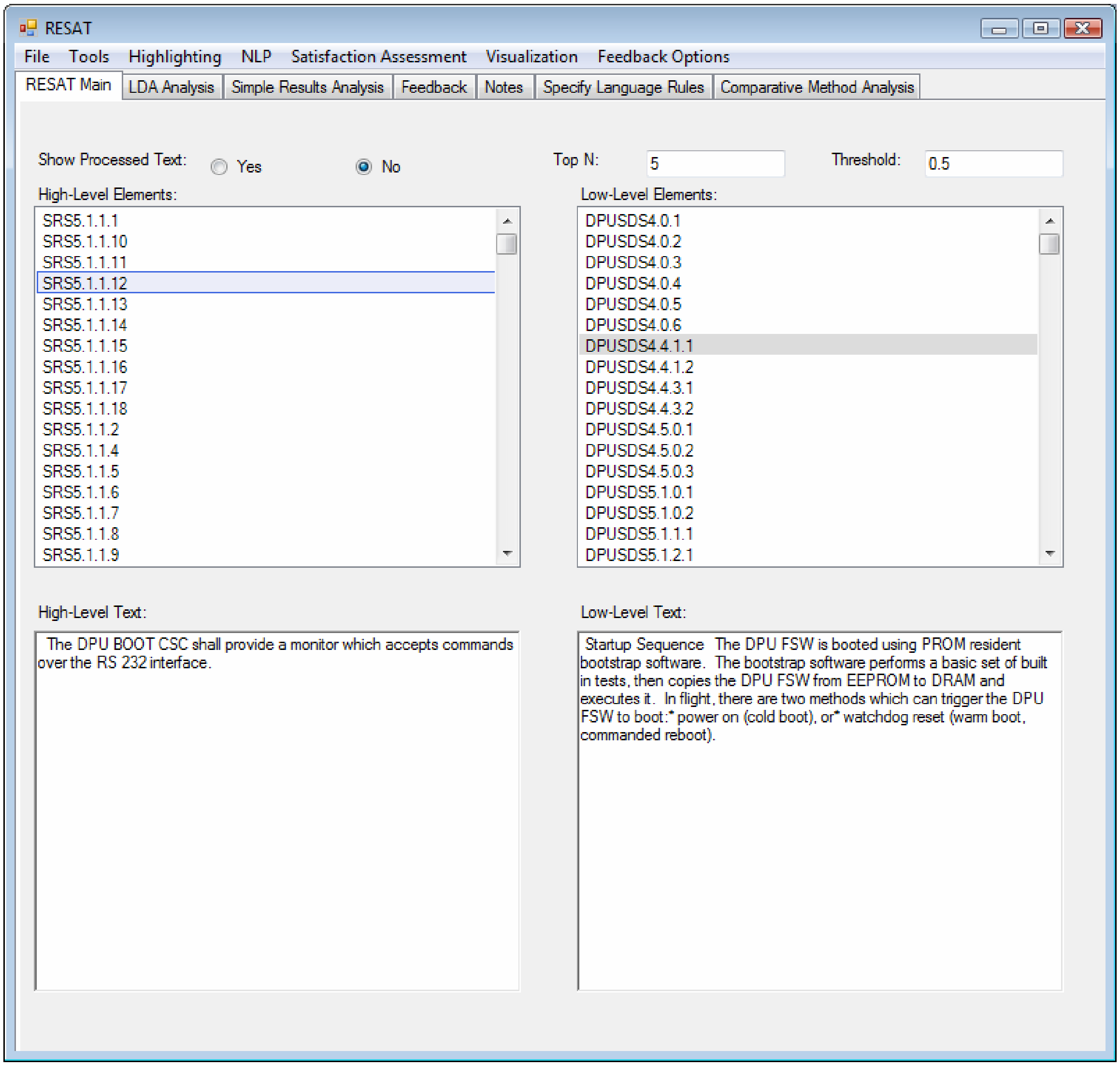
want
wanted
wanting
wants
was
way
ways
we
well
wells
went
were
what
when
where
whether
which
while
who
whole
whose
why
will
with
within
without
work
worked
working
works
would
Y
year
years
yet
you
young
younger
youngest
your
yours

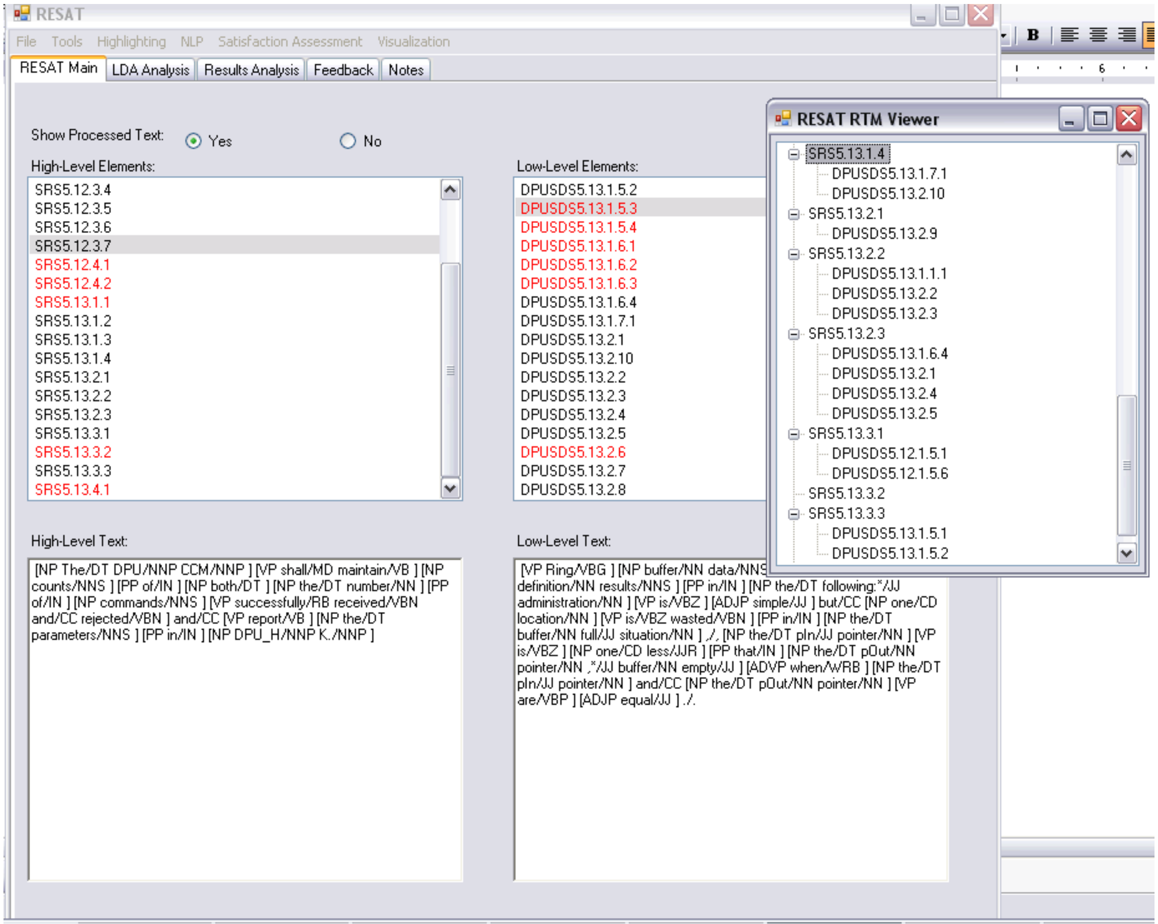
Appendix B: RESAT Screenshots



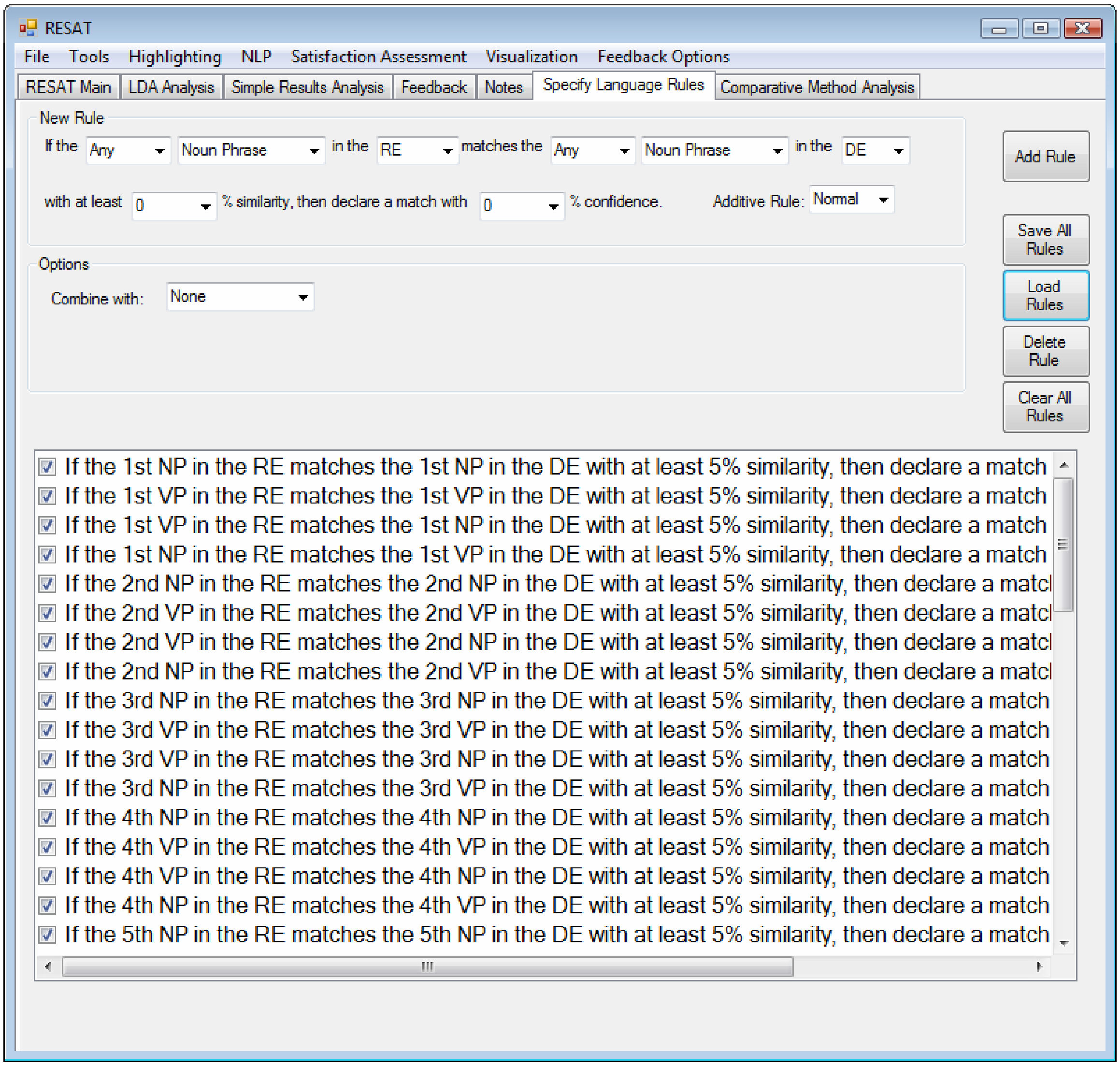
RESAT Main Page with Processed Text



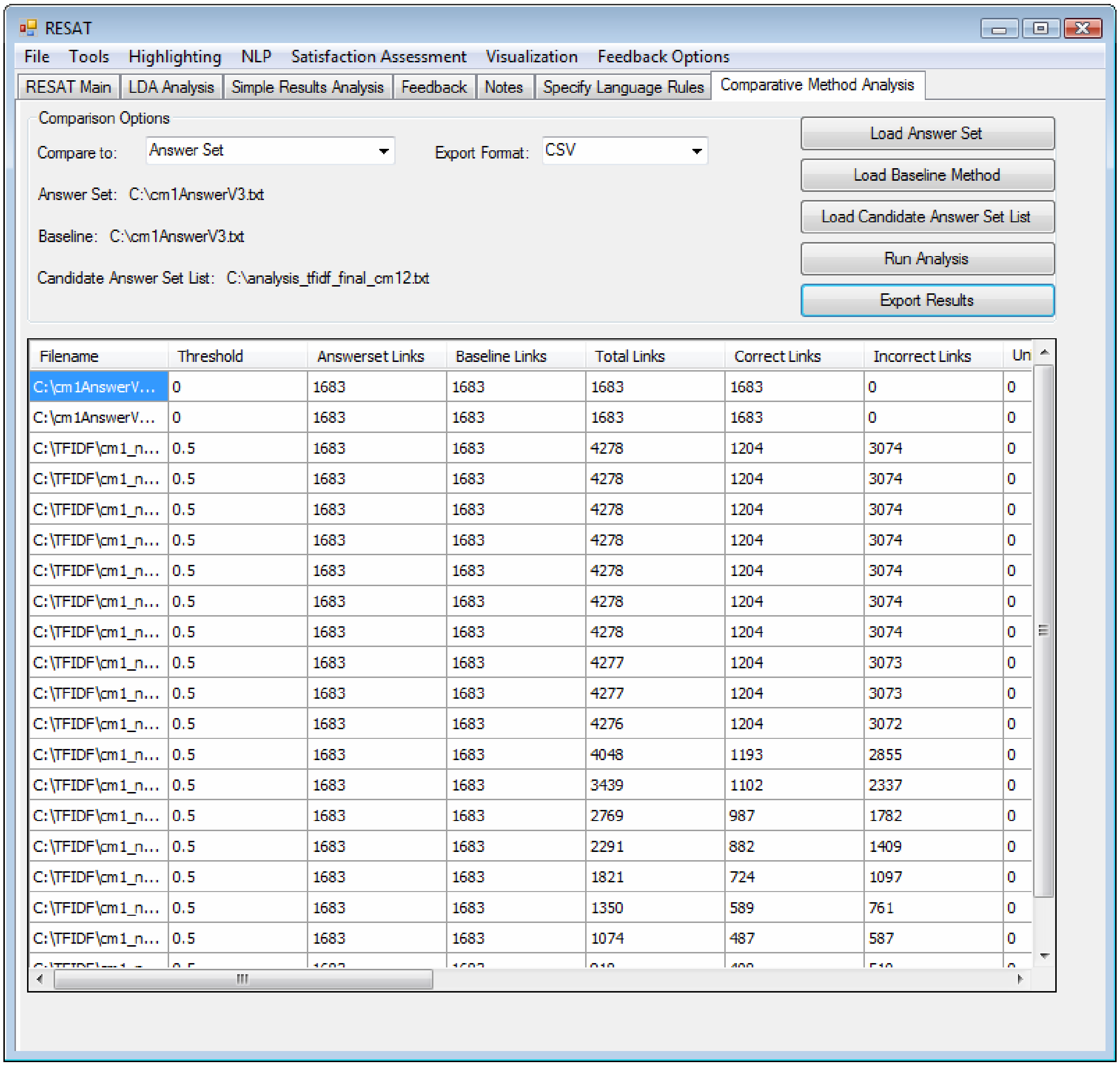
RESAT Main Page with Normal Text



RTM Visualization



RESAT Rule Specification Interface



RESAT Analysis Mode

Appendix C: RESAT Data Structures

SATData
+numRE : int +numDE : int +numThesaurusEntries : int +requirements : ArrayList +designElements : ArrayList +modifiedRequirements : ArrayList +modifiedDesignElements : ArrayList +thesaurus : ArrayList +stopWords : ArrayList +stopwordFilePath : string +numStopWords : int +totalNumChunks : int +numReqChunks : int
+SATData() +getDE(in DEName : string) : int +getRE(in REName : string) : int +checkForRTMMatch(in myRE : RE, in myDE : DE) : bool +parseChunks() +synTagString(in input : string) : string +preProcessString(in input : string) : string +loadThesaurus(in thesaurusFilename : string) +loadHighAndLowFiles(in highPath : string, in lowPath : string) -tokenizeString(in preStem : string) : string[] +loadRTMforSAT(in myRTM : string) +removeAllButLettersAndNums(in myString : string) : string +removePunctuation(in myString : string) : string +removeStopWordsFromString(in myString : string) : string +removeStopWordsFromFile(in currentFile : string, in targetFile : string) +WriteToStream(in strm : Stream, in text : string) +loadStopWordFile() +getReqIndex(in reqName : string) : int +getDEIndex(in DEName : string) : int +satStemWord(in myTerm : string) : string +satStemString(in input : string) : string +saveFeedbackMarkup(in reqPath : string, in DEPath : string)

Figure F1. SATData Data Structure.

satisfactionPair
+reqChunkNum : int +deChunkNum : int +sim : double
+satisfactionPair(in reqChunkNum : int, in deChunkNum : int, in chunkSimTFIDF : double)

Figure F2. SatisfactionPair Data Structure.

RE
+name : string +text : string +processedText : string +tokens : string[] +tokens_preprocessed : string[] +tokens_stemmed : string[] +tokens_syntagged : string[] +naiveSatTokens : string[] +SAT_TFIDF : ArrayList +naiveSatTokenized : string +chunks : ArrayList +chunkIndices : ArrayList +chunks_preprocessed : ArrayList +chunks_syntagged : ArrayList +chunks_POS : ArrayList +naiveSatChunks : ArrayList +naiveSatChunked : string +feedbackMarkupText : string +multiple : bool +numSatisfying : int +satisfiedBy : ArrayList +certainty : ArrayList +tracedTo : ArrayList +keywordsMatched : ArrayList +keywordsMissed : ArrayList +status : string +sentenceSplitText : string +tokenizedText : string +preprocessedText : string +POStaggedText : string +chunkedText : string +thesaurusTaggedText : string
+setProcessedText(in newText : string) +RE() +RE(in myName : string, in myText : string)

Figure F3. RE Data Structure.

DE
+name : string +text : string +processedText : string +tokens : string[] +tokens_preprocessed : string[] +tokens_stemmed : string[] +tokens_syntagged : string[] +naiveSatTokens : string[] +SAT_TFIDF : ArrayList +naiveSat : string +chunks : ArrayList +chunkIndices : ArrayList +chunks_preprocessed : ArrayList +chunks_syntagged : ArrayList +chunks_POS : ArrayList +naiveSatChunks : ArrayList +naiveSatChunked : string +feedbackMarkupText : string +multiple : bool +certainty : ArrayList = new ArrayList() +tracedFrom : ArrayList = new ArrayList() +satisfies : ArrayList = new ArrayList() +numSatisfies : int +numTracedFrom : int +sentenceSplitText : string +tokenizedText : string +preprocessedText : string +POStaggedText : string +chunkedText : string +thesaurusTaggedText : string
+setProcessedText(in newText : string) +DE() +DE(in myName : string, in myText : string)

Figure F4. DE Data Structure.

Figure F5. ChunkPOSInfo Data Structure.

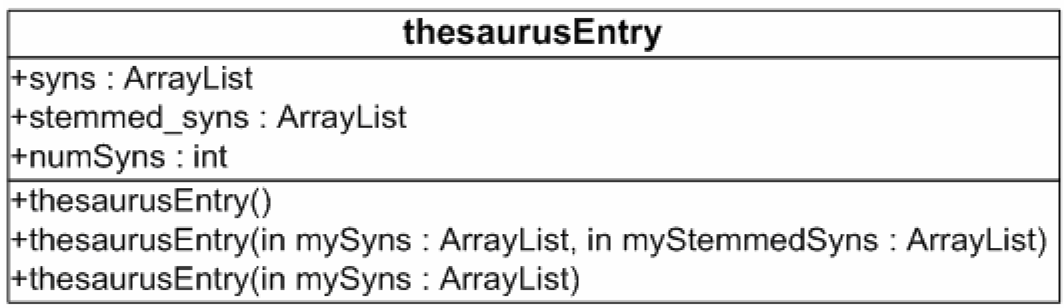


Figure F6. ThesaurusEntry Data Structure.

Appendix D: File Formats

Requirement Files:

Requirements read into the system should each be individual text files within a directory. The filename of each file is used as an identifier for the file within RESAT. A sample requirement is:

File: SRS5.13.1.3.txt

> The DPU-BIT shall test the Error Detection and Correction (EDAC) on the Company X Communication/Memory Module by reading preprogrammed error locations in PROM.

Design Element Files:

Likewise, design elements are individual text files within another directory. A sample design element is:

File: DPUSDS5.3.1.1.txt

> Initialization The DPU-BIT should be initialized every time the DPU boots. The startup task, usrRoot() should call bitPart1() before initializing the device drivers and bitPart2() after initializing EDAC and the device drivers.

Requirements Traceability Matrices:

RTMs are read into the system through a text file. Every other line of the text file is one row within the RTM, with only nonzero values listed. Other lines contain a "%" and newline character as a delimiter. A sample RTM is:

File: myRTM.txt

```
%
SRS5.1.1.1
%
SRS5.1.1.10   DPUSDS4.4.1.1   DPUSDS5.1.0.2   DPUSDS5.1.2.3
%
SRS5.1.1.11    DPUSDS5.1.0.2    DPUSDS5.1.2.3    DPUSDS5.2.3.7.1    DPUSDS5.3.0.1
DPUSDS5.3.2.1.4
%
SRS5.1.1.12   DPUSDS5.1.4.2
```

Satisfaction Assessment Output File:

The satisfaction assessment file format contains one requirement chunk per line. The numeric identifier of the chunk is the first word in the line, followed by " – " and a list of comma-separated design element chunk numbers for each of the design element chunks that satisfy the requirement chunk. A sample satisfaction assessment file is:

File myOutput.txt

```
1  -
2  -
3  -  43
4  -  33, 36, 45, 49, 66, 79, 115
5  -
6  -  40, 64, 104, 123, 132
7  -
8  -  33, 36, 45, 49, 66, 79, 115
9 -   118, 124
10  -  119, 125
11  -  126
12  -  59, 121, 127
```

Appendix E: Data Sets

CM-1 Subset 1:

Descriptive Statistics:

Data Set Size: 22 Requirements x 52 Design Elements
Number of RTM Links: 95
Average Number of Design Element Links per Requirement: 4.318181818
Number of Requirement Chunks: 298
Number of Design Element Chunks: 2982
Number of Requirement and Design Element Chunk Pairs: 885
Number of Chunk Pairs in the RTM: 82,138
Number of Possible Chunk Pairs: 888,636

CM-1 Subset 1 RTM:

%
SRS5.12.2.1 DPUSDS5.12.1.2.4 DPUSDS5.12.1.4.1 DPUSDS5.12.1.4.3
DPUSDS5.12.1.4.2 DPUSDS5.12.1.4.5
%
SRS5.12.2.2 DPUSDS5.12.0.1 DPUSDS5.12.1.3.1 DPUSDS5.12.1.3.2
DPUSDS5.12.1.3.3 DPUSDS5.12.2.1
%
SRS5.12.3.1 DPUSDS5.12.0.1 DPUSDS5.12.1.2.1 DPUSDS5.12.1.2.3
%
SRS5.12.3.2 DPUSDS5.12.0.1 DPUSDS5.12.1.2.1 DPUSDS5.12.1.2.2
DPUSDS5.12.1.2.3 DPUSDS5.12.1.5.1 DPUSDS5.12.1.5.5 DPUSDS5.12.1.5.6
DPUSDS5.12.2.2 DPUSDS5.13.1.3.3
%
SRS5.12.3.3 DPUSDS5.12.0.1 DPUSDS5.12.1.2.1 DPUSDS5.12.1.2.2
DPUSDS5.12.1.2.3
%
SRS5.12.3.4 DPUSDS5.12.0.1 DPUSDS5.12.1.5.2 DPUSDS5.12.1.5.3
DPUSDS5.12.1.5.4 DPUSDS5.12.2.2
%
SRS5.12.3.5 DPUSDS5.12.1.3.3
%
SRS5.12.3.6
%
SRS5.12.3.7 DPUSDS5.12.0.1 DPUSDS5.12.1.3.3
%
SRS5.12.4.1 DPUSDS5.12.1.4.4 DPUSDS5.12.1.4.5
%
SRS5.12.4.2 DPUSDS5.12.0.1 DPUSDS5.12.1.3.2 DPUSDS5.12.1.3.1
DPUSDS5.12.2.1

%
SRS5.13.1.1 DPUSDS5.12.1.5.5 DPUSDS5.13.0.2 DPUSDS5.13.1.1.1
DPUSDS5.13.1.3.1 DPUSDS5.13.1.3.2 DPUSDS5.13.1.3.3 DPUSDS5.13.1.6.4
%
SRS5.13.1.2 DPUSDS5.13.1.3.2 DPUSDS5.13.1.1.1 DPUSDS5.13.0.2
DPUSDS5.13.1.3.3 DPUSDS5.13.1.2.1 DPUSDS5.13.1.6.4 DPUSDS5.13.1.3.1
DPUSDS5.13.1.5.1 DPUSDS5.13.2.9
%
SRS5.13.1.3 DPUSDS5.13.1.6.1 DPUSDS5.13.2.1
%
SRS5.13.1.4 DPUSDS5.13.0.2 DPUSDS5.13.1.7.1 DPUSDS5.13.2.7
%
SRS5.13.2.1 DPUSDS5.13.1.3.2 DPUSDS5.13.1.5.1 DPUSDS5.13.2.9
%
SRS5.13.2.2 DPUSDS5.13.1.6.3 DPUSDS5.13.2.2 DPUSDS5.13.2.3
%
SRS5.13.2.3 DPUSDS5.13.0.2 DPUSDS5.13.1.6.4 DPUSDS5.13.2.4
DPUSDS5.13.2.5
%
SRS5.13.3.1 DPUSDS5.12.0.1 DPUSDS5.12.1.2.1 DPUSDS5.12.1.5.5
DPUSDS5.12.2.2 DPUSDS5.13.0.2 DPUSDS5.13.1.3.3
%
SRS5.13.3.2 DPUSDS5.13.0.2 DPUSDS5.13.1.3.3
%
SRS5.13.3.3 DPUSDS5.13.1.2.1 DPUSDS5.13.1.5.1 DPUSDS5.13.1.5.2
%
SRS5.13.4.1 DPUSDS5.13.0.2 DPUSDS5.13.1.1.1 DPUSDS5.13.1.2.1
DPUSDS5.13.1.3.1 DPUSDS5.13.1.3.2 DPUSDS5.13.1.3.3 DPUSDS5.13.2.2
DPUSDS5.13.2.3 DPUSDS5.13.2.4 DPUSDS5.13.2.5 DPUSDS5.13.2.6
DPUSDS5.13.2.9

CM-1 Subset 1 Satisfaction Answer Set:

0 - 616
1 -
2 -
3 -
4 - 619 623 626 629 881 882 886 890 907 908 922 924 933 946 959 982 983 986 987
997 1016 1023 1116 1117 1121 1130 1140 1142 1152 1157 1006 1018 1040 981 910 911
912 1164
5 -
6 - 625 628 630 929 989 928 930 988 990 999 1005 1006 1000 1005 1019 1154 1162
631 632 1163 1164
7 - 333 651 761 762 332 674 695 703 734 743 728 727
8 -

9 - 336
10 -
11 - 336 653 665 672 709 720 778 783 1468 1474 1479 678 697 707 736 739 791 819 867 1476
12 -
13 -
14 -
15 - 337 666 679 693 701 710 1469 735
16 -
17 - 340 661 669 681 715 1466 1472 678
18 - 339 659 668 683 686 697 712 714 1465 1471
19 -
20 -
21 - 375 590
22 -
23 -
24 -
25 -
26 - 330 438 613
27 - 330 439 551 614
28 -
29 - 610
30 -
31 - 590
32 -
33 -
34 -
35 -
36 -
37 -
38 -
39 - 463 465 606
40 - 299 304 308 416 560 528 1175
41 -
42 -
43 -
44 - 1180 1484
45 - 377 591 1177 1181 1357 1382 1415 1429 1486 2064 1174
46 - 380 590 1177 1182 1383 1410 1413 1418 1423 1487 2012 2014 507 514 1173 1356 1382 1414 1429 1445
47 -
48 - 384 389 1384 1489 1502 2015 508 519 520
49 -
50 - 353 391 492 532 593 1491 2017
51 - 528 535 299 307 308 393 416 437 500 488 575
52 - 549 572 575 579

53 - 329 549 421 422 431 432 435 436 448 550 573
54 -
55 - 339 415 475
56 -
57 - 307 308
58 -
59 - 323 420 435 485 486 556 557 559 587
60 - 320 591
61 -
62 - 532 593 353 391 492
63 - 1304 1346
64 -
65 -
66 - 1229 1272 1332 1341 1351
67 - 375 1217 1233 1234 1240 1243 1244 1267 1274 1287 1293 1294 1311 1314 1334 1529 1537 1225 1229 1235 1238 1239 1532 1546 1547 1545
68 -
69 - 1218 1312 1323
70 -
71 - 375 1221 1242 1293 1542 380 1221 1314 380 1216 1254 1270 1297 1270 1317 1349 1487 1501
72 - 1335 1336
73 - 1337
74 -
75 - 1246 1339 1345 1549
76 - 375 1221 1242 1293 1542 380 1221 1314 380 1216 1254 1270 1297 1270 1317 1349 1487 1501
77 - 1528
78 -
79 - 1248 1300 1531 1537 1532
80 -
81 - 389
82 - 375 1221 1242 1293 1542 380 1221 1314 380 1216 1254 1270 1297 1270 1317 1349 1487 1501
83 - 1218 1229 1249 1252 1272 1294 1351
84 - 1229
85 - 1229
86 - 375 1221 1242 1293 1542 380 1221 1314 380 1216 1254 1270 1297 1270 1317 1349 1487 1501
87 - 1234 1239 1243 1279 1290 1541 1544
88 - 762 769
89 -
90 - 789
91 -
92 -
93 -

94 - 783 795 811 802 819 856
95 -
96 - 789
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106 - 783 791
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130 -
131 -
132 -
133 - 299 333
134 - 809
135 - 355 806
136 -
137 - 808
138 - 355
139 - 356

140 - 357 811 808
141 - 358 808
142 -
143 -
144 - 355
145 - 319 391 351
146 -
147 -
148 - 1077
149 -
150 - 1053 1092 1121 1130 1140 1142 1111 1097
151 - 1059 1060 1067 1101 1112 1126 1147
152 - 703
153 -
154 - 717 683 663 1466
155 -
156 -
157 - 340 661 669 678 681 715 1472 717
158 - 1604 1699 1742 1729 1807 1843 1859 1987 1866 1955 2344
159 - 1680 1681 1808
160 - 1679 1683 1684 1734 1809 1829 1979 1982 1989
161 -
162 - 1814 1830 1978
163 - 1695 1707 1716 1733 1735 1812 1816 1822 1847 1975 2311 2317 2353
164 - 2319
165 - 1361 1363 1692 1977 1984 1406 1396
166 - 1719 1722 1818 1820 1824 2309 2329 2330 2335 2342 1897 1908 1923 1951 1970 2039 2054 2326 2355 1719 1722 1818 1820 1930 1704 1724 1731 1615 1949 1951 2922 2933 2937 2940 2942
167 - 1719 1722 1818 1820 1719 1722 1818 1820 1824 2309 2329 2330 2335 2342 1897 1908 1923 1951 1970 2039 2054 2326 2355 1930 1704 1724 1731 1615 1949 1951 2922 2933 2937 2940 2942
168 - 1859 1699 1606 2017 1771 1775 2344 1807 2919 2928 2959 2945 1625 1634 1710 1711 1729 1748 1798 1827 1840 1955 1966
169 -
170 - 1627
171 -
172 - 1628 1793 1802 1850 1952 2326 2345
173 - 1628 1724 1794 1802 1825 1838 1850 1952 1968 2145 2191 2321 2326 2345 1704 1698 1731 1615 1630 1820
174 - 1628 1726 1727 1793 1802 1825 1837 1850 1952 1967 2322 2326 2345
175 - 2147
176 - 1619 1621 1647 1707 1716 1722 1733 1735 1796 1812 1816 1822 1847 1897 1920 2311 2317 2348 2353 1867 1908 2924
177 -

178 - 1859 1699 1606 2017 1771 1775 2344 1807 2919 2928 2959 2945 1625 1634 1710 1711 1729 1748 1798 1827 1840 1955 1966
179 -
180 - 1612 1855 2136 2137 2143
181 -
182 - 1719 1818 1918 2314
183 -
184 - 1820 1628 1724 1794 1802 1825 1838 1850 1952 1968 2145 2191 2321 2326 2345 1704 1698 1731 1615 1630
185 -
186 -
187 - 2273 2377
188 - 2272 2371
189 - 2273 2371
190 -
191 - 2267 2271 2373 2383
192 - 2267 2268 2374 2385
193 -
194 - 2270 2377 2382
195 - 1604 1606 2358 2366 2730
196 - 1658 1661 2365
197 - 1655 1656 1659 2357 2359 2366 2369 2828 2741 2799
198 -
199 - 1663
200 -
201 - 2365 1661 2362
202 - 1859 1835 1884 2919 2928 2945
203 - 2918 2919
204 - 1855 2143 1862 1881 2136 2137 2152 2924 2929 2982
205 -
206 -
207 -
208 -
209 - 2971
210 -
211 -
212 - 2918 2952
213 -
214 - 1892 1893 2144
215 - 1894 1905 1838 1850 2145 2146 2147 2148
216 -
217 - 1894 2145 2933 2940 2942
218 - 2960 2971
219 -
220 -
221 - 2500 2552 2520

222 -
223 - 2291 2477 2483 2493 2518 2529 2531 2535 2540 2545 2578 2611 2485 2488 2479 2504 2508 2510 2562
224 -
225 - 2499 2551
226 -
227 - 2292
228 -
229 - 2295 2496 2548 2553
230 -
231 -
232 -
233 - 2295 2491 2543
234 -
235 - 2297 2575
236 -
237 -
238 -
239 - 2493 2528 2601 2610
240 - 2615
241 - 1604
242 - 1625 2327 2349
243 - 1650 1653 2309 2311 2329 2335 2342 2355 2637 2643 2653 2660 2676 2682
244 -
245 - 2671
246 -
247 -
248 -
249 - 1653 2327 2329
250 -
251 -
252 -
253 -
254 -
255 - 2645 2662
256 -
257 - 2350
258 -
259 - 2356
260 -
261 - 1604 1955 2005 1987 1994
262 -
263 - 1679 1979
264 -
265 -

266 - 375 1382 807 266 1383 1393 1401 1403 1410 1413 1501 1692 516 1487 2014 1532 1531 1690 1691 1692 1977 2026 2045 2066
267 -
268 -
269 - 1695 1686 1647 2018 1975
270 -
271 - 375 1382 807 266 1383 1393 1401 1403 1410 1413 1501 1692 516 1487 2014 1532 1531 1690 1691 1692 1977 2026 2045 2066
272 - 377 1486
273 - 377 1486
274 -
275 - 383 518 520 1384 1491 1677 2017 501 1367 1358 510 1529 2068
276 -
277 - 393 426 488 1408 2068
278 - 1994 1604 1606
279 - 1681
280 - 1680 1683 1989
281 - 1684 1982
282 - 1993 1981
283 -
284 - 1686 1692 1695 1977 1621
285 - 1775 1798
286 -
287 - 1772 1779 1780 2156 2201
288 -
289 - 1779 1780 2136 2137 2152 2199 2200
290 -
291 - 1771
292 - 1711 1742 1771 1807
293 -
294 - 1621
295 -
296 -
297 -

Domain Specific Thesaurus for the CM-1 Data Set:

collect|gather|accumulate
implement|accomplish|code
memory|storage|disk
incrementally|periodically
commands|orders
record|store|save
discontinue|stop
unrecoverable|irrepairable
real-time|instant
non-deferred|instant
receipt|receive|get
discontinue|stop|end|cease
Watchdog|timer|clock|detector
commandability|use|charge|in charge|control
ground|earth
DPU_HK|TASK_HBEAT|heartbeat
DPU_TMALI|error handler|error|handler
DPU_TMALI|TMALI|telescope|module|interface
non-responsive|stalled|stopped|not halting|continuous
DPU-CMD|command|commands
byte-code|name|identifier
errno|error number|error
DPU-EEPRM|EEPROM
DPU-ICUI|ICU
callbacks|functions|handlers|function|callback
interrupt|pause|break|handler
ring|circle|loop
DCI|driver|interface|api
MB|megabyte
ms|millisecond
queue|line|list|buffer
respond|reply
component|part|section|piece|module
instrument|system|processor
CSC|command|control
ccmctrltask|ccmctrltask()|control
spawns|starts|initiates|initializes|init|boot
housekeeping|upkeep|tmalihkget|hk
task|tmalitask
packets|parts|items|data|information
monitors|watches|displays
dispatch|command dispatch|ccmcmdtask|ccmcmdtask()|ccmcmdprocess|ccmcmdtask
static|unchanging
interrupt|break|stop|cease|end

initialize|start|reset|set|ccminit|ccminit()
defaults|SYSTEM_CONFIG_AREA
command length verification|ccmdlengthinit|ccmcmdlengthinit()
monitoring|watching|supervising
toggles|switches|flips|changes|blocks|semaphore|swap
semaphore|synchronize|wait|semdciwait
block|pause|stop|tmailwait|semdciwait
reboot|restart|initialize|reset
effect|cause|start|initialize
hz|hertz
semaphore|turn|switch
interrupt|ccmerrenq|queue|enqueue|error|monitor|enq|tmali_event_queue|FIFO|inline
data|structure|data structure
data structure|ring buffer
fifo|first in first out
health|status|check|health check|ccmhealthchk|ccmhealthchk()
military|mil
standard|std
mil-std-1553|interface|1533
g-icu|ground|ground control|control|transmitter
g-scu|ground|control|ground control
icu/ssi|transmitter
ccmhkmkcmdecho|echo|repeat|retransmit|return|continue
ccmcmddispatch|send|dispatch|emit|download|dnld
dequeued|processed|removed|handled
verify|check
ccmtaskreport|task|report|status|control
upload|transmit|send|emit|d_mame_dat_upld|upld
poke|check|verify|get|ask|D_mem_Dat_poke
dat|data
mem|memory
constraint|rule|logic
company|organization
z|x|y
maximum|most
register|eeprom
register|dram
s_ccm_missing_seqno|error|event
seqno|sequence|number|label
cncl|cancel
#|number
file|filename|dpu_blk.##|dpu_blk
entirety|whole|entire|all
filesystem|files|memory
ccm|command|control|module
virtual|simulated

error|s_ccm_err_repeat|err|error|fault|failure|bug|ccmisrerror
flush|restart|initilize
insure|shall|must|ensure
circumvent|go around|avoid|evade|fix
limitation|problem|deficiency
appropriate|correct|right|exact
reference|guide|manpage|manual|vxworks|VxWorks®|programmer's guide
frequently|often|regularly
routine|call|function|operation|mechanism
execute|run
nil|zero|empty
sum|total|all
RAD6000|register
atomic|individual|unique|alone|single
length|size|queuesize
command|tmalidciframedepthset|frame|depth
time|seconds|milliseconds|timeout
window|frame|period
indicates|shows|points
pout|pointer
incremented|increased|added
true|valid|satisfied|
false|wrong|no|unsatisfied
caller|parent|driver
s_tmali_queu_full|error
configure|settings|set|tmalibitarrangementset
configure|settings|set|tmalidciframedepthget
configure|settings|set|tmalidciframedepthset
configure|settings|set|tmalidciwindowset
configure|settings|set|tmalidatatimeoutset
configure|settings|set|tmalidatatimeoutget
isr|tmalitransfertoqueueisr|ccmisrerror|tmalidcierrorreportedisr
tmalinextevent|next|sequence

CM-1:

Descriptive Statistics:

Data Set Size: 235 Requirements x 220 Design Elements
Number of RTM Links: 362
Average Number of Design Element Links per Requirement: 1.5404
Number of Requirement Chunks: 2,780
Number of Design Element Chunks: 10,490

Number of Requirement and Design Element Chunk Pairs: 1,683
Number of Chunk Pairs in the RTM: 205,696
Number of Possible Chunk Pairs: 29,162,200

CM-1 RTM:

%
SRS5.1.1.1
%
SRS5.1.1.10 DPUSDS4.4.1.1 DPUSDS5.1.0.2 DPUSDS5.1.2.3
%
SRS5.1.1.11 DPUSDS5.1.0.2 DPUSDS5.1.2.3 DPUSDS5.2.3.7.1 DPUSDS5.3.0.1 DPUSDS5.3.2.1.4
%
SRS5.1.1.12 DPUSDS5.1.4.2
%
SRS5.1.1.13
%
SRS5.1.1.14
%
SRS5.1.1.15 DPUSDS5.1.2.1
%
SRS5.1.1.16 DPUSDS5.1.2.1 DPUSDS5.6.0.1
%
SRS5.1.1.17 DPUSDS5.1.0.2
%
SRS5.1.1.18 DPUSDS4.4.1.2 DPUSDS5.1.0.2 DPUSDS5.1.3.1
%
SRS5.1.1.2 DPUSDS5.1.0.2
%
SRS5.1.1.4
%
SRS5.1.1.5
%
SRS5.1.1.6
%
SRS5.1.1.7 DPUSDS4.4.1.1 DPUSDS4.4.1.2 DPUSDS5.1.0.2 DPUSDS5.3.2.1.4
%
SRS5.1.1.8 DPUSDS5.1.2.2
%
SRS5.1.1.9 DPUSDS5.1.2.2 DPUSDS5.2.3.7.1 DPUSDS5.3.0.1
%
SRS5.1.2.1 DPUSDS4.4.1.2 DPUSDS5.1.0.2 DPUSDS5.1.2.1 DPUSDS5.3.0.1
%
SRS5.1.3.1 DPUSDS5.1.2.3 DPUSDS5.2.3.7.1 DPUSDS5.3.0.1 DPUSDS5.4.0.1

%
SRS5.1.3.10
%
SRS5.1.3.11 DPUSDS5.3.0.1
%
SRS5.1.3.12 DPUSDS5.3.0.1 DPUSDS5.3.1.1 DPUSDS5.3.2.1.3
%
SRS5.1.3.2 DPUSDS5.1.2.1 DPUSDS5.1.2.3 DPUSDS5.2.3.7.1 DPUSDS5.3.0.1 DPUSDS5.3.2.1.4
%
SRS5.1.3.3 DPUSDS5.3.0.1
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SRS5.1.3.4 DPUSDS5.1.0.2
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SRS5.1.3.5 DPUSDS5.1.4.2
%
SRS5.1.3.6 DPUSDS5.1.4.2
%
SRS5.1.3.7 DPUSDS5.1.4.2 DPUSDS5.2.3.9.1
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SRS5.1.3.8 DPUSDS5.2.4.2.1 DPUSDS5.2.4.2.2 DPUSDS5.2.4.2.3 DPUSDS5.2.4.2.4
%
SRS5.1.3.9 DPUSDS5.1.0.2 DPUSDS5.1.2.1 DPUSDS5.1.2.2 DPUSDS5.9.0.1 DPUSDS5.9.1.4.1
%
SRS5.1.4.1 DPUSDS5.1.4.2 DPUSDS5.18.0.1
%
SRS5.1.4.10 DPUSDS5.1.2.3
%
SRS5.1.4.2 DPUSDS5.3.1.1 DPUSDS5.4.0.1
%
SRS5.1.4.3
%
SRS5.1.4.5
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SRS5.1.4.6 DPUSDS5.1.3.1
%
SRS5.1.4.7 DPUSDS5.1.3.1
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SRS5.1.4.8
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SRS5.1.4.9 DPUSDS5.1.3.1 DPUSDS5.9.2.1
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SRS5.10.4.1 DPUSDS5.12.1.4.4 DPUSDS5.14.1.1.2 DPUSDS5.2.3.6.8
%

SRS5.12.1.1 DPUSDS5.12.0.1
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SRS5.12.1.10
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SRS5.12.1.11
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SRS5.12.1.12
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SRS5.12.1.13
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SRS5.12.1.14 DPUSDS4.4.1.2 DPUSDS5.12.1.2.3 DPUSDS5.2.4.3.1 DPUSDS5.2.4.3.2
%
SRS5.12.1.15 DPUSDS5.12.0.1 DPUSDS5.2.4.4.2
%
SRS5.12.1.16 DPUSDS5.12.1.3.1 DPUSDS5.12.1.3.3 DPUSDS5.16.1.2.1 DPUSDS5.19.2.4
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SRS5.12.1.17 DPUSDS4.4.1.1 DPUSDS5.2.4.3.1
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SRS5.12.1.18
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SRS5.12.1.19 DPUSDS5.14.1.2.1 DPUSDS5.15.1.2.1
%
SRS5.12.1.2 DPUSDS5.12.0.1
%
SRS5.12.1.20 DPUSDS5.12.1.5.1 DPUSDS5.15.1.2.1 DPUSDS5.19.1.4.1
%
SRS5.12.1.21 DPUSDS5.12.1.4.3 DPUSDS5.13.1.3.2 DPUSDS5.15.1.2.3 DPUSDS5.16.1.2.2
%
SRS5.12.1.3 DPUSDS4.4.1.2 DPUSDS5.12.1.2.1
%
SRS5.12.1.4 DPUSDS5.12.0.1 DPUSDS5.12.1.2.1 DPUSDS5.12.1.5.1 DPUSDS5.13.1.2.1 DPUSDS5.14.1.1.1 DPUSDS5.14.2.4 DPUSDS5.15.1.1.1 DPUSDS5.19.1.1 DPUSDS5.19.2.10 DPUSDS5.19.2.9
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SRS5.12.1.5 DPUSDS5.12.1.5.1 DPUSDS5.14.1.3.1 DPUSDS5.15.1.2.1
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SRS5.12.1.6 DPUSDS5.16.2.5
%
SRS5.12.1.7
%
SRS5.12.1.8 DPUSDS5.13.1.6.3 DPUSDS5.14.0.3
%

SRS5.12.1.9   DPUSDS5.1.4.2   DPUSDS5.12.1.2.2   DPUSDS5.12.1.5.1
DPUSDS5.12.1.5.4   DPUSDS5.19.2.7
%
SRS5.12.2.1
%
SRS5.12.2.2   DPUSDS5.12.0.1   DPUSDS5.12.1.3.1   DPUSDS5.13.1.3.1
%
SRS5.12.3.1   DPUSDS5.12.1.2.3   DPUSDS5.12.1.5.1
%
SRS5.12.3.2   DPUSDS5.12.0.1   DPUSDS5.12.1.2.3   DPUSDS5.12.1.5.1
DPUSDS5.12.2.2
%
SRS5.12.3.3   DPUSDS5.19.1.2.0.1
%
SRS5.12.3.4   DPUSDS5.12.1.2.4   DPUSDS5.12.1.5.2   DPUSDS5.12.2.2
%
SRS5.12.3.5   DPUSDS5.12.1.5.2   DPUSDS5.2.6.0.1
%
SRS5.12.3.6   DPUSDS5.12.1.5.2   DPUSDS5.18.2.2   DPUSDS5.2.6.0.1
%
SRS5.12.3.7   DPUSDS5.12.1.3.3   DPUSDS5.12.1.5.2   DPUSDS5.13.2.7
%
SRS5.12.4.1   DPUSDS5.2.4.4.1
%
SRS5.12.4.2   DPUSDS5.18.0.1
%
SRS5.13.1.1   DPUSDS5.2.3.6.3
%
SRS5.13.1.2   DPUSDS5.13.1.5.1   DPUSDS5.13.2.8   DPUSDS5.13.2.9
%
SRS5.13.1.3   DPUSDS5.13.2.1   DPUSDS5.19.1.2.0.3   DPUSDS5.19.1.2.2
%
SRS5.13.1.4   DPUSDS5.13.1.7.1   DPUSDS5.13.2.10
%
SRS5.13.2.1   DPUSDS5.13.2.9
%
SRS5.13.2.2   DPUSDS5.13.1.1.1   DPUSDS5.13.2.2   DPUSDS5.13.2.3
%
SRS5.13.2.3   DPUSDS5.13.1.6.4   DPUSDS5.13.2.1   DPUSDS5.13.2.4
DPUSDS5.13.2.5
%
SRS5.13.3.1   DPUSDS5.12.1.5.1   DPUSDS5.12.1.5.6   DPUSDS5.18.2.2
%
SRS5.13.3.2   DPUSDS5.18.2.3   DPUSDS5.2.3.6.3
%

SRS5.13.3.3 DPUSDS5.1.2.3 DPUSDS5.13.1.5.1 DPUSDS5.13.1.5.2
DPUSDS5.18.2.3 DPUSDS5.2.3.6.3
%
SRS5.13.4.1
%
SRS5.14.1.1
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SRS5.14.1.2 DPUSDS5.16.1.2.1 DPUSDS5.16.1.2.2 DPUSDS5.16.1.3.1
%
SRS5.14.1.3 DPUSDS4.4.3.2
%
SRS5.14.1.5 DPUSDS5.14.1.2.5 DPUSDS5.14.2.4
%
SRS5.14.1.6 DPUSDS5.12.1.3.2 DPUSDS5.14.0.1 DPUSDS5.14.1.3.1
DPUSDS5.14.2.2
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SRS5.14.1.7
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SRS5.14.1.8
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SRS5.14.1.9 DPUSDS5.14.1.1.1
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SRS5.14.2.1
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SRS5.14.2.2 DPUSDS5.12.0.1 DPUSDS5.12.1.3.1 DPUSDS5.12.1.3.2
DPUSDS5.14.1.2.1 DPUSDS5.15.1.2.1
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SRS5.14.2.3 DPUSDS5.14.2.3
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SRS5.14.2.5 DPUSDS5.14.1.2.3
%
SRS5.14.3.1 DPUSDS5.12.1.5.1 DPUSDS5.13.2.9
%
SRS5.14.3.2 DPUSDS5.14.1.2.5
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SRS5.14.3.3 DPUSDS5.14.2.3
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SRS5.14.3.4 DPUSDS5.3.2.1.1
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SRS5.14.3.5 DPUSDS5.14.0.3 DPUSDS5.14.1.3.1 DPUSDS5.15.1.2.2
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SRS5.14.4.1
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SRS5.14.4.2 DPUSDS5.16.1.2.1
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SRS5.15.1.1

%
SRS5.15.1.2 DPUSDS5.15.1.2.1
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SRS5.15.3.2 DPUSDS5.12.2.2 DPUSDS5.3.2.1.1
%
SRS5.16.1.1 DPUSDS5.2.4.4.1
%
SRS5.16.1.2 DPUSDS5.16.1.1 DPUSDS5.16.1.3.1 DPUSDS5.16.2.4
DPUSDS5.16.2.5 DPUSDS5.16.2.6
%
SRS5.16.1.3 DPUSDS5.16.1.1 DPUSDS5.16.1.4.1 DPUSDS5.16.1.4.2
DPUSDS5.16.1.4.3 DPUSDS5.16.2.2 DPUSDS5.16.2.3
%
SRS5.16.1.4
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SRS5.16.1.5
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SRS5.16.1.6
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SRS5.16.1.7 DPUSDS5.1.2.2 DPUSDS5.16.1.1.1 DPUSDS5.16.1.4.1
DPUSDS5.16.1.4.2 DPUSDS5.16.2.2
%
SRS5.16.3.1 DPUSDS5.12.1.5.6 DPUSDS5.18.2.2
%
SRS5.16.4.1
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SRS5.16.4.2
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SRS5.16.4.3
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SRS5.18.1.1 DPUSDS5.12.1.3.1 DPUSDS5.18.1.2.3
%
SRS5.18.1.2 DPUSDS5.13.0.2 DPUSDS5.16.0.1 DPUSDS5.18.0.1
DPUSDS5.18.1.1 DPUSDS5.18.1.2.3 DPUSDS5.19.1.2.0.1
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SRS5.18.1.3
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SRS5.18.2.1
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SRS5.18.3.1 DPUSDS5.12.1.2.3 DPUSDS5.12.1.5.1 DPUSDS5.12.1.5.2
DPUSDS5.3.2.1.1
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SRS5.18.3.2 DPUSDS5.18.1.2.2
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SRS5.18.3.3 DPUSDS5.18.1.2.2 DPUSDS5.18.1.2.3
%

SRS5.18.4.1 DPUSDS5.12.2.1 DPUSDS5.18.1.1 DPUSDS5.18.1.2.1
DPUSDS5.18.1.2.3 DPUSDS5.18.2.1 DPUSDS5.18.2.3 DPUSDS5.8.0.1
DPUSDS5.8.1.5 DPUSDS5.8.4.1
%
SRS5.18.4.2 DPUSDS5.12.2.1 DPUSDS5.14.1.3.1 DPUSDS5.18.1.1
DPUSDS5.18.1.2.3 DPUSDS5.18.2.3 DPUSDS5.8.2.1
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SRS5.18.4.3 DPUSDS5.18.2.1
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SRS5.19.1.1 DPUSDS5.14.1.2.5
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SRS5.19.1.10
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SRS5.19.1.11
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SRS5.19.1.12 DPUSDS5.19.1.2.1 DPUSDS5.19.1.2.2 DPUSDS5.19.1.2.3
DPUSDS5.19.1.2.4 DPUSDS5.19.1.2.5 DPUSDS5.19.2.1
%
SRS5.19.1.13 DPUSDS5.19.1.2.0.3
%
SRS5.19.1.14 DPUSDS5.15.1.2.2 DPUSDS5.15.1.2.3
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SRS5.19.1.15 DPUSDS5.19.0.6
%
SRS5.19.1.16 DPUSDS5.19.1.2.4
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SRS5.19.1.17 DPUSDS5.19.0.3 DPUSDS5.19.1.2.5
%
SRS5.19.1.18 DPUSDS5.19.1.2.0.3 DPUSDS5.19.2.5
%
SRS5.19.1.19 DPUSDS5.13.0.1
%
SRS5.19.1.2 DPUSDS5.19.1.2.0.1 DPUSDS5.19.2.2
%
SRS5.19.1.20
%
SRS5.19.1.21 DPUSDS5.19.0.2 DPUSDS5.19.0.3
%
SRS5.19.1.23 DPUSDS5.13.0.2 DPUSDS5.19.2.7
%
SRS5.19.1.24 DPUSDS5.19.2.1 DPUSDS5.19.2.2
%
SRS5.19.1.26 DPUSDS5.19.2.5
%
SRS5.19.1.27
%

SRS5.19.1.28   DPUSDS5.19.1.2.2   DPUSDS5.19.1.2.5
%
SRS5.19.1.29   DPUSDS5.18.0.1
%
SRS5.19.1.3   DPUSDS5.19.1.2.0.3   DPUSDS5.19.1.2.1   DPUSDS5.19.1.3.1
DPUSDS5.19.1.3.4
%
SRS5.19.1.30
%
SRS5.19.1.4   DPUSDS5.19.1.2.2
%
SRS5.19.1.5
%
SRS5.19.1.6   DPUSDS5.13.1.3.1
%
SRS5.19.1.7   DPUSDS5.19.0.2   DPUSDS5.19.0.6   DPUSDS5.19.1.2.0.4
%
SRS5.19.1.8   DPUSDS5.19.0.6
%
SRS5.19.1.9   DPUSDS5.19.1.2.0.1
%
SRS5.19.2.1   DPUSDS5.19.1.2.0.3
%
SRS5.19.2.3
%
SRS5.19.3.1
%
SRS5.19.3.2
%
SRS5.19.3.4
%
SRS5.2.1.1   DPUSDS4.5.0.3
%
SRS5.2.1.2
%
SRS5.2.1.3   DPUSDS4.5.0.1   DPUSDS4.5.0.2   DPUSDS5.6.0.1
%
SRS5.2.1.4   DPUSDS5.3.2.1.3
%
SRS5.2.1.5   DPUSDS4.4.1.2
%
SRS5.2.1.6   DPUSDS5.16.1.2.2   DPUSDS5.16.2.6   DPUSDS5.2.4.4.1
DPUSDS5.2.4.4.2   DPUSDS5.2.4.4.3
%
SRS5.2.1.7   DPUSDS5.16.1.1   DPUSDS5.16.1.3.1   DPUSDS5.2.4.4.1
DPUSDS5.2.4.4.2

%
SRS5.2.3.1 DPUSDS5.2.3.7.1 DPUSDS5.3.2.1.4
%
SRS5.2.3.2
%
SRS5.2.3.3 DPUSDS5.2.3.6.2 DPUSDS5.2.3.6.3 DPUSDS5.2.3.6.5
DPUSDS5.2.3.6.6 DPUSDS5.2.3.6.7 DPUSDS5.2.3.6.8
%
SRS5.3.1.1 DPUSDS5.1.2.3 DPUSDS5.3.0.1
%
SRS5.3.1.2 DPUSDS5.3.0.1
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SRS5.3.1.3 DPUSDS5.1.2.3
%
SRS5.3.1.4
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SRS5.3.1.5 DPUSDS5.1.2.1 DPUSDS5.1.2.3
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SRS5.3.2.1
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SRS5.3.3.1 DPUSDS5.1.2.3
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SRS5.3.4.1
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SRS5.3.4.2
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SRS5.3.4.3 DPUSDS5.3.0.1
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SRS5.4.1.1 DPUSDS5.1.2.3
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SRS5.4.1.2
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SRS5.4.1.3 DPUSDS5.1.2.3
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SRS5.4.1.4
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SRS5.4.1.5
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SRS5.4.1.6
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SRS5.4.3.1
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SRS5.4.3.2
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SRS5.4.4.2
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SRS5.5.4.1
%
SRS5.7.1.1 DPUSDS5.7.0.1 DPUSDS5.7.1.1 DPUSDS5.7.2.1
%
SRS5.7.1.2
%
SRS5.7.1.3
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SRS5.7.1.4
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SRS5.7.3.3
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SRS5.7.4.1
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SRS5.7.4.2 DPUSDS5.7.1.1
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SRS5.7.4.3 DPUSDS5.7.1.1
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SRS5.8.1.1 DPUSDS5.8.2.1
%
SRS5.8.1.2 DPUSDS5.18.2.3
%
SRS5.8.1.3 DPUSDS5.8.2.1
%
SRS5.8.1.4 DPUSDS5.2.3.4.1
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SRS5.8.1.5
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SRS5.8.1.6 DPUSDS5.18.2.1 DPUSDS5.18.2.3
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SRS5.8.1.9
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SRS5.8.3.1
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SRS5.8.3.2
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SRS5.8.3.3
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SRS5.8.3.4
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SRS5.8.4.1
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SRS5.8.4.2 DPUSDS5.8.3.1
%
SRS5.8.4.3 DPUSDS5.8.3.1
%

SRS5.9.1.1
%
SRS5.9.1.10   DPUSDS5.9.1.4.1
%
SRS5.9.1.11
%
SRS5.9.1.12
%
SRS5.9.1.13
%
SRS5.9.1.14
%
SRS5.9.1.2   DPUSDS5.13.1.1.1   DPUSDS5.13.1.6.4   DPUSDS5.13.2.5
%
SRS5.9.1.3
%
SRS5.9.1.4
%
SRS5.9.1.5
%
SRS5.9.1.6
%
SRS5.9.1.7
%
SRS5.9.1.8   DPUSDS5.13.1.6.1   DPUSDS5.13.2.1
%
SRS5.9.1.9   DPUSDS5.9.0.1
%
SRS5.9.2.1   DPUSDS5.13.0.2   DPUSDS5.13.1.6.3
%
SRS5.9.3.1   DPUSDS5.18.2.3
%
SRS5.9.3.2
%
SRS5.9.3.3   DPUSDS5.12.1.5.1   DPUSDS5.12.2.2   DPUSDS5.18.2.2
DPUSDS5.9.1.5.1
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Gantt:

Descriptive Statistics:

Data Set Size: 17 Requirements x 78 Design Elements
Number of RTM Links: 68
Average Number of Design Element Links per Requirement: 4
Number of Requirement Chunks: 314
Number of Design Element Chunks: 876
Number of Requirement and Design Element Chunk Pairs: 539
Number of Chunk Pairs in the RTM: 15,430
Number of Possible Chunk Pairs: 275,064

Gantt RTM:

%
r4.txt d4_1.txt d4_2.txt d4_3.txt d4_4.txt
%
r6.txt d6_1.txt d6_2.txt d6_3.txt d6_4.txt d6_5.txt d6_6.txt
%
r8.txt d8_1.txt d8_2.txt d8_3.txt
%
r10.txt d10_1.txt d10_2.txt d10_3.txt d10_4.txt d10_5.txt d10_6.txt d10_7.txt d10_8.txt
%
r12.txt d12_1.txt d12_2.txt d12_3.txt d12_4.txt d12_5.txt d12_6.txt d12_7.txt
%
r14.txt d14_1.txt d14_2.txt d14_3.txt
%
r16.txt d16_1.txt d16_2.txt d16_3.txt
%
r1.txt d1_1.txt d1_2.txt d1_3.txt d1_4.txt
%
r2.txt d2_1.txt d2_2.txt d2_3.txt
%
r3.txt d3_1.txt d3_2.txt d3_3.txt
%

r5.txt d5_1.txt d5_2.txt d5_3.txt d5_4.txt
%
r7.txt d7_1.txt d7_2.txt d7_3.txt
%
r9.txt d9_1.txt d9_2.txt d9_3.txt d9_4.txt
%
r11.txt d11_1.txt d11_2.txt d11_3.txt
%
r13.txt d13_1.txt d13_2.txt d13_3.txt d13_4.txt
%
r15.txt d15_1.txt d15_2.txt
%
r17.txt d17_1.txt d17_2.txt d17_3.txt d17_4.txt

Gantt Satisfaction Answer Set:

[Section 1]
128 627
0 - 119 125 133 202 214
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2 - 116 128 131 137 144 153 156 158 177 192
3 -
4 -
5 -
6 - 119 125 133 202 214
7 -
8 - 205
9 - 118 124 134 147 163 213
10 - 118 124 134 147 163 213
11 - 205
12 -
13 -
14 - 119 125 133 202 214
15 - 119 125 133 202 214
16 - 205
17 -
18 - 118 124 134 147 163 213
19 - 116 128 131 137 144 153 156 158 177 192
20 - 209
21 - 201 210
22 - 119 125 133 202 214
23 - 203
24 -
25 - 205
26 -
27 - 118 124 134 147 163 213

28 -
29 -
30 -
31 - 304 314
32 -
33 -
34 - 263 254 271 308
35 - 241 247 305 315 316 317
36 - 304 314
37 -
38 -
39 - 235 254 265 272 284 291 298
40 -
41 - 220 221 226 227 243 249
42 - 304 314
43 -
44 - 326 339 351
45 -
46 -
47 -
48 - 349 361
49 -
50 -
51 -
52 -
53 -
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55 -
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58 -
59 -
60 -
61 -
62 - 364 370 373 378 386 392 396 406
63 -
64 -
65 -
66 - 362 397
67 -
68 - 368 400
69 -
70 -
71 - 368
72 - 401
73 -

74 - 403
75 -
76 - 389
77 -
78 - 408 414 418 430 437 441 449 453 457 465 466 470 471 473 479 483 487 495 496 500 501
79 -
80 -
81 - 417
82 - 410 420 442 455 475 485
83 -
84 -
85 -
86 -
87 - 408 414 418 430 437 441 449 453 457 465 466 470 471 473 479 483 487 495 496 500 501
88 -
89 - 410 420 442 455 475 485
90 -
91 - 408 414 418 430 437 441 449 453 457 465 466 470 471 473 479 483 487 495 496 500 501
92 -
93 -
94 -
95 - 514 554 560 568
96 -
97 - 514 554 560 568
98 - 514 554 560 568
99 -
100 - 516 517 522 526 529 532 547
101 - 514 554 560 568
102 - 508 551 563 574 579 588
103 -
104 -
105 - 553 559 569 582
106 - 589 613
107 - 590
108 -
109 -
110 - 597 609
111 -
112 - 591 592 601 604 616 631
113 -
114 -
115 -
116 -

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124 -
125 -
126 -
127 –
[Section 2]
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2 -
3 -
4 -
5 - 329 345
6 -
7 - 309 324 331 340 347 356 363
8 -
9 -
10 -
11 - 321
12 - 321
13 -
14 - 361
15 - 199 202 207 210 218 219 223
16 -
17 -
18 -
19 - 202 210 223
20 -
21 -
22 - 228
23 -
24 -
25 -
26 -
27 -
28 - 215
29 - 216
30 -
31 - 199 207 218 219
32 - 251 256 261

33 - 252
34 -
35 -
36 - 234 235 236 248 257
37 - 251 256 261
38 - 252
39 -
40 -
41 -
42 - 241 243 247 250 260
43 - 267 271 277
44 - 267 271 277
45 - 266 276
46 -
47 -
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52 -
53 - 286 291 298 300 306 307
54 - 284 293
55 - 283 290
56 -
57 - 286 291 300 306
58 -
59 - 297 304
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63 - 284 293
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72 -
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78 - 286 291 300 306

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81 -
82 -
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84 -
85 - 297 304
86 -
87 - 286 291 300 306
88 -
89 - 298
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92 -
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96 -
97 -
98 - 372 373 383 394 395 400 402 403 405 406 411 413 424
99 - 372 394 403 405
100 - 373 383 395 400 402 406 411 413 424
101 - 381
102 -
103 - 381
104 -
105 - 373 383 395 400 402 406 411 413 424
106 -
107 -
108 -
109 - 381 421
110 - 422
111 -
112 - 373 383 395 400 402 406 411 413 424
113 - 430 431 437 438 446 447
114 - 430 437 446
115 - 430 437 446
116 - 431 438 447
117 -
118 - 438
119 - 431
120 - 447
121 - 460 474 484 485
122 - 460 474 484 485
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124 - 462 482 489

125 -
126 - 462 482 489
127 -
128 -
129 - 464
130 -
131 -
132 -
133 -
134 - 462 482 489
135 - 460 474 484 485
136 -
137 -
138 - 467
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142 -
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144 -
145 - 467
146 -
147 - 464
148 -
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151 - 494 499 506 510
152 -
153 -
154 - 497 504 511
155 -
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163 - 517 523 536
164 - 518 525 527 532 534
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167 - 518 525 527 532 534
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169 - 530
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171 -
172 - 518 525 527 532 534
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174 -
175 -
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177 -
178 -
179 - 517 523 536
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181 - 518 525 527 532 534
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183 - 518 525 527 532 534
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186 - 518 525 527 532 534
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188 -
189 - 545
190 -
191 - 518 525 527 532 534
192 -
193 -
194 -
195 - 545
196 -
197 - 518 525 527 532 534
198 -

Appendix F: Rule Sets

0|NP|RE|0|NP|DE|60|25|True
0|VP|RE|0|VP|DE|60|25|True
0|VP|RE|0|NP|DE|60|25|True
0|NP|RE|0|VP|DE|60|25|True
0|NP|RE|0|NP|DE|60|25|True
0|VP|RE|0|VP|DE|60|25|True
0|VP|RE|0|NP|DE|60|25|True
0|NP|RE|0|VP|DE|60|25|True

0|NP|RE|0|NP|DE|60|25|True
0|VP|RE|0|VP|DE|60|25|True
0|VP|RE|0|NP|DE|60|25|True
0|NP|RE|0|VP|DE|60|25|True
0|NP|RE|0|NP|DE|60|25|True
0|VP|RE|0|VP|DE|60|25|True
0|VP|RE|0|NP|DE|60|25|True
0|NP|RE|0|VP|DE|60|25|True

0|NP|RE|0|NP|DE|100|-2|True
0|VP|RE|0|VP|DE|100|-2|True
0|ADJP|RE|0|ADJP|DE|100|0|True
0|ADVP|RE|0|VP|ADVP|100|0|True
0|CONJP|RE|0|CONJP|DE|100|0|True
0|INTJ|RE|0|INTJ|DE|100|0|True
0|LST|RE|0|LST|DE|100|0|True
0|PP|RE|0|PP|DE|100|0|True
0|PRT|RE|0|PRT|DE|100|0|True

0|NP|RE|0|NP|DE|100|25|True
0|VP|RE|0|VP|DE|100|25|True
0|ADJP|RE|0|ADJP|DE|100|25|True
0|ADVP|RE|0|ADVP|DE|100|25|True
1|NP|RE|1|NP|DE|100|25|True
1|VP|RE|1|VP|DE|100|25|True
1|ADJP|RE|1|ADJP|DE|100|25|True
1|ADVP|RE|1|VP|ADVP|100|25|True
1|CONJP|RE|1|CONJP|DE|100|25|True
1|INTJ|RE|1|INTJ|DE|100|25|True
1|LST|RE|1|LST|DE|100|25|True
1|PP|RE|1|PP|DE|100|25|True
1|PRT|RE|1|PRT|DE|100|25|True
2|NP|RE|2|NP|DE|100|25|True
2|VP|RE|2|VP|DE|100|25|True
2|ADJP|RE|2|ADJP|DE|100|25|True

2|ADVP|RE|2|VP|ADVP|100|25|True
2|CONJP|RE|2|CONJP|DE|100|25|True
2|INTJ|RE|2|INTJ|DE|100|25|True
2|LST|RE|2|LST|DE|100|25|True
2|PP|RE|2|PP|DE|100|25|True
2|PRT|RE|2|PRT|DE|100|25|True
3|NP|RE|3|NP|DE|100|25|True
3|VP|RE|3|VP|DE|100|25|True
3|ADJP|RE|3|ADJP|DE|100|25|True
3|ADVP|RE|3|VP|ADVP|100|25|True
3|CONJP|RE|3|CONJP|DE|100|25|True
3|INTJ|RE|3|INTJ|DE|100|25|True
3|LST|RE|3|LST|DE|100|25|True
3|PP|RE|3|PP|DE|100|25|True
3|PRT|RE|3|PRT|DE|100|25|True
4|NP|RE|4|NP|DE|100|25|True
4|VP|RE|4|VP|DE|100|25|True
4|ADJP|RE|4|ADJP|DE|100|25|True
4|ADVP|RE|4|VP|ADVP|100|25|True
4|CONJP|RE|4|CONJP|DE|100|25|True
4|INTJ|RE|4|INTJ|DE|100|25|True
4|LST|RE|4|LST|DE|100|25|True
4|PP|RE|4|PP|DE|100|25|True
4|PRT|RE|4|PRT|DE|100|25|True
5|NP|RE|5|NP|DE|100|25|True
5|VP|RE|5|VP|DE|100|25|True
5|ADJP|RE|5|ADJP|DE|100|25|True
5|ADVP|RE|5|VP|ADVP|100|25|True
5|CONJP|RE|5|CONJP|DE|100|25|True
5|INTJ|RE|5|INTJ|DE|100|25|True
5|LST|RE|5|LST|DE|100|25|True
5|PP|RE|5|PP|DE|100|25|True
5|PRT|RE|5|PRT|DE|100|25|True
6|NP|RE|6|NP|DE|100|25|True
6|VP|RE|6|VP|DE|100|25|True
6|ADJP|RE|6|ADJP|DE|100|25|True
6|ADVP|RE|6|VP|ADVP|100|25|True
6|CONJP|RE|6|CONJP|DE|100|25|True
6|INTJ|RE|6|INTJ|DE|100|25|True
6|LST|RE|6|LST|DE|100|25|True
6|PP|RE|6|PP|DE|100|25|True
6|PRT|RE|6|PRT|DE|100|25|True
7|NP|RE|7|NP|DE|100|25|True
7|VP|RE|7|VP|DE|100|25|True
7|ADJP|RE|7|ADJP|DE|100|25|True
7|ADVP|RE|7|VP|ADVP|100|25|True

7|CONJP|RE|7|CONJP|DE|100|25|True
7|INTJ|RE|7|INTJ|DE|100|25|True
7|LST|RE|7|LST|DE|100|25|True
7|PP|RE|7|PP|DE|100|25|True
7|PRT|RE|7|PRT|DE|100|25|True

0|NP|RE|0|NP|DE|100|0|True
0|VP|RE|0|VP|DE|100|0|True
1|NP|RE|1|NP|DE|100|0|True
1|VP|RE|1|VP|DE|100|0|True
1|ADJP|RE|1|ADJP|DE|100|0|True
1|ADVP|RE|1|VP|ADVP|100|0|True
1|CONJP|RE|1|CONJP|DE|100|0|True
1|INTJ|RE|1|INTJ|DE|100|0|True
1|LST|RE|1|LST|DE|100|0|True
1|PP|RE|1|PP|DE|100|0|True
1|PRT|RE|1|PRT|DE|100|0|True
2|NP|RE|2|NP|DE|100|0|True
2|VP|RE|2|VP|DE|100|0|True
2|ADJP|RE|2|ADJP|DE|100|0|True
2|ADVP|RE|2|VP|ADVP|100|0|True
2|CONJP|RE|2|CONJP|DE|100|0|True
2|INTJ|RE|2|INTJ|DE|100|0|True
2|LST|RE|2|LST|DE|100|0|True
2|PP|RE|2|PP|DE|100|0|True
2|PRT|RE|2|PRT|DE|100|0|True
3|NP|RE|3|NP|DE|100|0|True
3|VP|RE|3|VP|DE|100|0|True
3|ADJP|RE|3|ADJP|DE|100|0|True
3|ADVP|RE|3|VP|ADVP|100|0|True
3|CONJP|RE|3|CONJP|DE|100|0|True
3|INTJ|RE|3|INTJ|DE|100|0|True
3|LST|RE|3|LST|DE|100|0|True
3|PP|RE|3|PP|DE|100|0|True
3|PRT|RE|3|PRT|DE|100|0|True
4|NP|RE|4|NP|DE|100|0|True
4|VP|RE|4|VP|DE|100|0|True
4|ADJP|RE|4|ADJP|DE|100|0|True
4|ADVP|RE|4|VP|ADVP|100|0|True
4|CONJP|RE|4|CONJP|DE|100|0|True
4|INTJ|RE|4|INTJ|DE|100|0|True
4|LST|RE|4|LST|DE|100|0|True
4|PP|RE|4|PP|DE|100|0|True
4|PRT|RE|4|PRT|DE|100|0|True
5|NP|RE|5|NP|DE|100|0|True
5|VP|RE|5|VP|DE|100|0|True

5|ADJP|RE|5|ADJP|DE|100|0|True
5|ADVP|RE|5|VP|ADVP|100|0|True
5|CONJP|RE|5|CONJP|DE|100|0|True
5|INTJ|RE|5|INTJ|DE|100|0|True
5|LST|RE|5|LST|DE|100|0|True
5|PP|RE|5|PP|DE|100|0|True
5|PRT|RE|5|PRT|DE|100|0|True
6|NP|RE|6|NP|DE|100|0|True
6|VP|RE|6|VP|DE|100|0|True
6|ADJP|RE|6|ADJP|DE|100|0|True
6|ADVP|RE|6|VP|ADVP|100|0|True
6|CONJP|RE|6|CONJP|DE|100|0|True
6|INTJ|RE|6|INTJ|DE|100|0|True
6|LST|RE|6|LST|DE|100|0|True
6|PP|RE|6|PP|DE|100|0|True
6|PRT|RE|6|PRT|DE|100|0|True
7|NP|RE|7|NP|DE|100|0|True
7|VP|RE|7|VP|DE|100|0|True
7|ADJP|RE|7|ADJP|DE|100|0|True
7|ADVP|RE|7|VP|ADVP|100|0|True
7|CONJP|RE|7|CONJP|DE|100|0|True
7|INTJ|RE|7|INTJ|DE|100|0|True
7|LST|RE|7|LST|DE|100|0|True
7|PP|RE|7|PP|DE|100|0|True
7|PRT|RE|7|PRT|DE|100|0|True

0|NP|RE|0|NP|DE|100|0|True
0|VP|RE|0|VP|DE|100|0|True
0|ADJP|RE|0|ADJP|DE|100|0|True
0|ADVP|RE|0|ADVP|DE|100|0|True
1|NP|RE|1|NP|DE|100|0|True
1|VP|RE|1|VP|DE|100|0|True
1|ADJP|RE|1|ADJP|DE|100|0|True
1|ADVP|RE|1|VP|ADVP|100|0|True
1|CONJP|RE|1|CONJP|DE|100|0|True
1|INTJ|RE|1|INTJ|DE|100|0|True
1|LST|RE|1|LST|DE|100|0|True
1|PP|RE|1|PP|DE|100|0|True
1|PRT|RE|1|PRT|DE|100|0|True
2|NP|RE|2|NP|DE|100|0|True
2|VP|RE|2|VP|DE|100|0|True
2|ADJP|RE|2|ADJP|DE|100|0|True
2|ADVP|RE|2|VP|ADVP|100|0|True
2|CONJP|RE|2|CONJP|DE|100|0|True
2|INTJ|RE|2|INTJ|DE|100|0|True
2|LST|RE|2|LST|DE|100|0|True

2|PP|RE|2|PP|DE|100|0|True
2|PRT|RE|2|PRT|DE|100|0|True
3|NP|RE|3|NP|DE|100|0|True
3|VP|RE|3|VP|DE|100|0|True
3|ADJP|RE|3|ADJP|DE|100|0|True
3|ADVP|RE|3|VP|ADVP|100|0|True
3|CONJP|RE|3|CONJP|DE|100|0|True
3|INTJ|RE|3|INTJ|DE|100|0|True
3|LST|RE|3|LST|DE|100|0|True
3|PP|RE|3|PP|DE|100|0|True
3|PRT|RE|3|PRT|DE|100|0|True
4|NP|RE|4|NP|DE|100|0|True
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4|ADJP|RE|4|ADJP|DE|100|0|True
4|ADVP|RE|4|VP|ADVP|100|0|True
4|CONJP|RE|4|CONJP|DE|100|0|True
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5|CONJP|RE|5|CONJP|DE|100|0|True
5|INTJ|RE|5|INTJ|DE|100|0|True
5|LST|RE|5|LST|DE|100|0|True
5|PP|RE|5|PP|DE|100|0|True
5|PRT|RE|5|PRT|DE|100|0|True
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6|ADVP|RE|6|VP|ADVP|100|0|True
6|CONJP|RE|6|CONJP|DE|100|0|True
6|INTJ|RE|6|INTJ|DE|100|0|True
6|LST|RE|6|LST|DE|100|0|True
6|PP|RE|6|PP|DE|100|0|True
6|PRT|RE|6|PRT|DE|100|0|True
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7|ADJP|RE|7|ADJP|DE|100|0|True
7|ADVP|RE|7|VP|ADVP|100|0|True
7|CONJP|RE|7|CONJP|DE|100|0|True
7|INTJ|RE|7|INTJ|DE|100|0|True
7|LST|RE|7|LST|DE|100|0|True
7|PP|RE|7|PP|DE|100|0|True

7|PRT|RE|7|PRT|DE|100|0|True

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0|VP|RE|0|VP|DE|100|25|True
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0|NP|RE|0|VP|DE|100|25|True

0|NP|RE|0|NP|DE|100|0|True
0|VP|RE|0|VP|DE|100|0|True
0|VP|RE|0|NP|DE|100|0|True
0|NP|RE|0|VP|DE|100|0|True

0|NP|RE|0|NP|DE|100|25|True
0|VP|RE|0|VP|DE|100|25|True
0|VP|RE|0|NP|DE|100|25|True
0|NP|RE|0|VP|DE|100|25|True
0|ADJP|RE|0|ADJP|DE|100|25|True
0|VP|RE|0|VP|DE|100|25|True
0|VP|RE|0|ADJP|DE|100|25|True
0|ADJP|RE|0|VP|DE|100|25|True
0|ADJP|RE|0|ADJP|DE|100|25|True
0|ADVP|RE|0|ADVP|DE|100|25|True
0|ADVP|RE|0|ADJP|DE|100|25|True
0|ADJP|RE|0|ADVP|DE|100|25|True
0|NP|RE|0|NP|DE|100|25|True
0|ADVP|RE|0|ADVP|DE|100|25|True
0|ADVP|RE|0|NP|DE|100|25|True
0|NP|RE|0|ADVP|DE|100|25|True

0|NP|RE|0|NP|DE|100|0|True
0|VP|RE|0|VP|DE|100|0|True
0|VP|RE|0|NP|DE|100|0|True
0|NP|RE|0|VP|DE|100|0|True
0|ADJP|RE|0|ADJP|DE|100|0|True
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0|VP|RE|0|ADJP|DE|100|0|True
0|ADJP|RE|0|VP|DE|100|0|True
0|ADJP|RE|0|ADJP|DE|100|0|True
0|ADVP|RE|0|ADVP|DE|100|0|True
0|ADVP|RE|0|ADJP|DE|100|0|True
0|ADJP|RE|0|ADVP|DE|100|0|True
0|NP|RE|0|NP|DE|100|0|True
0|ADVP|RE|0|ADVP|DE|100|0|True
0|ADVP|RE|0|NP|DE|100|0|True
0|NP|RE|0|ADVP|DE|100|0|True

```
0|NP|RE|0|NP|DE|100|25|True
0|VP|RE|0|VP|DE|100|25|True
0|VP|RE|0|NP|DE|100|25|True
0|NP|RE|0|VP|DE|100|25|True
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1|VP|RE|1|VP|DE|100|25|True
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1|NP|RE|1|VP|DE|100|25|True
2|NP|RE|2|NP|DE|100|25|True
2|VP|RE|2|VP|DE|100|25|True
2|VP|RE|2|NP|DE|100|25|True
2|NP|RE|2|VP|DE|100|25|True
3|NP|RE|3|NP|DE|100|25|True
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3|VP|RE|3|NP|DE|100|25|True
3|NP|RE|3|VP|DE|100|25|True
4|NP|RE|4|NP|DE|100|25|True
4|VP|RE|4|VP|DE|100|25|True
4|VP|RE|4|NP|DE|100|25|True
4|NP|RE|4|VP|DE|100|25|True
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2|NP|RE|2|VP|DE|100|25|True
3|NP|RE|3|NP|DE|100|25|True
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1|NP|RE|1|NP|DE|100|-2|True
1|VP|RE|1|VP|DE|100|-2|True
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1|ADVP|RE|1|VP|ADVP|100|0|True
1|CONJP|RE|1|CONJP|DE|100|0|True
1|INTJ|RE|1|INTJ|DE|100|0|True
1|LST|RE|1|LST|DE|100|0|True
1|PP|RE|1|PP|DE|100|0|True
1|PRT|RE|1|PRT|DE|100|0|True
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2|VP|RE|2|VP|DE|100|-2|True
2|ADJP|RE|2|ADJP|DE|100|0|True
2|ADVP|RE|2|VP|ADVP|100|0|True
2|CONJP|RE|2|CONJP|DE|100|0|True
2|INTJ|RE|2|INTJ|DE|100|0|True
2|LST|RE|2|LST|DE|100|0|True
2|PP|RE|2|PP|DE|100|0|True
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3|ADJP|RE|3|ADJP|DE|100|0|True
3|ADVP|RE|3|VP|ADVP|100|0|True
3|CONJP|RE|3|CONJP|DE|100|0|True
3|INTJ|RE|3|INTJ|DE|100|0|True
3|LST|RE|3|LST|DE|100|0|True
3|PP|RE|3|PP|DE|100|0|True
3|PRT|RE|3|PRT|DE|100|0|True
4|NP|RE|4|NP|DE|100|-2|True
4|VP|RE|4|VP|DE|100|-2|True
4|ADJP|RE|4|ADJP|DE|100|0|True
4|ADVP|RE|4|VP|ADVP|100|0|True
4|CONJP|RE|4|CONJP|DE|100|0|True
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4|INTJ|RE|4|INTJ|DE|100|0|True
4|LST|RE|4|LST|DE|100|0|True
4|PP|RE|4|PP|DE|100|0|True
4|PRT|RE|4|PRT|DE|100|0|True
5|NP|RE|5|NP|DE|100|-2|True
5|VP|RE|5|VP|DE|100|-2|True
5|ADJP|RE|5|ADJP|DE|100|0|True
5|ADVP|RE|5|VP|ADVP|100|0|True
5|CONJP|RE|5|CONJP|DE|100|0|True
5|INTJ|RE|5|INTJ|DE|100|0|True
5|LST|RE|5|LST|DE|100|0|True
5|PP|RE|5|PP|DE|100|0|True
5|PRT|RE|5|PRT|DE|100|0|True
6|NP|RE|6|NP|DE|100|-2|True
6|VP|RE|6|VP|DE|100|-2|True
6|ADJP|RE|6|ADJP|DE|100|0|True
6|ADVP|RE|6|VP|ADVP|100|0|True
6|CONJP|RE|6|CONJP|DE|100|0|True
6|INTJ|RE|6|INTJ|DE|100|0|True
6|LST|RE|6|LST|DE|100|0|True
6|PP|RE|6|PP|DE|100|0|True
6|PRT|RE|6|PRT|DE|100|0|True
7|NP|RE|7|NP|DE|100|-2|True
7|VP|RE|7|VP|DE|100|-2|True
7|ADJP|RE|7|ADJP|DE|100|0|True
7|ADVP|RE|7|VP|ADVP|100|0|True
7|CONJP|RE|7|CONJP|DE|100|0|True
7|INTJ|RE|7|INTJ|DE|100|0|True
7|LST|RE|7|LST|DE|100|0|True
7|PP|RE|7|PP|DE|100|0|True
7|PRT|RE|7|PRT|DE|100|0|True

1|NP|RE|1|NP|DE|100|-2|True
1|VP|RE|1|VP|DE|100|-2|True
1|ADJP|RE|1|ADJP|DE|100|-2|True
1|ADVP|RE|1|VP|ADVP|100|-2|True
1|CONJP|RE|1|CONJP|DE|100|0|True
1|INTJ|RE|1|INTJ|DE|100|0|True
1|LST|RE|1|LST|DE|100|0|True
1|PP|RE|1|PP|DE|100|0|True
1|PRT|RE|1|PRT|DE|100|0|True
2|NP|RE|2|NP|DE|100|-2|True
2|VP|RE|2|VP|DE|100|-2|True
2|ADJP|RE|2|ADJP|DE|100|-2|True
2|ADVP|RE|2|VP|ADVP|100|-2|True
2|CONJP|RE|2|CONJP|DE|100|0|True

2|INTJ|RE|2|INTJ|DE|100|0|True
2|LST|RE|2|LST|DE|100|0|True
2|PP|RE|2|PP|DE|100|0|True
2|PRT|RE|2|PRT|DE|100|0|True
3|NP|RE|3|NP|DE|100|-2|True
3|VP|RE|3|VP|DE|100|-2|True
3|ADJP|RE|3|ADJP|DE|100|-2|True
3|ADVP|RE|3|VP|ADVP|100|-2|True
3|CONJP|RE|3|CONJP|DE|100|0|True
3|INTJ|RE|3|INTJ|DE|100|0|True
3|LST|RE|3|LST|DE|100|0|True
3|PP|RE|3|PP|DE|100|0|True
3|PRT|RE|3|PRT|DE|100|0|True
4|NP|RE|4|NP|DE|100|-2|True
4|VP|RE|4|VP|DE|100|-2|True
4|ADJP|RE|4|ADJP|DE|100|-2|True
4|ADVP|RE|4|VP|ADVP|100|-2|True
4|CONJP|RE|4|CONJP|DE|100|0|True
4|INTJ|RE|4|INTJ|DE|100|0|True
4|LST|RE|4|LST|DE|100|0|True
4|PP|RE|4|PP|DE|100|0|True
4|PRT|RE|4|PRT|DE|100|0|True
5|NP|RE|5|NP|DE|100|-2|True
5|VP|RE|5|VP|DE|100|-2|True
5|ADJP|RE|5|ADJP|DE|100|-2|True
5|ADVP|RE|5|VP|ADVP|100|-2|True
5|CONJP|RE|5|CONJP|DE|100|0|True
5|INTJ|RE|5|INTJ|DE|100|0|True
5|LST|RE|5|LST|DE|100|0|True
5|PP|RE|5|PP|DE|100|0|True
5|PRT|RE|5|PRT|DE|100|0|True
6|NP|RE|6|NP|DE|100|-2|True
6|VP|RE|6|VP|DE|100|-2|True
6|ADJP|RE|6|ADJP|DE|100|-2|True
6|ADVP|RE|6|VP|ADVP|100|-2|True
6|CONJP|RE|6|CONJP|DE|100|0|True
6|INTJ|RE|6|INTJ|DE|100|0|True
6|LST|RE|6|LST|DE|100|0|True
6|PP|RE|6|PP|DE|100|0|True
6|PRT|RE|6|PRT|DE|100|0|True
7|NP|RE|7|NP|DE|100|-2|True
7|VP|RE|7|VP|DE|100|-2|True
7|ADJP|RE|7|ADJP|DE|100|-2|True
7|ADVP|RE|7|VP|ADVP|100|-2|True
7|CONJP|RE|7|CONJP|DE|100|0|True
7|INTJ|RE|7|INTJ|DE|100|0|True

7|LST|RE|7|LST|DE|100|0|True
7|PP|RE|7|PP|DE|100|0|True
7|PRT|RE|7|PRT|DE|100|0|True

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0|ADVP|RE|0|VP|ADVP|100|0|True
0|CONJP|RE|0|CONJP|DE|100|0|True
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0|LST|RE|0|LST|DE|100|0|True
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1|ADVP|RE|1|VP|ADVP|100|0|True
1|CONJP|RE|1|CONJP|DE|100|0|True
1|INTJ|RE|1|INTJ|DE|100|0|True
1|LST|RE|1|LST|DE|100|0|True
1|PP|RE|1|PP|DE|100|0|True
1|PRT|RE|1|PRT|DE|100|0|True
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2|ADVP|RE|2|VP|ADVP|100|0|True
2|CONJP|RE|2|CONJP|DE|100|0|True
2|INTJ|RE|2|INTJ|DE|100|0|True
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2|PP|RE|2|PP|DE|100|0|True
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3|NP|RE|3|NP|DE|100|0|True
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3|ADJP|RE|3|ADJP|DE|100|0|True
3|ADVP|RE|3|VP|ADVP|100|0|True

3|CONJP|RE|3|CONJP|DE|100|0|True
3|INTJ|RE|3|INTJ|DE|100|0|True
3|LST|RE|3|LST|DE|100|0|True
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4|NP|RE|4|NP|DE|100|0|True
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4|ADVP|RE|4|VP|ADVP|100|0|True
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4|LST|RE|4|LST|DE|100|0|True
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1|CONJP|RE|1|CONJP|DE|100|25|True
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6|ADVP|RE|6|VP|ADVP|100|25|True
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6|INTJ|RE|6|INTJ|DE|100|25|True
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1|PRT|RE|1|PRT|DE|100|25|True
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0|ADVP|RE|0|ADVP|DE|10|0|True
0|VP|RE|0|VP|DE|10|0|True
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0|ADVP|RE|0|VP|DE|10|0|True
0|NP|RE|0|NP|DE|10|0|True
0|ADVP|RE|0|ADVP|DE|10|0|True
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0|ADVP|RE|0|ADVP|DE|10|0|True

0|ADVP|RE|0|ADJP|DE|10|0|True
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0|NP|RE|0|NP|DE|10|25|True
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0|ADVP|RE|0|ADVP|DE|10|25|True
0|ADVP|RE|0|ADJP|DE|10|25|True
0|ADJP|RE|0|ADVP|DE|10|25|True

1|NP|RE|1|NP|DE|10|-2|True
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1|ADVP|RE|1|VP|ADVP|10|0|True
1|CONJP|RE|1|CONJP|DE|10|0|True
1|INTJ|RE|1|INTJ|DE|10|0|True
1|LST|RE|1|LST|DE|10|0|True
1|PP|RE|1|PP|DE|10|0|True
1|PRT|RE|1|PRT|DE|10|0|True
2|NP|RE|2|NP|DE|10|-2|True
2|VP|RE|2|VP|DE|10|-2|True
2|ADJP|RE|2|ADJP|DE|10|0|True
2|ADVP|RE|2|VP|ADVP|10|0|True
2|CONJP|RE|2|CONJP|DE|10|0|True
2|INTJ|RE|2|INTJ|DE|10|0|True
2|LST|RE|2|LST|DE|10|0|True
2|PP|RE|2|PP|DE|10|0|True
2|PRT|RE|2|PRT|DE|10|0|True

3|NP|RE|3|NP|DE|10|-2|True
3|VP|RE|3|VP|DE|10|-2|True
3|ADJP|RE|3|ADJP|DE|10|0|True
3|ADVP|RE|3|VP|ADVP|10|0|True
3|CONJP|RE|3|CONJP|DE|10|0|True
3|INTJ|RE|3|INTJ|DE|10|0|True
3|LST|RE|3|LST|DE|10|0|True
3|PP|RE|3|PP|DE|10|0|True
3|PRT|RE|3|PRT|DE|10|0|True
4|NP|RE|4|NP|DE|10|-2|True
4|VP|RE|4|VP|DE|10|-2|True
4|ADJP|RE|4|ADJP|DE|10|0|True
4|ADVP|RE|4|VP|ADVP|10|0|True
4|CONJP|RE|4|CONJP|DE|10|0|True
4|INTJ|RE|4|INTJ|DE|10|0|True
4|LST|RE|4|LST|DE|10|0|True
4|PP|RE|4|PP|DE|10|0|True
4|PRT|RE|4|PRT|DE|10|0|True
5|NP|RE|5|NP|DE|10|-2|True
5|VP|RE|5|VP|DE|10|-2|True
5|ADJP|RE|5|ADJP|DE|10|0|True
5|ADVP|RE|5|VP|ADVP|10|0|True
5|CONJP|RE|5|CONJP|DE|10|0|True
5|INTJ|RE|5|INTJ|DE|10|0|True
5|LST|RE|5|LST|DE|10|0|True
5|PP|RE|5|PP|DE|10|0|True
5|PRT|RE|5|PRT|DE|10|0|True
6|NP|RE|6|NP|DE|10|-2|True
6|VP|RE|6|VP|DE|10|-2|True
6|ADJP|RE|6|ADJP|DE|10|0|True
6|ADVP|RE|6|VP|ADVP|10|0|True
6|CONJP|RE|6|CONJP|DE|10|0|True
6|INTJ|RE|6|INTJ|DE|10|0|True
6|LST|RE|6|LST|DE|10|0|True
6|PP|RE|6|PP|DE|10|0|True
6|PRT|RE|6|PRT|DE|10|0|True
7|NP|RE|7|NP|DE|10|-2|True
7|VP|RE|7|VP|DE|10|-2|True
7|ADJP|RE|7|ADJP|DE|10|0|True
7|ADVP|RE|7|VP|ADVP|10|0|True
7|CONJP|RE|7|CONJP|DE|10|0|True
7|INTJ|RE|7|INTJ|DE|10|0|True
7|LST|RE|7|LST|DE|10|0|True
7|PP|RE|7|PP|DE|10|0|True
7|PRT|RE|7|PRT|DE|10|0|True

1|NP|RE|1|NP|DE|10|-2|True
1|VP|RE|1|VP|DE|10|-2|True
1|ADJP|RE|1|ADJP|DE|10|-2|True
1|ADVP|RE|1|VP|ADVP|10|-2|True
1|CONJP|RE|1|CONJP|DE|10|0|True
1|INTJ|RE|1|INTJ|DE|10|0|True
1|LST|RE|1|LST|DE|10|0|True
1|PP|RE|1|PP|DE|10|0|True
1|PRT|RE|1|PRT|DE|10|0|True
2|NP|RE|2|NP|DE|10|-2|True
2|VP|RE|2|VP|DE|10|-2|True
2|ADJP|RE|2|ADJP|DE|10|-2|True
2|ADVP|RE|2|VP|ADVP|10|-2|True
2|CONJP|RE|2|CONJP|DE|10|0|True
2|INTJ|RE|2|INTJ|DE|10|0|True
2|LST|RE|2|LST|DE|10|0|True
2|PP|RE|2|PP|DE|10|0|True
2|PRT|RE|2|PRT|DE|10|0|True
3|NP|RE|3|NP|DE|10|-2|True
3|VP|RE|3|VP|DE|10|-2|True
3|ADJP|RE|3|ADJP|DE|10|-2|True
3|ADVP|RE|3|VP|ADVP|10|-2|True
3|CONJP|RE|3|CONJP|DE|10|0|True
3|INTJ|RE|3|INTJ|DE|10|0|True
3|LST|RE|3|LST|DE|10|0|True
3|PP|RE|3|PP|DE|10|0|True
3|PRT|RE|3|PRT|DE|10|0|True
4|NP|RE|4|NP|DE|10|-2|True
4|VP|RE|4|VP|DE|10|-2|True
4|ADJP|RE|4|ADJP|DE|10|-2|True
4|ADVP|RE|4|VP|ADVP|10|-2|True
4|CONJP|RE|4|CONJP|DE|10|0|True
4|INTJ|RE|4|INTJ|DE|10|0|True
4|LST|RE|4|LST|DE|10|0|True
4|PP|RE|4|PP|DE|10|0|True
4|PRT|RE|4|PRT|DE|10|0|True
5|NP|RE|5|NP|DE|10|-2|True
5|VP|RE|5|VP|DE|10|-2|True
5|ADJP|RE|5|ADJP|DE|10|-2|True
5|ADVP|RE|5|VP|ADVP|10|-2|True
5|CONJP|RE|5|CONJP|DE|10|0|True
5|INTJ|RE|5|INTJ|DE|10|0|True
5|LST|RE|5|LST|DE|10|0|True
5|PP|RE|5|PP|DE|10|0|True
5|PRT|RE|5|PRT|DE|10|0|True
6|NP|RE|6|NP|DE|10|-2|True

6|VP|RE|6|VP|DE|10|-2|True
6|ADJP|RE|6|ADJP|DE|10|-2|True
6|ADVP|RE|6|VP|ADVP|10|-2|True
6|CONJP|RE|6|CONJP|DE|10|0|True
6|INTJ|RE|6|INTJ|DE|10|0|True
6|LST|RE|6|LST|DE|10|0|True
6|PP|RE|6|PP|DE|10|0|True
6|PRT|RE|6|PRT|DE|10|0|True
7|NP|RE|7|NP|DE|10|-2|True
7|VP|RE|7|VP|DE|10|-2|True
7|ADJP|RE|7|ADJP|DE|10|-2|True
7|ADVP|RE|7|VP|ADVP|10|-2|True
7|CONJP|RE|7|CONJP|DE|10|0|True
7|INTJ|RE|7|INTJ|DE|10|0|True
7|LST|RE|7|LST|DE|10|0|True
7|PP|RE|7|PP|DE|10|0|True
7|PRT|RE|7|PRT|DE|10|0|True

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0|VP|RE|0|VP|DE|10|0|True
0|ADJP|RE|0|ADJP|DE|10|0|True
0|ADVP|RE|0|VP|ADVP|10|0|True
0|CONJP|RE|0|CONJP|DE|10|0|True
0|INTJ|RE|0|INTJ|DE|10|0|True
0|LST|RE|0|LST|DE|10|0|True
0|PP|RE|0|PP|DE|10|0|True
0|PRT|RE|0|PRT|DE|10|0|True

0|NP|RE|0|NP|DE|10|25|True
0|VP|RE|0|VP|DE|10|25|True
0|ADJP|RE|0|ADJP|DE|10|25|True
0|ADVP|RE|0|VP|ADVP|10|25|True
0|CONJP|RE|0|CONJP|DE|10|25|True
0|INTJ|RE|0|INTJ|DE|10|25|True
0|LST|RE|0|LST|DE|10|25|True
0|PP|RE|0|PP|DE|10|25|True
0|PRT|RE|0|PRT|DE|10|25|True

1|NP|RE|1|NP|DE|10|0|True
1|VP|RE|1|VP|DE|10|0|True
1|ADJP|RE|1|ADJP|DE|10|0|True
1|ADVP|RE|1|VP|ADVP|10|0|True
1|CONJP|RE|1|CONJP|DE|10|0|True
1|INTJ|RE|1|INTJ|DE|10|0|True
1|LST|RE|1|LST|DE|10|0|True
1|PP|RE|1|PP|DE|10|0|True

1|PRT|RE|1|PRT|DE|10|0|True
2|NP|RE|2|NP|DE|10|0|True
2|VP|RE|2|VP|DE|10|0|True
2|ADJP|RE|2|ADJP|DE|10|0|True
2|ADVP|RE|2|VP|ADVP|10|0|True
2|CONJP|RE|2|CONJP|DE|10|0|True
2|INTJ|RE|2|INTJ|DE|10|0|True
2|LST|RE|2|LST|DE|10|0|True
2|PP|RE|2|PP|DE|10|0|True
2|PRT|RE|2|PRT|DE|10|0|True
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3|ADJP|RE|3|ADJP|DE|10|0|True
3|ADVP|RE|3|VP|ADVP|10|0|True
3|CONJP|RE|3|CONJP|DE|10|0|True
3|INTJ|RE|3|INTJ|DE|10|0|True
3|LST|RE|3|LST|DE|10|0|True
3|PP|RE|3|PP|DE|10|0|True
3|PRT|RE|3|PRT|DE|10|0|True
4|NP|RE|4|NP|DE|10|0|True
4|VP|RE|4|VP|DE|10|0|True
4|ADJP|RE|4|ADJP|DE|10|0|True
4|ADVP|RE|4|VP|ADVP|10|0|True
4|CONJP|RE|4|CONJP|DE|10|0|True
4|INTJ|RE|4|INTJ|DE|10|0|True
4|LST|RE|4|LST|DE|10|0|True
4|PP|RE|4|PP|DE|10|0|True
4|PRT|RE|4|PRT|DE|10|0|True
5|NP|RE|5|NP|DE|10|0|True
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5|ADJP|RE|5|ADJP|DE|10|0|True
5|ADVP|RE|5|VP|ADVP|10|0|True
5|CONJP|RE|5|CONJP|DE|10|0|True
5|INTJ|RE|5|INTJ|DE|10|0|True
5|LST|RE|5|LST|DE|10|0|True
5|PP|RE|5|PP|DE|10|0|True
5|PRT|RE|5|PRT|DE|10|0|True
6|NP|RE|6|NP|DE|10|0|True
6|VP|RE|6|VP|DE|10|0|True
6|ADJP|RE|6|ADJP|DE|10|0|True
6|ADVP|RE|6|VP|ADVP|10|0|True
6|CONJP|RE|6|CONJP|DE|10|0|True
6|INTJ|RE|6|INTJ|DE|10|0|True
6|LST|RE|6|LST|DE|10|0|True
6|PP|RE|6|PP|DE|10|0|True
6|PRT|RE|6|PRT|DE|10|0|True

7|NP|RE|7|NP|DE|10|0|True
7|VP|RE|7|VP|DE|10|0|True
7|ADJP|RE|7|ADJP|DE|10|0|True
7|ADVP|RE|7|VP|ADVP|10|0|True
7|CONJP|RE|7|CONJP|DE|10|0|True
7|INTJ|RE|7|INTJ|DE|10|0|True
7|LST|RE|7|LST|DE|10|0|True
7|PP|RE|7|PP|DE|10|0|True
7|PRT|RE|7|PRT|DE|10|0|True

1|NP|RE|1|NP|DE|10|25|True
1|VP|RE|1|VP|DE|10|25|True
1|ADJP|RE|1|ADJP|DE|10|25|True
1|ADVP|RE|1|VP|ADVP|10|25|True
1|CONJP|RE|1|CONJP|DE|10|25|True
1|INTJ|RE|1|INTJ|DE|10|25|True
1|LST|RE|1|LST|DE|10|25|True
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1|PRT|RE|1|PRT|DE|10|25|True
2|NP|RE|2|NP|DE|10|25|True
2|VP|RE|2|VP|DE|10|25|True
2|ADJP|RE|2|ADJP|DE|10|25|True
2|ADVP|RE|2|VP|ADVP|10|25|True
2|CONJP|RE|2|CONJP|DE|10|25|True
2|INTJ|RE|2|INTJ|DE|10|25|True
2|LST|RE|2|LST|DE|10|25|True
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3|NP|RE|3|NP|DE|10|25|True
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3|ADVP|RE|3|VP|ADVP|10|25|True
3|CONJP|RE|3|CONJP|DE|10|25|True
3|INTJ|RE|3|INTJ|DE|10|25|True
3|LST|RE|3|LST|DE|10|25|True
3|PP|RE|3|PP|DE|10|25|True
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4|NP|RE|4|NP|DE|10|25|True
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4|ADVP|RE|4|VP|ADVP|10|25|True
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4|INTJ|RE|4|INTJ|DE|10|25|True
4|LST|RE|4|LST|DE|10|25|True
4|PP|RE|4|PP|DE|10|25|True
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5|NP|RE|5|NP|DE|10|25|True
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5|ADJP|RE|5|ADJP|DE|10|25|True
5|ADVP|RE|5|VP|ADVP|10|25|True
5|CONJP|RE|5|CONJP|DE|10|25|True
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5|LST|RE|5|LST|DE|10|25|True
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7|INTJ|RE|7|INTJ|DE|10|25|True
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1|PRT|RE|1|PRT|DE|10|25|True
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2|ADVP|RE|2|VP|ADVP|10|25|True
2|CONJP|RE|2|CONJP|DE|10|25|True
2|INTJ|RE|2|INTJ|DE|10|25|True
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2|PP|RE|2|PP|DE|10|25|True
2|PRT|RE|2|PRT|DE|10|25|True
3|NP|RE|3|NP|DE|10|25|True
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3|CONJP|RE|3|CONJP|DE|10|25|True
3|INTJ|RE|3|INTJ|DE|10|25|True
3|LST|RE|3|LST|DE|10|25|True
3|PP|RE|3|PP|DE|10|25|True
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7|NP|RE|7|NP|DE|10|25|True
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7|ADVP|RE|7|VP|ADVP|10|25|True
7|CONJP|RE|7|CONJP|DE|10|25|True
7|INTJ|RE|7|INTJ|DE|10|25|True
7|LST|RE|7|LST|DE|10|25|True
7|PP|RE|7|PP|DE|10|25|True

7|PRT|RE|7|PRT|DE|10|25|True

0|NP|RE|0|NP|DE|20|-2|True
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0|ADVP|RE|0|VP|ADVP|20|0|True
0|CONJP|RE|0|CONJP|DE|20|0|True
0|INTJ|RE|0|INTJ|DE|20|0|True
0|LST|RE|0|LST|DE|20|0|True
0|PP|RE|0|PP|DE|20|0|True
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0|NP|RE|0|NP|DE|20|25|True
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1|NP|RE|1|NP|DE|20|25|True
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1|ADJP|RE|1|ADJP|DE|20|25|True
1|ADVP|RE|1|VP|ADVP|20|25|True
1|CONJP|RE|1|CONJP|DE|20|25|True
1|INTJ|RE|1|INTJ|DE|20|25|True
1|LST|RE|1|LST|DE|20|25|True
1|PP|RE|1|PP|DE|20|25|True
1|PRT|RE|1|PRT|DE|20|25|True
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2|VP|RE|2|VP|DE|20|25|True
2|ADJP|RE|2|ADJP|DE|20|25|True
2|ADVP|RE|2|VP|ADVP|20|25|True
2|CONJP|RE|2|CONJP|DE|20|25|True
2|INTJ|RE|2|INTJ|DE|20|25|True
2|LST|RE|2|LST|DE|20|25|True
2|PP|RE|2|PP|DE|20|25|True
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3|CONJP|RE|3|CONJP|DE|20|25|True
3|INTJ|RE|3|INTJ|DE|20|25|True
3|LST|RE|3|LST|DE|20|25|True
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3|PRT|RE|3|PRT|DE|20|25|True
4|NP|RE|4|NP|DE|20|25|True
4|VP|RE|4|VP|DE|20|25|True
4|ADJP|RE|4|ADJP|DE|20|25|True

4|ADVP|RE|4|VP|ADVP|20|25|True
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4|INTJ|RE|4|INTJ|DE|20|25|True
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4|PP|RE|4|PP|DE|20|25|True
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7|NP|RE|7|VP|DE|20|0|True

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0|ADVP|RE|0|VP|ADVP|20|-2|True
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0|INTJ|RE|0|INTJ|DE|20|0|True
0|LST|RE|0|LST|DE|20|0|True

0|PP|RE|0|PP|DE|20|0|True
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0|NP|RE|0|NP|DE|20|0|True
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0|NP|RE|0|NP|DE|20|0|True
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0|VP|RE|0|NP|DE|20|0|True
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0|NP|RE|0|NP|DE|20|0|True
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0|NP|RE|0|NP|DE|20|25|True
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1|NP|RE|1|NP|DE|20|-2|True
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1|CONJP|RE|1|CONJP|DE|20|0|True
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1|LST|RE|1|LST|DE|20|0|True
1|PP|RE|1|PP|DE|20|0|True
1|PRT|RE|1|PRT|DE|20|0|True
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2|LST|RE|2|LST|DE|20|0|True
2|PP|RE|2|PP|DE|20|0|True
2|PRT|RE|2|PRT|DE|20|0|True
3|NP|RE|3|NP|DE|20|-2|True
3|VP|RE|3|VP|DE|20|-2|True
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6|NP|RE|6|NP|DE|20|-2|True
6|VP|RE|6|VP|DE|20|-2|True
6|ADJP|RE|6|ADJP|DE|20|0|True
6|ADVP|RE|6|VP|ADVP|20|0|True
6|CONJP|RE|6|CONJP|DE|20|0|True

```
6|INTJ|RE|6|INTJ|DE|20|0|True
6|LST|RE|6|LST|DE|20|0|True
6|PP|RE|6|PP|DE|20|0|True
6|PRT|RE|6|PRT|DE|20|0|True
7|NP|RE|7|NP|DE|20|-2|True
7|VP|RE|7|VP|DE|20|-2|True
7|ADJP|RE|7|ADJP|DE|20|0|True
7|ADVP|RE|7|VP|ADVP|20|0|True
7|CONJP|RE|7|CONJP|DE|20|0|True
7|INTJ|RE|7|INTJ|DE|20|0|True
7|LST|RE|7|LST|DE|20|0|True
7|PP|RE|7|PP|DE|20|0|True
7|PRT|RE|7|PRT|DE|20|0|True

1|NP|RE|1|NP|DE|20|-2|True
1|VP|RE|1|VP|DE|20|-2|True
1|ADJP|RE|1|ADJP|DE|20|-2|True
1|ADVP|RE|1|VP|ADVP|20|-2|True
1|CONJP|RE|1|CONJP|DE|20|0|True
1|INTJ|RE|1|INTJ|DE|20|0|True
1|LST|RE|1|LST|DE|20|0|True
1|PP|RE|1|PP|DE|20|0|True
1|PRT|RE|1|PRT|DE|20|0|True
2|NP|RE|2|NP|DE|20|-2|True
2|VP|RE|2|VP|DE|20|-2|True
2|ADJP|RE|2|ADJP|DE|20|-2|True
2|ADVP|RE|2|VP|ADVP|20|-2|True
2|CONJP|RE|2|CONJP|DE|20|0|True
2|INTJ|RE|2|INTJ|DE|20|0|True
2|LST|RE|2|LST|DE|20|0|True
2|PP|RE|2|PP|DE|20|0|True
2|PRT|RE|2|PRT|DE|20|0|True
3|NP|RE|3|NP|DE|20|-2|True
3|VP|RE|3|VP|DE|20|-2|True
3|ADJP|RE|3|ADJP|DE|20|-2|True
3|ADVP|RE|3|VP|ADVP|20|-2|True
3|CONJP|RE|3|CONJP|DE|20|0|True
3|INTJ|RE|3|INTJ|DE|20|0|True
3|LST|RE|3|LST|DE|20|0|True
3|PP|RE|3|PP|DE|20|0|True
3|PRT|RE|3|PRT|DE|20|0|True
4|NP|RE|4|NP|DE|20|-2|True
4|VP|RE|4|VP|DE|20|-2|True
4|ADJP|RE|4|ADJP|DE|20|-2|True
4|ADVP|RE|4|VP|ADVP|20|-2|True
4|CONJP|RE|4|CONJP|DE|20|0|True
```

4|INTJ|RE|4|INTJ|DE|20|0|True
4|LST|RE|4|LST|DE|20|0|True
4|PP|RE|4|PP|DE|20|0|True
4|PRT|RE|4|PRT|DE|20|0|True
5|NP|RE|5|NP|DE|20|-2|True
5|VP|RE|5|VP|DE|20|-2|True
5|ADJP|RE|5|ADJP|DE|20|-2|True
5|ADVP|RE|5|VP|ADVP|20|-2|True
5|CONJP|RE|5|CONJP|DE|20|0|True
5|INTJ|RE|5|INTJ|DE|20|0|True
5|LST|RE|5|LST|DE|20|0|True
5|PP|RE|5|PP|DE|20|0|True
5|PRT|RE|5|PRT|DE|20|0|True
6|NP|RE|6|NP|DE|20|-2|True
6|VP|RE|6|VP|DE|20|-2|True
6|ADJP|RE|6|ADJP|DE|20|-2|True
6|ADVP|RE|6|VP|ADVP|20|-2|True
6|CONJP|RE|6|CONJP|DE|20|0|True
6|INTJ|RE|6|INTJ|DE|20|0|True
6|LST|RE|6|LST|DE|20|0|True
6|PP|RE|6|PP|DE|20|0|True
6|PRT|RE|6|PRT|DE|20|0|True
7|NP|RE|7|NP|DE|20|-2|True
7|VP|RE|7|VP|DE|20|-2|True
7|ADJP|RE|7|ADJP|DE|20|-2|True
7|ADVP|RE|7|VP|ADVP|20|-2|True
7|CONJP|RE|7|CONJP|DE|20|0|True
7|INTJ|RE|7|INTJ|DE|20|0|True
7|LST|RE|7|LST|DE|20|0|True
7|PP|RE|7|PP|DE|20|0|True
7|PRT|RE|7|PRT|DE|20|0|True

0|NP|RE|0|NP|DE|20|0|True
0|VP|RE|0|VP|DE|20|0|True
0|ADJP|RE|0|ADJP|DE|20|0|True
0|ADVP|RE|0|VP|ADVP|20|0|True
0|CONJP|RE|0|CONJP|DE|20|0|True
0|INTJ|RE|0|INTJ|DE|20|0|True
0|LST|RE|0|LST|DE|20|0|True
0|PP|RE|0|PP|DE|20|0|True
0|PRT|RE|0|PRT|DE|20|0|True

0|NP|RE|0|NP|DE|20|25|True
0|VP|RE|0|VP|DE|20|25|True
0|ADJP|RE|0|ADJP|DE|20|25|True
0|ADVP|RE|0|VP|ADVP|20|25|True

```
0|CONJP|RE|0|CONJP|DE|20|25|True
0|INTJ|RE|0|INTJ|DE|20|25|True
0|LST|RE|0|LST|DE|20|25|True
0|PP|RE|0|PP|DE|20|25|True
0|PRT|RE|0|PRT|DE|20|25|True

1|NP|RE|1|NP|DE|20|0|True
1|VP|RE|1|VP|DE|20|0|True
1|ADJP|RE|1|ADJP|DE|20|0|True
1|ADVP|RE|1|VP|ADVP|20|0|True
1|CONJP|RE|1|CONJP|DE|20|0|True
1|INTJ|RE|1|INTJ|DE|20|0|True
1|LST|RE|1|LST|DE|20|0|True
1|PP|RE|1|PP|DE|20|0|True
1|PRT|RE|1|PRT|DE|20|0|True
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2|VP|RE|2|VP|DE|20|0|True
2|ADJP|RE|2|ADJP|DE|20|0|True
2|ADVP|RE|2|VP|ADVP|20|0|True
2|CONJP|RE|2|CONJP|DE|20|0|True
2|INTJ|RE|2|INTJ|DE|20|0|True
2|LST|RE|2|LST|DE|20|0|True
2|PP|RE|2|PP|DE|20|0|True
2|PRT|RE|2|PRT|DE|20|0|True
3|NP|RE|3|NP|DE|20|0|True
3|VP|RE|3|VP|DE|20|0|True
3|ADJP|RE|3|ADJP|DE|20|0|True
3|ADVP|RE|3|VP|ADVP|20|0|True
3|CONJP|RE|3|CONJP|DE|20|0|True
3|INTJ|RE|3|INTJ|DE|20|0|True
3|LST|RE|3|LST|DE|20|0|True
3|PP|RE|3|PP|DE|20|0|True
3|PRT|RE|3|PRT|DE|20|0|True
4|NP|RE|4|NP|DE|20|0|True
4|VP|RE|4|VP|DE|20|0|True
4|ADJP|RE|4|ADJP|DE|20|0|True
4|ADVP|RE|4|VP|ADVP|20|0|True
4|CONJP|RE|4|CONJP|DE|20|0|True
4|INTJ|RE|4|INTJ|DE|20|0|True
4|LST|RE|4|LST|DE|20|0|True
4|PP|RE|4|PP|DE|20|0|True
4|PRT|RE|4|PRT|DE|20|0|True
5|NP|RE|5|NP|DE|20|0|True
5|VP|RE|5|VP|DE|20|0|True
5|ADJP|RE|5|ADJP|DE|20|0|True
5|ADVP|RE|5|VP|ADVP|20|0|True
```

5|CONJP|RE|5|CONJP|DE|20|0|True
5|INTJ|RE|5|INTJ|DE|20|0|True
5|LST|RE|5|LST|DE|20|0|True
5|PP|RE|5|PP|DE|20|0|True
5|PRT|RE|5|PRT|DE|20|0|True
6|NP|RE|6|NP|DE|20|0|True
6|VP|RE|6|VP|DE|20|0|True
6|ADJP|RE|6|ADJP|DE|20|0|True
6|ADVP|RE|6|VP|ADVP|20|0|True
6|CONJP|RE|6|CONJP|DE|20|0|True
6|INTJ|RE|6|INTJ|DE|20|0|True
6|LST|RE|6|LST|DE|20|0|True
6|PP|RE|6|PP|DE|20|0|True
6|PRT|RE|6|PRT|DE|20|0|True
7|NP|RE|7|NP|DE|20|0|True
7|VP|RE|7|VP|DE|20|0|True
7|ADJP|RE|7|ADJP|DE|20|0|True
7|ADVP|RE|7|VP|ADVP|20|0|True
7|CONJP|RE|7|CONJP|DE|20|0|True
7|INTJ|RE|7|INTJ|DE|20|0|True
7|LST|RE|7|LST|DE|20|0|True
7|PP|RE|7|PP|DE|20|0|True
7|PRT|RE|7|PRT|DE|20|0|True

1|NP|RE|1|NP|DE|20|25|True
1|VP|RE|1|VP|DE|20|25|True
1|ADJP|RE|1|ADJP|DE|20|25|True
1|ADVP|RE|1|VP|ADVP|20|25|True
1|CONJP|RE|1|CONJP|DE|20|25|True
1|INTJ|RE|1|INTJ|DE|20|25|True
1|LST|RE|1|LST|DE|20|25|True
1|PP|RE|1|PP|DE|20|25|True
1|PRT|RE|1|PRT|DE|20|25|True
2|NP|RE|2|NP|DE|20|25|True
2|VP|RE|2|VP|DE|20|25|True
2|ADJP|RE|2|ADJP|DE|20|25|True
2|ADVP|RE|2|VP|ADVP|20|25|True
2|CONJP|RE|2|CONJP|DE|20|25|True
2|INTJ|RE|2|INTJ|DE|20|25|True
2|LST|RE|2|LST|DE|20|25|True
2|PP|RE|2|PP|DE|20|25|True
2|PRT|RE|2|PRT|DE|20|25|True
3|NP|RE|3|NP|DE|20|25|True
3|VP|RE|3|VP|DE|20|25|True
3|ADJP|RE|3|ADJP|DE|20|25|True
3|ADVP|RE|3|VP|ADVP|20|25|True

3|CONJP|RE|3|CONJP|DE|20|25|True
3|INTJ|RE|3|INTJ|DE|20|25|True
3|LST|RE|3|LST|DE|20|25|True
3|PP|RE|3|PP|DE|20|25|True
3|PRT|RE|3|PRT|DE|20|25|True
4|NP|RE|4|NP|DE|20|25|True
4|VP|RE|4|VP|DE|20|25|True
4|ADJP|RE|4|ADJP|DE|20|25|True
4|ADVP|RE|4|VP|ADVP|20|25|True
4|CONJP|RE|4|CONJP|DE|20|25|True
4|INTJ|RE|4|INTJ|DE|20|25|True
4|LST|RE|4|LST|DE|20|25|True
4|PP|RE|4|PP|DE|20|25|True
4|PRT|RE|4|PRT|DE|20|25|True
5|NP|RE|5|NP|DE|20|25|True
5|VP|RE|5|VP|DE|20|25|True
5|ADJP|RE|5|ADJP|DE|20|25|True
5|ADVP|RE|5|VP|ADVP|20|25|True
5|CONJP|RE|5|CONJP|DE|20|25|True
5|INTJ|RE|5|INTJ|DE|20|25|True
5|LST|RE|5|LST|DE|20|25|True
5|PP|RE|5|PP|DE|20|25|True
5|PRT|RE|5|PRT|DE|20|25|True
6|NP|RE|6|NP|DE|20|25|True
6|VP|RE|6|VP|DE|20|25|True
6|ADJP|RE|6|ADJP|DE|20|25|True
6|ADVP|RE|6|VP|ADVP|20|25|True
6|CONJP|RE|6|CONJP|DE|20|25|True
6|INTJ|RE|6|INTJ|DE|20|25|True
6|LST|RE|6|LST|DE|20|25|True
6|PP|RE|6|PP|DE|20|25|True
6|PRT|RE|6|PRT|DE|20|25|True
7|NP|RE|7|NP|DE|20|25|True
7|VP|RE|7|VP|DE|20|25|True
7|ADJP|RE|7|ADJP|DE|20|25|True
7|ADVP|RE|7|VP|ADVP|20|25|True
7|CONJP|RE|7|CONJP|DE|20|25|True
7|INTJ|RE|7|INTJ|DE|20|25|True
7|LST|RE|7|LST|DE|20|25|True
7|PP|RE|7|PP|DE|20|25|True
7|PRT|RE|7|PRT|DE|20|25|True

0|NP|RE|0|NP|DE|20|25|True
0|VP|RE|0|VP|DE|20|25|True
1|NP|RE|1|NP|DE|20|25|True
1|VP|RE|1|VP|DE|20|25|True

1|ADJP|RE|1|ADJP|DE|20|25|True
1|ADVP|RE|1|VP|ADVP|20|25|True
1|CONJP|RE|1|CONJP|DE|20|25|True
1|INTJ|RE|1|INTJ|DE|20|25|True
1|LST|RE|1|LST|DE|20|25|True
1|PP|RE|1|PP|DE|20|25|True
1|PRT|RE|1|PRT|DE|20|25|True
2|NP|RE|2|NP|DE|20|25|True
2|VP|RE|2|VP|DE|20|25|True
2|ADJP|RE|2|ADJP|DE|20|25|True
2|ADVP|RE|2|VP|ADVP|20|25|True
2|CONJP|RE|2|CONJP|DE|20|25|True
2|INTJ|RE|2|INTJ|DE|20|25|True
2|LST|RE|2|LST|DE|20|25|True
2|PP|RE|2|PP|DE|20|25|True
2|PRT|RE|2|PRT|DE|20|25|True
3|NP|RE|3|NP|DE|20|25|True
3|VP|RE|3|VP|DE|20|25|True
3|ADJP|RE|3|ADJP|DE|20|25|True
3|ADVP|RE|3|VP|ADVP|20|25|True
3|CONJP|RE|3|CONJP|DE|20|25|True
3|INTJ|RE|3|INTJ|DE|20|25|True
3|LST|RE|3|LST|DE|20|25|True
3|PP|RE|3|PP|DE|20|25|True
3|PRT|RE|3|PRT|DE|20|25|True
4|NP|RE|4|NP|DE|20|25|True
4|VP|RE|4|VP|DE|20|25|True
4|ADJP|RE|4|ADJP|DE|20|25|True
4|ADVP|RE|4|VP|ADVP|20|25|True
4|CONJP|RE|4|CONJP|DE|20|25|True
4|INTJ|RE|4|INTJ|DE|20|25|True
4|LST|RE|4|LST|DE|20|25|True
4|PP|RE|4|PP|DE|20|25|True
4|PRT|RE|4|PRT|DE|20|25|True
5|NP|RE|5|NP|DE|20|25|True
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5|ADJP|RE|5|ADJP|DE|20|25|True
5|ADVP|RE|5|VP|ADVP|20|25|True
5|CONJP|RE|5|CONJP|DE|20|25|True
5|INTJ|RE|5|INTJ|DE|20|25|True
5|LST|RE|5|LST|DE|20|25|True
5|PP|RE|5|PP|DE|20|25|True
5|PRT|RE|5|PRT|DE|20|25|True
6|NP|RE|6|NP|DE|20|25|True
6|VP|RE|6|VP|DE|20|25|True
6|ADJP|RE|6|ADJP|DE|20|25|True

6|ADVP|RE|6|VP|ADVP|20|25|True
6|CONJP|RE|6|CONJP|DE|20|25|True
6|INTJ|RE|6|INTJ|DE|20|25|True
6|LST|RE|6|LST|DE|20|25|True
6|PP|RE|6|PP|DE|20|25|True
6|PRT|RE|6|PRT|DE|20|25|True
7|NP|RE|7|NP|DE|20|25|True
7|VP|RE|7|VP|DE|20|25|True
7|ADJP|RE|7|ADJP|DE|20|25|True
7|ADVP|RE|7|VP|ADVP|20|25|True
7|CONJP|RE|7|CONJP|DE|20|25|True
7|INTJ|RE|7|INTJ|DE|20|25|True
7|LST|RE|7|LST|DE|20|25|True
7|PP|RE|7|PP|DE|20|25|True
7|PRT|RE|7|PRT|DE|20|25|True

0|NP|RE|0|NP|DE|30|-2|True
0|VP|RE|0|VP|DE|30|-2|True
0|ADJP|RE|0|ADJP|DE|30|0|True
0|ADVP|RE|0|VP|ADVP|30|0|True
0|CONJP|RE|0|CONJP|DE|30|0|True
0|INTJ|RE|0|INTJ|DE|30|0|True
0|LST|RE|0|LST|DE|30|0|True
0|PP|RE|0|PP|DE|30|0|True
0|PRT|RE|0|PRT|DE|30|0|True

0|NP|RE|0|NP|DE|30|25|True
0|VP|RE|0|VP|DE|30|25|True
0|ADJP|RE|0|ADJP|DE|30|25|True
0|ADVP|RE|0|ADVP|DE|30|25|True
1|NP|RE|1|NP|DE|30|25|True
1|VP|RE|1|VP|DE|30|25|True
1|ADJP|RE|1|ADJP|DE|30|25|True
1|ADVP|RE|1|VP|ADVP|30|25|True
1|CONJP|RE|1|CONJP|DE|30|25|True
1|INTJ|RE|1|INTJ|DE|30|25|True
1|LST|RE|1|LST|DE|30|25|True
1|PP|RE|1|PP|DE|30|25|True
1|PRT|RE|1|PRT|DE|30|25|True
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2|ADVP|RE|2|VP|ADVP|30|25|True
2|CONJP|RE|2|CONJP|DE|30|25|True
2|INTJ|RE|2|INTJ|DE|30|25|True
2|LST|RE|2|LST|DE|30|25|True

2|PP|RE|2|PP|DE|30|25|True
2|PRT|RE|2|PRT|DE|30|25|True
3|NP|RE|3|NP|DE|30|25|True
3|VP|RE|3|VP|DE|30|25|True
3|ADJP|RE|3|ADJP|DE|30|25|True
3|ADVP|RE|3|VP|ADVP|30|25|True
3|CONJP|RE|3|CONJP|DE|30|25|True
3|INTJ|RE|3|INTJ|DE|30|25|True
3|LST|RE|3|LST|DE|30|25|True
3|PP|RE|3|PP|DE|30|25|True
3|PRT|RE|3|PRT|DE|30|25|True
4|NP|RE|4|NP|DE|30|25|True
4|VP|RE|4|VP|DE|30|25|True
4|ADJP|RE|4|ADJP|DE|30|25|True
4|ADVP|RE|4|VP|ADVP|30|25|True
4|CONJP|RE|4|CONJP|DE|30|25|True
4|INTJ|RE|4|INTJ|DE|30|25|True
4|LST|RE|4|LST|DE|30|25|True
4|PP|RE|4|PP|DE|30|25|True
4|PRT|RE|4|PRT|DE|30|25|True
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5|ADJP|RE|5|ADJP|DE|30|25|True
5|ADVP|RE|5|VP|ADVP|30|25|True
5|CONJP|RE|5|CONJP|DE|30|25|True
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5|LST|RE|5|LST|DE|30|25|True
5|PP|RE|5|PP|DE|30|25|True
5|PRT|RE|5|PRT|DE|30|25|True
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6|VP|RE|6|VP|DE|30|25|True
6|ADJP|RE|6|ADJP|DE|30|25|True
6|ADVP|RE|6|VP|ADVP|30|25|True
6|CONJP|RE|6|CONJP|DE|30|25|True
6|INTJ|RE|6|INTJ|DE|30|25|True
6|LST|RE|6|LST|DE|30|25|True
6|PP|RE|6|PP|DE|30|25|True
6|PRT|RE|6|PRT|DE|30|25|True
7|NP|RE|7|NP|DE|30|25|True
7|VP|RE|7|VP|DE|30|25|True
7|ADJP|RE|7|ADJP|DE|30|25|True
7|ADVP|RE|7|VP|ADVP|30|25|True
7|CONJP|RE|7|CONJP|DE|30|25|True
7|INTJ|RE|7|INTJ|DE|30|25|True
7|LST|RE|7|LST|DE|30|25|True
7|PP|RE|7|PP|DE|30|25|True

7|PRT|RE|7|PRT|DE|30|25|True

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0|VP|RE|0|VP|DE|30|0|True
1|NP|RE|1|NP|DE|30|0|True
1|VP|RE|1|VP|DE|30|0|True
1|ADJP|RE|1|ADJP|DE|30|0|True
1|ADVP|RE|1|VP|ADVP|30|0|True
1|CONJP|RE|1|CONJP|DE|30|0|True
1|INTJ|RE|1|INTJ|DE|30|0|True
1|LST|RE|1|LST|DE|30|0|True
1|PP|RE|1|PP|DE|30|0|True
1|PRT|RE|1|PRT|DE|30|0|True
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2|ADJP|RE|2|ADJP|DE|30|0|True
2|ADVP|RE|2|VP|ADVP|30|0|True
2|CONJP|RE|2|CONJP|DE|30|0|True
2|INTJ|RE|2|INTJ|DE|30|0|True
2|LST|RE|2|LST|DE|30|0|True
2|PP|RE|2|PP|DE|30|0|True
2|PRT|RE|2|PRT|DE|30|0|True
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3|ADJP|RE|3|ADJP|DE|30|0|True
3|ADVP|RE|3|VP|ADVP|30|0|True
3|CONJP|RE|3|CONJP|DE|30|0|True
3|INTJ|RE|3|INTJ|DE|30|0|True
3|LST|RE|3|LST|DE|30|0|True
3|PP|RE|3|PP|DE|30|0|True
3|PRT|RE|3|PRT|DE|30|0|True
4|NP|RE|4|NP|DE|30|0|True
4|VP|RE|4|VP|DE|30|0|True
4|ADJP|RE|4|ADJP|DE|30|0|True
4|ADVP|RE|4|VP|ADVP|30|0|True
4|CONJP|RE|4|CONJP|DE|30|0|True
4|INTJ|RE|4|INTJ|DE|30|0|True
4|LST|RE|4|LST|DE|30|0|True
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5|VP|RE|5|VP|DE|30|0|True
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5|ADVP|RE|5|VP|ADVP|30|0|True
5|CONJP|RE|5|CONJP|DE|30|0|True
5|INTJ|RE|5|INTJ|DE|30|0|True

5|LST|RE|5|LST|DE|30|0|True
5|PP|RE|5|PP|DE|30|0|True
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6|NP|RE|6|NP|DE|30|0|True
6|VP|RE|6|VP|DE|30|0|True
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6|PP|RE|6|PP|DE|30|0|True
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7|NP|RE|7|NP|DE|30|0|True
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7|ADVP|RE|7|VP|ADVP|30|0|True
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7|INTJ|RE|7|INTJ|DE|30|0|True
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2|ADVP|RE|2|VP|ADVP|30|0|True
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2|INTJ|RE|2|INTJ|DE|30|0|True
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4|ADJP|RE|4|ADVP|DE|30|0|True
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5|ADVP|RE|5|ADJP|DE|30|0|True
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7|ADJP|RE|7|ADJP|DE|30|0|True
7|ADVP|RE|7|ADVP|DE|30|0|True
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4|NP|RE|4|NP|DE|30|0|True
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6|NP|RE|6|NP|DE|30|0|True

6|ADVP|RE|6|ADVP|DE|30|0|True
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6|NP|RE|6|ADVP|DE|30|0|True
7|NP|RE|7|NP|DE|30|0|True
7|ADVP|RE|7|ADVP|DE|30|0|True
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7|VP|RE|7|VP|DE|30|0|True
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1|VP|RE|1|NP|DE|30|25|True
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7|VP|RE|7|VP|DE|30|0|True

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2|ADVP|RE|2|ADJP|DE|30|0|True
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4|VP|RE|4|NP|DE|30|25|True

4|NP|RE|4|VP|DE|30|25|True
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5|VP|RE|5|VP|DE|30|25|True
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1|ADVP|RE|1|ADVP|DE|30|25|True
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2|ADVP|RE|2|ADJP|DE|30|25|True
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4|ADJP|RE|4|ADVP|DE|30|25|True
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7|ADJP|RE|7|ADJP|DE|30|25|True
7|ADVP|RE|7|ADVP|DE|30|25|True
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0|NP|RE|0|VP|DE|30|0|True

0|NP|RE|0|NP|DE|30|25|True
0|VP|RE|0|VP|DE|30|25|True
0|VP|RE|0|NP|DE|30|25|True
0|NP|RE|0|VP|DE|30|25|True

0|NP|RE|0|NP|DE|30|0|True
0|VP|RE|0|VP|DE|30|0|True
0|VP|RE|0|NP|DE|30|0|True
0|NP|RE|0|VP|DE|30|0|True
0|ADJP|RE|0|ADJP|DE|30|0|True
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0|ADJP|RE|0|NP|DE|30|0|True
0|NP|RE|0|ADJP|DE|30|0|True
0|ADVP|RE|0|ADVP|DE|30|0|True
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0|ADVP|RE|0|ADVP|DE|30|0|True
0|ADVP|RE|0|ADJP|DE|30|0|True
0|ADJP|RE|0|ADVP|DE|30|0|True

0|NP|RE|0|NP|DE|30|25|True
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0|VP|RE|0|NP|DE|30|25|True
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0|ADVP|RE|0|ADVP|DE|30|25|True
0|VP|RE|0|VP|DE|30|25|True
0|VP|RE|0|ADVP|DE|30|25|True

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0|ADVP|RE|0|VP|DE|30|25|True
0|NP|RE|0|NP|DE|30|25|True
0|ADVP|RE|0|ADVP|DE|30|25|True
0|ADVP|RE|0|NP|DE|30|25|True
0|NP|RE|0|ADVP|DE|30|25|True
0|ADJP|RE|0|ADJP|DE|30|25|True
0|ADVP|RE|0|ADVP|DE|30|25|True
0|ADVP|RE|0|ADJP|DE|30|25|True
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1|NP|RE|1|NP|DE|30|-2|True
1|VP|RE|1|VP|DE|30|-2|True
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1|ADVP|RE|1|VP|ADVP|30|0|True
1|CONJP|RE|1|CONJP|DE|30|0|True
1|INTJ|RE|1|INTJ|DE|30|0|True
1|LST|RE|1|LST|DE|30|0|True
1|PP|RE|1|PP|DE|30|0|True
1|PRT|RE|1|PRT|DE|30|0|True
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2|VP|RE|2|VP|DE|30|-2|True
2|ADJP|RE|2|ADJP|DE|30|0|True
2|ADVP|RE|2|VP|ADVP|30|0|True
2|CONJP|RE|2|CONJP|DE|30|0|True
2|INTJ|RE|2|INTJ|DE|30|0|True
2|LST|RE|2|LST|DE|30|0|True
2|PP|RE|2|PP|DE|30|0|True
2|PRT|RE|2|PRT|DE|30|0|True
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3|ADJP|RE|3|ADJP|DE|30|0|True
3|ADVP|RE|3|VP|ADVP|30|0|True
3|CONJP|RE|3|CONJP|DE|30|0|True
3|INTJ|RE|3|INTJ|DE|30|0|True
3|LST|RE|3|LST|DE|30|0|True
3|PP|RE|3|PP|DE|30|0|True
3|PRT|RE|3|PRT|DE|30|0|True
4|NP|RE|4|NP|DE|30|-2|True
4|VP|RE|4|VP|DE|30|-2|True
4|ADJP|RE|4|ADJP|DE|30|0|True
4|ADVP|RE|4|VP|ADVP|30|0|True
4|CONJP|RE|4|CONJP|DE|30|0|True
4|INTJ|RE|4|INTJ|DE|30|0|True
4|LST|RE|4|LST|DE|30|0|True
4|PP|RE|4|PP|DE|30|0|True
4|PRT|RE|4|PRT|DE|30|0|True
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5|NP|RE|5|NP|DE|30|-2|True
5|VP|RE|5|VP|DE|30|-2|True
5|ADJP|RE|5|ADJP|DE|30|0|True
5|ADVP|RE|5|VP|ADVP|30|0|True
5|CONJP|RE|5|CONJP|DE|30|0|True
5|INTJ|RE|5|INTJ|DE|30|0|True
5|LST|RE|5|LST|DE|30|0|True
5|PP|RE|5|PP|DE|30|0|True
5|PRT|RE|5|PRT|DE|30|0|True
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6|ADJP|RE|6|ADJP|DE|30|0|True
6|ADVP|RE|6|VP|ADVP|30|0|True
6|CONJP|RE|6|CONJP|DE|30|0|True
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6|LST|RE|6|LST|DE|30|0|True
6|PP|RE|6|PP|DE|30|0|True
6|PRT|RE|6|PRT|DE|30|0|True
7|NP|RE|7|NP|DE|30|-2|True
7|VP|RE|7|VP|DE|30|-2|True
7|ADJP|RE|7|ADJP|DE|30|0|True
7|ADVP|RE|7|VP|ADVP|30|0|True
7|CONJP|RE|7|CONJP|DE|30|0|True
7|INTJ|RE|7|INTJ|DE|30|0|True
7|LST|RE|7|LST|DE|30|0|True
7|PP|RE|7|PP|DE|30|0|True
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1|NP|RE|1|NP|DE|30|-2|True
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1|ADVP|RE|1|VP|ADVP|30|-2|True
1|CONJP|RE|1|CONJP|DE|30|0|True
1|INTJ|RE|1|INTJ|DE|30|0|True
1|LST|RE|1|LST|DE|30|0|True
1|PP|RE|1|PP|DE|30|0|True
1|PRT|RE|1|PRT|DE|30|0|True
2|NP|RE|2|NP|DE|30|-2|True
2|VP|RE|2|VP|DE|30|-2|True
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2|INTJ|RE|2|INTJ|DE|30|0|True
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2|PP|RE|2|PP|DE|30|0|True
2|PRT|RE|2|PRT|DE|30|0|True

3|NP|RE|3|NP|DE|30|-2|True
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3|ADVP|RE|3|VP|ADVP|30|-2|True
3|CONJP|RE|3|CONJP|DE|30|0|True
3|INTJ|RE|3|INTJ|DE|30|0|True
3|LST|RE|3|LST|DE|30|0|True
3|PP|RE|3|PP|DE|30|0|True
3|PRT|RE|3|PRT|DE|30|0|True
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4|ADVP|RE|4|VP|ADVP|30|-2|True
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4|LST|RE|4|LST|DE|30|0|True
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7|NP|RE|7|NP|DE|30|-2|True
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7|ADJP|RE|7|ADJP|DE|30|-2|True
7|ADVP|RE|7|VP|ADVP|30|-2|True
7|CONJP|RE|7|CONJP|DE|30|0|True
7|INTJ|RE|7|INTJ|DE|30|0|True
7|LST|RE|7|LST|DE|30|0|True
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0|NP|RE|0|NP|DE|30|0|True
0|VP|RE|0|VP|DE|30|0|True
0|ADJP|RE|0|ADJP|DE|30|0|True
0|ADVP|RE|0|VP|ADVP|30|0|True
0|CONJP|RE|0|CONJP|DE|30|0|True
0|INTJ|RE|0|INTJ|DE|30|0|True
0|LST|RE|0|LST|DE|30|0|True
0|PP|RE|0|PP|DE|30|0|True
0|PRT|RE|0|PRT|DE|30|0|True

0|NP|RE|0|NP|DE|30|25|True
0|VP|RE|0|VP|DE|30|25|True
0|ADJP|RE|0|ADJP|DE|30|25|True
0|ADVP|RE|0|VP|ADVP|30|25|True
0|CONJP|RE|0|CONJP|DE|30|25|True
0|INTJ|RE|0|INTJ|DE|30|25|True
0|LST|RE|0|LST|DE|30|25|True
0|PP|RE|0|PP|DE|30|25|True
0|PRT|RE|0|PRT|DE|30|25|True

1|NP|RE|1|NP|DE|30|0|True
1|VP|RE|1|VP|DE|30|0|True
1|ADJP|RE|1|ADJP|DE|30|0|True
1|ADVP|RE|1|VP|ADVP|30|0|True
1|CONJP|RE|1|CONJP|DE|30|0|True
1|INTJ|RE|1|INTJ|DE|30|0|True
1|LST|RE|1|LST|DE|30|0|True
1|PP|RE|1|PP|DE|30|0|True
1|PRT|RE|1|PRT|DE|30|0|True
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2|VP|RE|2|VP|DE|30|0|True
2|ADJP|RE|2|ADJP|DE|30|0|True
2|ADVP|RE|2|VP|ADVP|30|0|True
2|CONJP|RE|2|CONJP|DE|30|0|True
2|INTJ|RE|2|INTJ|DE|30|0|True
2|LST|RE|2|LST|DE|30|0|True
2|PP|RE|2|PP|DE|30|0|True
2|PRT|RE|2|PRT|DE|30|0|True
3|NP|RE|3|NP|DE|30|0|True
3|VP|RE|3|VP|DE|30|0|True
3|ADJP|RE|3|ADJP|DE|30|0|True
3|ADVP|RE|3|VP|ADVP|30|0|True
3|CONJP|RE|3|CONJP|DE|30|0|True
3|INTJ|RE|3|INTJ|DE|30|0|True
3|LST|RE|3|LST|DE|30|0|True
3|PP|RE|3|PP|DE|30|0|True

3|PRT|RE|3|PRT|DE|30|0|True
4|NP|RE|4|NP|DE|30|0|True
4|VP|RE|4|VP|DE|30|0|True
4|ADJP|RE|4|ADJP|DE|30|0|True
4|ADVP|RE|4|VP|ADVP|30|0|True
4|CONJP|RE|4|CONJP|DE|30|0|True
4|INTJ|RE|4|INTJ|DE|30|0|True
4|LST|RE|4|LST|DE|30|0|True
4|PP|RE|4|PP|DE|30|0|True
4|PRT|RE|4|PRT|DE|30|0|True
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5|ADJP|RE|5|ADJP|DE|30|0|True
5|ADVP|RE|5|VP|ADVP|30|0|True
5|CONJP|RE|5|CONJP|DE|30|0|True
5|INTJ|RE|5|INTJ|DE|30|0|True
5|LST|RE|5|LST|DE|30|0|True
5|PP|RE|5|PP|DE|30|0|True
5|PRT|RE|5|PRT|DE|30|0|True
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6|ADJP|RE|6|ADJP|DE|30|0|True
6|ADVP|RE|6|VP|ADVP|30|0|True
6|CONJP|RE|6|CONJP|DE|30|0|True
6|INTJ|RE|6|INTJ|DE|30|0|True
6|LST|RE|6|LST|DE|30|0|True
6|PP|RE|6|PP|DE|30|0|True
6|PRT|RE|6|PRT|DE|30|0|True
7|NP|RE|7|NP|DE|30|0|True
7|VP|RE|7|VP|DE|30|0|True
7|ADJP|RE|7|ADJP|DE|30|0|True
7|ADVP|RE|7|VP|ADVP|30|0|True
7|CONJP|RE|7|CONJP|DE|30|0|True
7|INTJ|RE|7|INTJ|DE|30|0|True
7|LST|RE|7|LST|DE|30|0|True
7|PP|RE|7|PP|DE|30|0|True
7|PRT|RE|7|PRT|DE|30|0|True

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1|ADJP|RE|1|ADJP|DE|30|25|True
1|ADVP|RE|1|VP|ADVP|30|25|True
1|CONJP|RE|1|CONJP|DE|30|25|True
1|INTJ|RE|1|INTJ|DE|30|25|True
1|LST|RE|1|LST|DE|30|25|True
1|PP|RE|1|PP|DE|30|25|True

1|PRT|RE|1|PRT|DE|30|25|True
2|NP|RE|2|NP|DE|30|25|True
2|VP|RE|2|VP|DE|30|25|True
2|ADJP|RE|2|ADJP|DE|30|25|True
2|ADVP|RE|2|VP|ADVP|30|25|True
2|CONJP|RE|2|CONJP|DE|30|25|True
2|INTJ|RE|2|INTJ|DE|30|25|True
2|LST|RE|2|LST|DE|30|25|True
2|PP|RE|2|PP|DE|30|25|True
2|PRT|RE|2|PRT|DE|30|25|True
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3|ADJP|RE|3|ADJP|DE|30|25|True
3|ADVP|RE|3|VP|ADVP|30|25|True
3|CONJP|RE|3|CONJP|DE|30|25|True
3|INTJ|RE|3|INTJ|DE|30|25|True
3|LST|RE|3|LST|DE|30|25|True
3|PP|RE|3|PP|DE|30|25|True
3|PRT|RE|3|PRT|DE|30|25|True
4|NP|RE|4|NP|DE|30|25|True
4|VP|RE|4|VP|DE|30|25|True
4|ADJP|RE|4|ADJP|DE|30|25|True
4|ADVP|RE|4|VP|ADVP|30|25|True
4|CONJP|RE|4|CONJP|DE|30|25|True
4|INTJ|RE|4|INTJ|DE|30|25|True
4|LST|RE|4|LST|DE|30|25|True
4|PP|RE|4|PP|DE|30|25|True
4|PRT|RE|4|PRT|DE|30|25|True
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5|ADVP|RE|5|VP|ADVP|30|25|True
5|CONJP|RE|5|CONJP|DE|30|25|True
5|INTJ|RE|5|INTJ|DE|30|25|True
5|LST|RE|5|LST|DE|30|25|True
5|PP|RE|5|PP|DE|30|25|True
5|PRT|RE|5|PRT|DE|30|25|True
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6|INTJ|RE|6|INTJ|DE|30|25|True
6|LST|RE|6|LST|DE|30|25|True
6|PP|RE|6|PP|DE|30|25|True
6|PRT|RE|6|PRT|DE|30|25|True

7|NP|RE|7|NP|DE|30|25|True
7|VP|RE|7|VP|DE|30|25|True
7|ADJP|RE|7|ADJP|DE|30|25|True
7|ADVP|RE|7|VP|ADVP|30|25|True
7|CONJP|RE|7|CONJP|DE|30|25|True
7|INTJ|RE|7|INTJ|DE|30|25|True
7|LST|RE|7|LST|DE|30|25|True
7|PP|RE|7|PP|DE|30|25|True
7|PRT|RE|7|PRT|DE|30|25|True

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0|VP|RE|0|VP|DE|30|25|True
1|NP|RE|1|NP|DE|30|25|True
1|VP|RE|1|VP|DE|30|25|True
1|ADJP|RE|1|ADJP|DE|30|25|True
1|ADVP|RE|1|VP|ADVP|30|25|True
1|CONJP|RE|1|CONJP|DE|30|25|True
1|INTJ|RE|1|INTJ|DE|30|25|True
1|LST|RE|1|LST|DE|30|25|True
1|PP|RE|1|PP|DE|30|25|True
1|PRT|RE|1|PRT|DE|30|25|True
2|NP|RE|2|NP|DE|30|25|True
2|VP|RE|2|VP|DE|30|25|True
2|ADJP|RE|2|ADJP|DE|30|25|True
2|ADVP|RE|2|VP|ADVP|30|25|True
2|CONJP|RE|2|CONJP|DE|30|25|True
2|INTJ|RE|2|INTJ|DE|30|25|True
2|LST|RE|2|LST|DE|30|25|True
2|PP|RE|2|PP|DE|30|25|True
2|PRT|RE|2|PRT|DE|30|25|True
3|NP|RE|3|NP|DE|30|25|True
3|VP|RE|3|VP|DE|30|25|True
3|ADJP|RE|3|ADJP|DE|30|25|True
3|ADVP|RE|3|VP|ADVP|30|25|True
3|CONJP|RE|3|CONJP|DE|30|25|True
3|INTJ|RE|3|INTJ|DE|30|25|True
3|LST|RE|3|LST|DE|30|25|True
3|PP|RE|3|PP|DE|30|25|True
3|PRT|RE|3|PRT|DE|30|25|True
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4|ADJP|RE|4|ADJP|DE|30|25|True
4|ADVP|RE|4|VP|ADVP|30|25|True
4|CONJP|RE|4|CONJP|DE|30|25|True
4|INTJ|RE|4|INTJ|DE|30|25|True
4|LST|RE|4|LST|DE|30|25|True

4|PP|RE|4|PP|DE|30|25|True
4|PRT|RE|4|PRT|DE|30|25|True
5|NP|RE|5|NP|DE|30|25|True
5|VP|RE|5|VP|DE|30|25|True
5|ADJP|RE|5|ADJP|DE|30|25|True
5|ADVP|RE|5|VP|ADVP|30|25|True
5|CONJP|RE|5|CONJP|DE|30|25|True
5|INTJ|RE|5|INTJ|DE|30|25|True
5|LST|RE|5|LST|DE|30|25|True
5|PP|RE|5|PP|DE|30|25|True
5|PRT|RE|5|PRT|DE|30|25|True
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6|VP|RE|6|VP|DE|30|25|True
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6|ADVP|RE|6|VP|ADVP|30|25|True
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6|INTJ|RE|6|INTJ|DE|30|25|True
6|LST|RE|6|LST|DE|30|25|True
6|PP|RE|6|PP|DE|30|25|True
6|PRT|RE|6|PRT|DE|30|25|True
7|NP|RE|7|NP|DE|30|25|True
7|VP|RE|7|VP|DE|30|25|True
7|ADJP|RE|7|ADJP|DE|30|25|True
7|ADVP|RE|7|VP|ADVP|30|25|True
7|CONJP|RE|7|CONJP|DE|30|25|True
7|INTJ|RE|7|INTJ|DE|30|25|True
7|LST|RE|7|LST|DE|30|25|True
7|PP|RE|7|PP|DE|30|25|True
7|PRT|RE|7|PRT|DE|30|25|True

0|NP|RE|0|NP|DE|33|-2|True
0|VP|RE|0|VP|DE|33|-2|True
0|ADJP|RE|0|ADJP|DE|33|0|True
0|ADVP|RE|0|VP|ADVP|33|0|True
0|CONJP|RE|0|CONJP|DE|33|0|True
0|INTJ|RE|0|INTJ|DE|33|0|True
0|LST|RE|0|LST|DE|33|0|True
0|PP|RE|0|PP|DE|33|0|True
0|PRT|RE|0|PRT|DE|33|0|True

0|NP|RE|0|NP|DE|33|25|True
0|VP|RE|0|VP|DE|33|25|True
0|ADJP|RE|0|ADJP|DE|33|25|True
0|ADVP|RE|0|ADVP|DE|33|25|True
1|NP|RE|1|NP|DE|33|25|True
1|VP|RE|1|VP|DE|33|25|True

1|ADJP|RE|1|ADJP|DE|33|25|True
1|ADVP|RE|1|VP|ADVP|33|25|True
1|CONJP|RE|1|CONJP|DE|33|25|True
1|INTJ|RE|1|INTJ|DE|33|25|True
1|LST|RE|1|LST|DE|33|25|True
1|PP|RE|1|PP|DE|33|25|True
1|PRT|RE|1|PRT|DE|33|25|True
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2|VP|RE|2|VP|DE|33|25|True
2|ADJP|RE|2|ADJP|DE|33|25|True
2|ADVP|RE|2|VP|ADVP|33|25|True
2|CONJP|RE|2|CONJP|DE|33|25|True
2|INTJ|RE|2|INTJ|DE|33|25|True
2|LST|RE|2|LST|DE|33|25|True
2|PP|RE|2|PP|DE|33|25|True
2|PRT|RE|2|PRT|DE|33|25|True
3|NP|RE|3|NP|DE|33|25|True
3|VP|RE|3|VP|DE|33|25|True
3|ADJP|RE|3|ADJP|DE|33|25|True
3|ADVP|RE|3|VP|ADVP|33|25|True
3|CONJP|RE|3|CONJP|DE|33|25|True
3|INTJ|RE|3|INTJ|DE|33|25|True
3|LST|RE|3|LST|DE|33|25|True
3|PP|RE|3|PP|DE|33|25|True
3|PRT|RE|3|PRT|DE|33|25|True
4|NP|RE|4|NP|DE|33|25|True
4|VP|RE|4|VP|DE|33|25|True
4|ADJP|RE|4|ADJP|DE|33|25|True
4|ADVP|RE|4|VP|ADVP|33|25|True
4|CONJP|RE|4|CONJP|DE|33|25|True
4|INTJ|RE|4|INTJ|DE|33|25|True
4|LST|RE|4|LST|DE|33|25|True
4|PP|RE|4|PP|DE|33|25|True
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5|NP|RE|5|NP|DE|33|25|True
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5|ADJP|RE|5|ADJP|DE|33|25|True
5|ADVP|RE|5|VP|ADVP|33|25|True
5|CONJP|RE|5|CONJP|DE|33|25|True
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5|LST|RE|5|LST|DE|33|25|True
5|PP|RE|5|PP|DE|33|25|True
5|PRT|RE|5|PRT|DE|33|25|True
6|NP|RE|6|NP|DE|33|25|True
6|VP|RE|6|VP|DE|33|25|True
6|ADJP|RE|6|ADJP|DE|33|25|True

6|ADVP|RE|6|VP|ADVP|33|25|True
6|CONJP|RE|6|CONJP|DE|33|25|True
6|INTJ|RE|6|INTJ|DE|33|25|True
6|LST|RE|6|LST|DE|33|25|True
6|PP|RE|6|PP|DE|33|25|True
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7|NP|RE|7|NP|DE|33|25|True
7|VP|RE|7|VP|DE|33|25|True
7|ADJP|RE|7|ADJP|DE|33|25|True
7|ADVP|RE|7|VP|ADVP|33|25|True
7|CONJP|RE|7|CONJP|DE|33|25|True
7|INTJ|RE|7|INTJ|DE|33|25|True
7|LST|RE|7|LST|DE|33|25|True
7|PP|RE|7|PP|DE|33|25|True
7|PRT|RE|7|PRT|DE|33|25|True

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1|NP|RE|1|NP|DE|33|0|True
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1|ADJP|RE|1|ADJP|DE|33|0|True
1|ADVP|RE|1|VP|ADVP|33|0|True
1|CONJP|RE|1|CONJP|DE|33|0|True
1|INTJ|RE|1|INTJ|DE|33|0|True
1|LST|RE|1|LST|DE|33|0|True
1|PP|RE|1|PP|DE|33|0|True
1|PRT|RE|1|PRT|DE|33|0|True
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2|ADJP|RE|2|ADJP|DE|33|0|True
2|ADVP|RE|2|VP|ADVP|33|0|True
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2|LST|RE|2|LST|DE|33|0|True
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3|ADVP|RE|3|VP|ADVP|33|0|True
3|CONJP|RE|3|CONJP|DE|33|0|True
3|INTJ|RE|3|INTJ|DE|33|0|True
3|LST|RE|3|LST|DE|33|0|True
3|PP|RE|3|PP|DE|33|0|True
3|PRT|RE|3|PRT|DE|33|0|True
4|NP|RE|4|NP|DE|33|0|True

4|VP|RE|4|VP|DE|33|0|True
4|ADJP|RE|4|ADJP|DE|33|0|True
4|ADVP|RE|4|VP|ADVP|33|0|True
4|CONJP|RE|4|CONJP|DE|33|0|True
4|INTJ|RE|4|INTJ|DE|33|0|True
4|LST|RE|4|LST|DE|33|0|True
4|PP|RE|4|PP|DE|33|0|True
4|PRT|RE|4|PRT|DE|33|0|True
5|NP|RE|5|NP|DE|33|0|True
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5|ADVP|RE|5|VP|ADVP|33|0|True
5|CONJP|RE|5|CONJP|DE|33|0|True
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5|LST|RE|5|LST|DE|33|0|True
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6|ADVP|RE|6|VP|ADVP|33|0|True
6|CONJP|RE|6|CONJP|DE|33|0|True
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6|LST|RE|6|LST|DE|33|0|True
6|PP|RE|6|PP|DE|33|0|True
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7|INTJ|RE|7|INTJ|DE|33|0|True
7|LST|RE|7|LST|DE|33|0|True
7|PP|RE|7|PP|DE|33|0|True
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1|NP|RE|1|NP|DE|33|0|True
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1|ADJP|RE|1|ADJP|DE|33|0|True
1|ADVP|RE|1|VP|ADVP|33|0|True
1|CONJP|RE|1|CONJP|DE|33|0|True
1|INTJ|RE|1|INTJ|DE|33|0|True

1|LST|RE|1|LST|DE|33|0|True
1|PP|RE|1|PP|DE|33|0|True
1|PRT|RE|1|PRT|DE|33|0|True
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2|VP|RE|2|VP|DE|33|0|True
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2|ADVP|RE|2|VP|ADVP|33|0|True
2|CONJP|RE|2|CONJP|DE|33|0|True
2|INTJ|RE|2|INTJ|DE|33|0|True
2|LST|RE|2|LST|DE|33|0|True
2|PP|RE|2|PP|DE|33|0|True
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3|ADJP|RE|3|ADJP|DE|33|0|True
3|ADVP|RE|3|VP|ADVP|33|0|True
3|CONJP|RE|3|CONJP|DE|33|0|True
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3|LST|RE|3|LST|DE|33|0|True
3|PP|RE|3|PP|DE|33|0|True
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4|ADJP|RE|4|ADJP|DE|33|0|True
4|ADVP|RE|4|VP|ADVP|33|0|True
4|CONJP|RE|4|CONJP|DE|33|0|True
4|INTJ|RE|4|INTJ|DE|33|0|True
4|LST|RE|4|LST|DE|33|0|True
4|PP|RE|4|PP|DE|33|0|True
4|PRT|RE|4|PRT|DE|33|0|True
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5|ADVP|RE|5|VP|ADVP|33|0|True
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5|LST|RE|5|LST|DE|33|0|True
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6|NP|RE|6|NP|DE|33|0|True
6|VP|RE|6|VP|DE|33|0|True
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6|ADVP|RE|6|VP|ADVP|33|0|True
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6|INTJ|RE|6|INTJ|DE|33|0|True
6|LST|RE|6|LST|DE|33|0|True

6|PP|RE|6|PP|DE|33|0|True
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7|VP|RE|7|VP|DE|33|0|True
7|ADJP|RE|7|ADJP|DE|33|0|True
7|ADVP|RE|7|VP|ADVP|33|0|True
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7|INTJ|RE|7|INTJ|DE|33|0|True
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7|NP|RE|7|VP|DE|33|0|True

1|NP|RE|1|NP|DE|33|25|True
1|VP|RE|1|VP|DE|33|25|True
1|VP|RE|1|NP|DE|33|25|True
1|NP|RE|1|VP|DE|33|25|True
2|NP|RE|2|NP|DE|33|25|True
2|VP|RE|2|VP|DE|33|25|True
2|VP|RE|2|NP|DE|33|25|True
2|NP|RE|2|VP|DE|33|25|True
3|NP|RE|3|NP|DE|33|25|True
3|VP|RE|3|VP|DE|33|25|True
3|VP|RE|3|NP|DE|33|25|True
3|NP|RE|3|VP|DE|33|25|True
4|NP|RE|4|NP|DE|33|25|True
4|VP|RE|4|VP|DE|33|25|True
4|VP|RE|4|NP|DE|33|25|True
4|NP|RE|4|VP|DE|33|25|True
5|NP|RE|5|NP|DE|33|25|True
5|VP|RE|5|VP|DE|33|25|True
5|VP|RE|5|NP|DE|33|25|True
5|NP|RE|5|VP|DE|33|25|True
6|NP|RE|6|NP|DE|33|25|True
6|VP|RE|6|VP|DE|33|25|True
6|VP|RE|6|NP|DE|33|25|True
6|NP|RE|6|VP|DE|33|25|True
7|NP|RE|7|NP|DE|33|25|True
7|VP|RE|7|VP|DE|33|25|True
7|VP|RE|7|NP|DE|33|25|True
7|NP|RE|7|VP|DE|33|25|True

1|NP|RE|1|NP|DE|33|0|True
1|VP|RE|1|VP|DE|33|0|True
1|VP|RE|1|NP|DE|33|0|True
1|NP|RE|1|VP|DE|33|0|True
2|NP|RE|2|NP|DE|33|0|True
2|VP|RE|2|VP|DE|33|0|True
2|VP|RE|2|NP|DE|33|0|True
2|NP|RE|2|VP|DE|33|0|True
3|NP|RE|3|NP|DE|33|0|True
3|VP|RE|3|VP|DE|33|0|True
3|VP|RE|3|NP|DE|33|0|True
3|NP|RE|3|VP|DE|33|0|True

4|NP|RE|4|NP|DE|33|0|True
4|VP|RE|4|VP|DE|33|0|True
4|VP|RE|4|NP|DE|33|0|True
4|NP|RE|4|VP|DE|33|0|True
5|NP|RE|5|NP|DE|33|0|True
5|VP|RE|5|VP|DE|33|0|True
5|VP|RE|5|NP|DE|33|0|True
5|NP|RE|5|VP|DE|33|0|True
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6|VP|RE|6|VP|DE|33|0|True
6|VP|RE|6|NP|DE|33|0|True
6|NP|RE|6|VP|DE|33|0|True
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7|VP|RE|7|NP|DE|33|0|True
7|NP|RE|7|VP|DE|33|0|True
1|ADJP|RE|1|ADJP|DE|33|0|True
1|ADVP|RE|1|ADVP|DE|33|0|True
1|ADVP|RE|1|ADJP|DE|33|0|True
1|ADJP|RE|1|ADVP|DE|33|0|True
2|ADJP|RE|2|ADJP|DE|33|0|True
2|ADVP|RE|2|ADVP|DE|33|0|True
2|ADVP|RE|2|ADJP|DE|33|0|True
2|ADJP|RE|2|ADVP|DE|33|0|True
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7|ADJP|RE|7|ADJP|DE|33|0|True
7|ADVP|RE|7|ADVP|DE|33|0|True
7|ADVP|RE|7|ADJP|DE|33|0|True
7|ADJP|RE|7|ADVP|DE|33|0|True

1|NP|RE|1|NP|DE|33|25|True

1|VP|RE|1|VP|DE|33|25|True
1|VP|RE|1|NP|DE|33|25|True
1|NP|RE|1|VP|DE|33|25|True
2|NP|RE|2|NP|DE|33|25|True
2|VP|RE|2|VP|DE|33|25|True
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3|VP|RE|3|NP|DE|33|25|True
3|NP|RE|3|VP|DE|33|25|True
4|NP|RE|4|NP|DE|33|25|True
4|VP|RE|4|VP|DE|33|25|True
4|VP|RE|4|NP|DE|33|25|True
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5|NP|RE|5|NP|DE|33|25|True
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1|ADJP|RE|1|ADJP|DE|33|25|True
1|ADVP|RE|1|ADVP|DE|33|25|True
1|ADVP|RE|1|ADJP|DE|33|25|True
1|ADJP|RE|1|ADVP|DE|33|25|True
2|ADJP|RE|2|ADJP|DE|33|25|True
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2|ADVP|RE|2|ADJP|DE|33|25|True
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3|ADVP|RE|3|ADVP|DE|33|25|True
3|ADVP|RE|3|ADJP|DE|33|25|True
3|ADJP|RE|3|ADVP|DE|33|25|True
4|ADJP|RE|4|ADJP|DE|33|25|True
4|ADVP|RE|4|ADVP|DE|33|25|True
4|ADVP|RE|4|ADJP|DE|33|25|True
4|ADJP|RE|4|ADVP|DE|33|25|True
5|ADJP|RE|5|ADJP|DE|33|25|True
5|ADVP|RE|5|ADVP|DE|33|25|True
5|ADVP|RE|5|ADJP|DE|33|25|True

5|ADJP|RE|5|ADVP|DE|33|25|True
6|ADJP|RE|6|ADJP|DE|33|25|True
6|ADVP|RE|6|ADVP|DE|33|25|True
6|ADVP|RE|6|ADJP|DE|33|25|True
6|ADJP|RE|6|ADVP|DE|33|25|True
7|ADJP|RE|7|ADJP|DE|33|25|True
7|ADVP|RE|7|ADVP|DE|33|25|True
7|ADVP|RE|7|ADJP|DE|33|25|True
7|ADJP|RE|7|ADVP|DE|33|25|True

0|NP|RE|0|NP|DE|33|0|True
0|VP|RE|0|VP|DE|33|0|True
0|VP|RE|0|NP|DE|33|0|True
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0|NP|RE|0|NP|DE|33|25|True
0|VP|RE|0|VP|DE|33|25|True
0|VP|RE|0|NP|DE|33|25|True
0|NP|RE|0|VP|DE|33|25|True

0|NP|RE|0|NP|DE|33|0|True
0|VP|RE|0|VP|DE|33|0|True
0|VP|RE|0|NP|DE|33|0|True
0|NP|RE|0|VP|DE|33|0|True
0|ADJP|RE|0|ADJP|DE|33|0|True
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0|ADVP|RE|0|VP|DE|33|0|True
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0|ADVP|RE|0|ADVP|DE|33|0|True
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0|ADJP|RE|0|ADJP|DE|33|0|True
0|ADVP|RE|0|ADVP|DE|33|0|True
0|ADVP|RE|0|ADJP|DE|33|0|True
0|ADJP|RE|0|ADVP|DE|33|0|True

0|NP|RE|0|NP|DE|33|25|True

0|VP|RE|0|VP|DE|33|25|True
0|VP|RE|0|NP|DE|33|25|True
0|NP|RE|0|VP|DE|33|25|True
0|ADJP|RE|0|ADJP|DE|33|25|True
0|VP|RE|0|VP|DE|33|25|True
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0|ADJP|RE|0|VP|DE|33|25|True
0|NP|RE|0|NP|DE|33|25|True
0|ADJP|RE|0|ADJP|DE|33|25|True
0|ADJP|RE|0|NP|DE|33|25|True
0|NP|RE|0|ADJP|DE|33|25|True
0|ADVP|RE|0|ADVP|DE|33|25|True
0|VP|RE|0|VP|DE|33|25|True
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0|ADJP|RE|0|ADJP|DE|33|25|True
0|ADVP|RE|0|ADVP|DE|33|25|True
0|ADVP|RE|0|ADJP|DE|33|25|True
0|ADJP|RE|0|ADVP|DE|33|25|True

1|NP|RE|1|NP|DE|33|-2|True
1|VP|RE|1|VP|DE|33|-2|True
1|ADJP|RE|1|ADJP|DE|33|0|True
1|ADVP|RE|1|VP|ADVP|33|0|True
1|CONJP|RE|1|CONJP|DE|33|0|True
1|INTJ|RE|1|INTJ|DE|33|0|True
1|LST|RE|1|LST|DE|33|0|True
1|PP|RE|1|PP|DE|33|0|True
1|PRT|RE|1|PRT|DE|33|0|True
2|NP|RE|2|NP|DE|33|-2|True
2|VP|RE|2|VP|DE|33|-2|True
2|ADJP|RE|2|ADJP|DE|33|0|True
2|ADVP|RE|2|VP|ADVP|33|0|True
2|CONJP|RE|2|CONJP|DE|33|0|True
2|INTJ|RE|2|INTJ|DE|33|0|True
2|LST|RE|2|LST|DE|33|0|True
2|PP|RE|2|PP|DE|33|0|True
2|PRT|RE|2|PRT|DE|33|0|True
3|NP|RE|3|NP|DE|33|-2|True
3|VP|RE|3|VP|DE|33|-2|True
3|ADJP|RE|3|ADJP|DE|33|0|True
3|ADVP|RE|3|VP|ADVP|33|0|True

3|CONJP|RE|3|CONJP|DE|33|0|True
3|INTJ|RE|3|INTJ|DE|33|0|True
3|LST|RE|3|LST|DE|33|0|True
3|PP|RE|3|PP|DE|33|0|True
3|PRT|RE|3|PRT|DE|33|0|True
4|NP|RE|4|NP|DE|33|-2|True
4|VP|RE|4|VP|DE|33|-2|True
4|ADJP|RE|4|ADJP|DE|33|0|True
4|ADVP|RE|4|VP|ADVP|33|0|True
4|CONJP|RE|4|CONJP|DE|33|0|True
4|INTJ|RE|4|INTJ|DE|33|0|True
4|LST|RE|4|LST|DE|33|0|True
4|PP|RE|4|PP|DE|33|0|True
4|PRT|RE|4|PRT|DE|33|0|True
5|NP|RE|5|NP|DE|33|-2|True
5|VP|RE|5|VP|DE|33|-2|True
5|ADJP|RE|5|ADJP|DE|33|0|True
5|ADVP|RE|5|VP|ADVP|33|0|True
5|CONJP|RE|5|CONJP|DE|33|0|True
5|INTJ|RE|5|INTJ|DE|33|0|True
5|LST|RE|5|LST|DE|33|0|True
5|PP|RE|5|PP|DE|33|0|True
5|PRT|RE|5|PRT|DE|33|0|True
6|NP|RE|6|NP|DE|33|-2|True
6|VP|RE|6|VP|DE|33|-2|True
6|ADJP|RE|6|ADJP|DE|33|0|True
6|ADVP|RE|6|VP|ADVP|33|0|True
6|CONJP|RE|6|CONJP|DE|33|0|True
6|INTJ|RE|6|INTJ|DE|33|0|True
6|LST|RE|6|LST|DE|33|0|True
6|PP|RE|6|PP|DE|33|0|True
6|PRT|RE|6|PRT|DE|33|0|True
7|NP|RE|7|NP|DE|33|-2|True
7|VP|RE|7|VP|DE|33|-2|True
7|ADJP|RE|7|ADJP|DE|33|0|True
7|ADVP|RE|7|VP|ADVP|33|0|True
7|CONJP|RE|7|CONJP|DE|33|0|True
7|INTJ|RE|7|INTJ|DE|33|0|True
7|LST|RE|7|LST|DE|33|0|True
7|PP|RE|7|PP|DE|33|0|True
7|PRT|RE|7|PRT|DE|33|0|True

1|NP|RE|1|NP|DE|33|-2|True
1|VP|RE|1|VP|DE|33|-2|True
1|ADJP|RE|1|ADJP|DE|33|-2|True
1|ADVP|RE|1|VP|ADVP|33|-2|True

1|CONJP|RE|1|CONJP|DE|33|0|True
1|INTJ|RE|1|INTJ|DE|33|0|True
1|LST|RE|1|LST|DE|33|0|True
1|PP|RE|1|PP|DE|33|0|True
1|PRT|RE|1|PRT|DE|33|0|True
2|NP|RE|2|NP|DE|33|-2|True
2|VP|RE|2|VP|DE|33|-2|True
2|ADJP|RE|2|ADJP|DE|33|-2|True
2|ADVP|RE|2|VP|ADVP|33|-2|True
2|CONJP|RE|2|CONJP|DE|33|0|True
2|INTJ|RE|2|INTJ|DE|33|0|True
2|LST|RE|2|LST|DE|33|0|True
2|PP|RE|2|PP|DE|33|0|True
2|PRT|RE|2|PRT|DE|33|0|True
3|NP|RE|3|NP|DE|33|-2|True
3|VP|RE|3|VP|DE|33|-2|True
3|ADJP|RE|3|ADJP|DE|33|-2|True
3|ADVP|RE|3|VP|ADVP|33|-2|True
3|CONJP|RE|3|CONJP|DE|33|0|True
3|INTJ|RE|3|INTJ|DE|33|0|True
3|LST|RE|3|LST|DE|33|0|True
3|PP|RE|3|PP|DE|33|0|True
3|PRT|RE|3|PRT|DE|33|0|True
4|NP|RE|4|NP|DE|33|-2|True
4|VP|RE|4|VP|DE|33|-2|True
4|ADJP|RE|4|ADJP|DE|33|-2|True
4|ADVP|RE|4|VP|ADVP|33|-2|True
4|CONJP|RE|4|CONJP|DE|33|0|True
4|INTJ|RE|4|INTJ|DE|33|0|True
4|LST|RE|4|LST|DE|33|0|True
4|PP|RE|4|PP|DE|33|0|True
4|PRT|RE|4|PRT|DE|33|0|True
5|NP|RE|5|NP|DE|33|-2|True
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5|ADJP|RE|5|ADJP|DE|33|-2|True
5|ADVP|RE|5|VP|ADVP|33|-2|True
5|CONJP|RE|5|CONJP|DE|33|0|True
5|INTJ|RE|5|INTJ|DE|33|0|True
5|LST|RE|5|LST|DE|33|0|True
5|PP|RE|5|PP|DE|33|0|True
5|PRT|RE|5|PRT|DE|33|0|True
6|NP|RE|6|NP|DE|33|-2|True
6|VP|RE|6|VP|DE|33|-2|True
6|ADJP|RE|6|ADJP|DE|33|-2|True
6|ADVP|RE|6|VP|ADVP|33|-2|True
6|CONJP|RE|6|CONJP|DE|33|0|True

6|INTJ|RE|6|INTJ|DE|33|0|True
6|LST|RE|6|LST|DE|33|0|True
6|PP|RE|6|PP|DE|33|0|True
6|PRT|RE|6|PRT|DE|33|0|True
7|NP|RE|7|NP|DE|33|-2|True
7|VP|RE|7|VP|DE|33|-2|True
7|ADJP|RE|7|ADJP|DE|33|-2|True
7|ADVP|RE|7|VP|ADVP|33|-2|True
7|CONJP|RE|7|CONJP|DE|33|0|True
7|INTJ|RE|7|INTJ|DE|33|0|True
7|LST|RE|7|LST|DE|33|0|True
7|PP|RE|7|PP|DE|33|0|True
7|PRT|RE|7|PRT|DE|33|0|True

0|NP|RE|0|NP|DE|33|0|True
0|VP|RE|0|VP|DE|33|0|True
0|ADJP|RE|0|ADJP|DE|33|0|True
0|ADVP|RE|0|VP|ADVP|33|0|True
0|CONJP|RE|0|CONJP|DE|33|0|True
0|INTJ|RE|0|INTJ|DE|33|0|True
0|LST|RE|0|LST|DE|33|0|True
0|PP|RE|0|PP|DE|33|0|True
0|PRT|RE|0|PRT|DE|33|0|True

0|NP|RE|0|NP|DE|33|25|True
0|VP|RE|0|VP|DE|33|25|True
0|ADJP|RE|0|ADJP|DE|33|25|True
0|ADVP|RE|0|VP|ADVP|33|25|True
0|CONJP|RE|0|CONJP|DE|33|25|True
0|INTJ|RE|0|INTJ|DE|33|25|True
0|LST|RE|0|LST|DE|33|25|True
0|PP|RE|0|PP|DE|33|25|True
0|PRT|RE|0|PRT|DE|33|25|True

1|NP|RE|1|NP|DE|33|0|True
1|VP|RE|1|VP|DE|33|0|True
1|ADJP|RE|1|ADJP|DE|33|0|True
1|ADVP|RE|1|VP|ADVP|33|0|True
1|CONJP|RE|1|CONJP|DE|33|0|True
1|INTJ|RE|1|INTJ|DE|33|0|True
1|LST|RE|1|LST|DE|33|0|True
1|PP|RE|1|PP|DE|33|0|True
1|PRT|RE|1|PRT|DE|33|0|True
2|NP|RE|2|NP|DE|33|0|True
2|VP|RE|2|VP|DE|33|0|True
2|ADJP|RE|2|ADJP|DE|33|0|True

2|ADVP|RE|2|VP|ADVP|33|0|True
2|CONJP|RE|2|CONJP|DE|33|0|True
2|INTJ|RE|2|INTJ|DE|33|0|True
2|LST|RE|2|LST|DE|33|0|True
2|PP|RE|2|PP|DE|33|0|True
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3|ADJP|RE|3|ADJP|DE|33|0|True
3|ADVP|RE|3|VP|ADVP|33|0|True
3|CONJP|RE|3|CONJP|DE|33|0|True
3|INTJ|RE|3|INTJ|DE|33|0|True
3|LST|RE|3|LST|DE|33|0|True
3|PP|RE|3|PP|DE|33|0|True
3|PRT|RE|3|PRT|DE|33|0|True
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4|ADJP|RE|4|ADJP|DE|33|0|True
4|ADVP|RE|4|VP|ADVP|33|0|True
4|CONJP|RE|4|CONJP|DE|33|0|True
4|INTJ|RE|4|INTJ|DE|33|0|True
4|LST|RE|4|LST|DE|33|0|True
4|PP|RE|4|PP|DE|33|0|True
4|PRT|RE|4|PRT|DE|33|0|True
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5|ADJP|RE|5|ADJP|DE|33|0|True
5|ADVP|RE|5|VP|ADVP|33|0|True
5|CONJP|RE|5|CONJP|DE|33|0|True
5|INTJ|RE|5|INTJ|DE|33|0|True
5|LST|RE|5|LST|DE|33|0|True
5|PP|RE|5|PP|DE|33|0|True
5|PRT|RE|5|PRT|DE|33|0|True
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6|ADJP|RE|6|ADJP|DE|33|0|True
6|ADVP|RE|6|VP|ADVP|33|0|True
6|CONJP|RE|6|CONJP|DE|33|0|True
6|INTJ|RE|6|INTJ|DE|33|0|True
6|LST|RE|6|LST|DE|33|0|True
6|PP|RE|6|PP|DE|33|0|True
6|PRT|RE|6|PRT|DE|33|0|True
7|NP|RE|7|NP|DE|33|0|True
7|VP|RE|7|VP|DE|33|0|True
7|ADJP|RE|7|ADJP|DE|33|0|True
7|ADVP|RE|7|VP|ADVP|33|0|True

7|CONJP|RE|7|CONJP|DE|33|0|True
7|INTJ|RE|7|INTJ|DE|33|0|True
7|LST|RE|7|LST|DE|33|0|True
7|PP|RE|7|PP|DE|33|0|True
7|PRT|RE|7|PRT|DE|33|0|True

1|NP|RE|1|NP|DE|33|25|True
1|VP|RE|1|VP|DE|33|25|True
1|ADJP|RE|1|ADJP|DE|33|25|True
1|ADVP|RE|1|VP|ADVP|33|25|True
1|CONJP|RE|1|CONJP|DE|33|25|True
1|INTJ|RE|1|INTJ|DE|33|25|True
1|LST|RE|1|LST|DE|33|25|True
1|PP|RE|1|PP|DE|33|25|True
1|PRT|RE|1|PRT|DE|33|25|True
2|NP|RE|2|NP|DE|33|25|True
2|VP|RE|2|VP|DE|33|25|True
2|ADJP|RE|2|ADJP|DE|33|25|True
2|ADVP|RE|2|VP|ADVP|33|25|True
2|CONJP|RE|2|CONJP|DE|33|25|True
2|INTJ|RE|2|INTJ|DE|33|25|True
2|LST|RE|2|LST|DE|33|25|True
2|PP|RE|2|PP|DE|33|25|True
2|PRT|RE|2|PRT|DE|33|25|True
3|NP|RE|3|NP|DE|33|25|True
3|VP|RE|3|VP|DE|33|25|True
3|ADJP|RE|3|ADJP|DE|33|25|True
3|ADVP|RE|3|VP|ADVP|33|25|True
3|CONJP|RE|3|CONJP|DE|33|25|True
3|INTJ|RE|3|INTJ|DE|33|25|True
3|LST|RE|3|LST|DE|33|25|True
3|PP|RE|3|PP|DE|33|25|True
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4|NP|RE|4|NP|DE|33|25|True
4|VP|RE|4|VP|DE|33|25|True
4|ADJP|RE|4|ADJP|DE|33|25|True
4|ADVP|RE|4|VP|ADVP|33|25|True
4|CONJP|RE|4|CONJP|DE|33|25|True
4|INTJ|RE|4|INTJ|DE|33|25|True
4|LST|RE|4|LST|DE|33|25|True
4|PP|RE|4|PP|DE|33|25|True
4|PRT|RE|4|PRT|DE|33|25|True
5|NP|RE|5|NP|DE|33|25|True
5|VP|RE|5|VP|DE|33|25|True
5|ADJP|RE|5|ADJP|DE|33|25|True
5|ADVP|RE|5|VP|ADVP|33|25|True

5|CONJP|RE|5|CONJP|DE|33|25|True
5|INTJ|RE|5|INTJ|DE|33|25|True
5|LST|RE|5|LST|DE|33|25|True
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5|PRT|RE|5|PRT|DE|33|25|True
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6|VP|RE|6|VP|DE|33|25|True
6|ADJP|RE|6|ADJP|DE|33|25|True
6|ADVP|RE|6|VP|ADVP|33|25|True
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6|INTJ|RE|6|INTJ|DE|33|25|True
6|LST|RE|6|LST|DE|33|25|True
6|PP|RE|6|PP|DE|33|25|True
6|PRT|RE|6|PRT|DE|33|25|True
7|NP|RE|7|NP|DE|33|25|True
7|VP|RE|7|VP|DE|33|25|True
7|ADJP|RE|7|ADJP|DE|33|25|True
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7|INTJ|RE|7|INTJ|DE|33|25|True
7|LST|RE|7|LST|DE|33|25|True
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1|ADVP|RE|1|VP|ADVP|33|25|True
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2|ADVP|RE|2|VP|ADVP|33|25|True
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2|INTJ|RE|2|INTJ|DE|33|25|True
2|LST|RE|2|LST|DE|33|25|True
2|PP|RE|2|PP|DE|33|25|True
2|PRT|RE|2|PRT|DE|33|25|True
3|NP|RE|3|NP|DE|33|25|True
3|VP|RE|3|VP|DE|33|25|True

3|ADJP|RE|3|ADJP|DE|33|25|True
3|ADVP|RE|3|VP|ADVP|33|25|True
3|CONJP|RE|3|CONJP|DE|33|25|True
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3|LST|RE|3|LST|DE|33|25|True
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4|ADVP|RE|4|VP|ADVP|33|25|True
4|CONJP|RE|4|CONJP|DE|33|25|True
4|INTJ|RE|4|INTJ|DE|33|25|True
4|LST|RE|4|LST|DE|33|25|True
4|PP|RE|4|PP|DE|33|25|True
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5|ADVP|RE|5|VP|ADVP|33|25|True
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6|ADVP|RE|6|VP|ADVP|33|25|True
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7|INTJ|RE|7|INTJ|DE|33|25|True
7|LST|RE|7|LST|DE|33|25|True
7|PP|RE|7|PP|DE|33|25|True
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0|INTJ|RE|0|INTJ|DE|40|0|True
0|LST|RE|0|LST|DE|40|0|True
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2|ADVP|RE|2|VP|ADVP|40|25|True
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2|LST|RE|2|LST|DE|40|25|True
2|PP|RE|2|PP|DE|40|25|True
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3|INTJ|RE|3|INTJ|DE|40|25|True
3|LST|RE|3|LST|DE|40|25|True
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3|PRT|RE|3|PRT|DE|40|25|True
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4|ADVP|RE|4|VP|ADVP|40|25|True
4|CONJP|RE|4|CONJP|DE|40|25|True
4|INTJ|RE|4|INTJ|DE|40|25|True
4|LST|RE|4|LST|DE|40|25|True

4|PP|RE|4|PP|DE|40|25|True
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5|NP|RE|5|NP|DE|40|25|True
5|VP|RE|5|VP|DE|40|25|True
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6|INTJ|RE|6|INTJ|DE|40|25|True
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6|PP|RE|6|PP|DE|40|25|True
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7|ADVP|RE|7|VP|ADVP|40|25|True
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7|INTJ|RE|7|INTJ|DE|40|25|True
7|LST|RE|7|LST|DE|40|25|True
7|PP|RE|7|PP|DE|40|25|True
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1|ADVP|RE|1|VP|ADVP|40|0|True
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1|LST|RE|1|LST|DE|40|0|True
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2|ADVP|RE|2|VP|ADVP|40|0|True
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2|PP|RE|2|PP|DE|40|0|True
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3|ADVP|RE|3|VP|ADVP|40|0|True
3|CONJP|RE|3|CONJP|DE|40|0|True
3|INTJ|RE|3|INTJ|DE|40|0|True
3|LST|RE|3|LST|DE|40|0|True
3|PP|RE|3|PP|DE|40|0|True
3|PRT|RE|3|PRT|DE|40|0|True
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4|ADVP|RE|4|VP|ADVP|40|0|True
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4|LST|RE|4|LST|DE|40|0|True
4|PP|RE|4|PP|DE|40|0|True
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7|CONJP|RE|7|CONJP|DE|40|0|True
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1|ADVP|RE|1|VP|ADVP|40|0|True
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1|LST|RE|1|LST|DE|40|0|True
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2|ADVP|RE|2|VP|ADVP|40|0|True
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3|ADVP|RE|3|VP|ADVP|40|0|True
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1|VP|RE|1|NP|DE|40|25|True
1|NP|RE|1|VP|DE|40|25|True
2|NP|RE|2|NP|DE|40|25|True
2|VP|RE|2|VP|DE|40|25|True
2|VP|RE|2|NP|DE|40|25|True
2|NP|RE|2|VP|DE|40|25|True
3|NP|RE|3|NP|DE|40|25|True
3|VP|RE|3|VP|DE|40|25|True
3|VP|RE|3|NP|DE|40|25|True
3|NP|RE|3|VP|DE|40|25|True
4|NP|RE|4|NP|DE|40|25|True
4|VP|RE|4|VP|DE|40|25|True
4|VP|RE|4|NP|DE|40|25|True
4|NP|RE|4|VP|DE|40|25|True
5|NP|RE|5|NP|DE|40|25|True
5|VP|RE|5|VP|DE|40|25|True
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6|VP|RE|6|VP|DE|40|25|True
6|VP|RE|6|NP|DE|40|25|True
6|NP|RE|6|VP|DE|40|25|True
7|NP|RE|7|NP|DE|40|25|True
7|VP|RE|7|VP|DE|40|25|True
7|VP|RE|7|NP|DE|40|25|True
7|NP|RE|7|VP|DE|40|25|True
1|ADJP|RE|1|ADJP|DE|40|25|True
1|ADVP|RE|1|ADVP|DE|40|25|True
1|ADVP|RE|1|ADJP|DE|40|25|True
1|ADJP|RE|1|ADVP|DE|40|25|True
2|ADJP|RE|2|ADJP|DE|40|25|True

2|ADVP|RE|2|ADVP|DE|40|25|True
2|ADVP|RE|2|ADJP|DE|40|25|True
2|ADJP|RE|2|ADVP|DE|40|25|True
3|ADJP|RE|3|ADJP|DE|40|25|True
3|ADVP|RE|3|ADVP|DE|40|25|True
3|ADVP|RE|3|ADJP|DE|40|25|True
3|ADJP|RE|3|ADVP|DE|40|25|True
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4|ADVP|RE|4|ADVP|DE|40|25|True
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4|ADJP|RE|4|ADVP|DE|40|25|True
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5|ADVP|RE|5|ADVP|DE|40|25|True
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7|ADJP|RE|7|ADJP|DE|40|25|True
7|ADVP|RE|7|ADVP|DE|40|25|True
7|ADVP|RE|7|ADJP|DE|40|25|True
7|ADJP|RE|7|ADVP|DE|40|25|True

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0|VP|RE|0|VP|DE|40|0|True
0|VP|RE|0|NP|DE|40|0|True
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0|NP|RE|0|NP|DE|40|25|True
0|VP|RE|0|VP|DE|40|25|True
0|VP|RE|0|NP|DE|40|25|True
0|NP|RE|0|VP|DE|40|25|True

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0|VP|RE|0|VP|DE|40|0|True
0|VP|RE|0|NP|DE|40|0|True
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0|ADJP|RE|0|ADJP|DE|40|0|True
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0|NP|RE|0|NP|DE|40|0|True
0|ADJP|RE|0|ADJP|DE|40|0|True
0|ADJP|RE|0|NP|DE|40|0|True
0|NP|RE|0|ADJP|DE|40|0|True

0|ADVP|RE|0|ADVP|DE|40|0|True
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0|NP|RE|0|NP|DE|40|0|True
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0|ADVP|RE|0|ADVP|DE|40|0|True
0|ADVP|RE|0|ADJP|DE|40|0|True
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0|NP|RE|0|NP|DE|40|25|True
0|VP|RE|0|VP|DE|40|25|True
0|VP|RE|0|NP|DE|40|25|True
0|NP|RE|0|VP|DE|40|25|True
0|ADJP|RE|0|ADJP|DE|40|25|True
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0|ADJP|RE|0|ADJP|DE|40|25|True
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0|ADJP|RE|0|ADJP|DE|40|25|True
0|ADVP|RE|0|ADVP|DE|40|25|True
0|ADVP|RE|0|ADJP|DE|40|25|True
0|ADJP|RE|0|ADVP|DE|40|25|True

1|NP|RE|1|NP|DE|40|-2|True
1|VP|RE|1|VP|DE|40|-2|True
1|ADJP|RE|1|ADJP|DE|40|0|True
1|ADVP|RE|1|VP|ADVP|40|0|True
1|CONJP|RE|1|CONJP|DE|40|0|True
1|INTJ|RE|1|INTJ|DE|40|0|True
1|LST|RE|1|LST|DE|40|0|True
1|PP|RE|1|PP|DE|40|0|True

1|PRT|RE|1|PRT|DE|40|0|True
2|NP|RE|2|NP|DE|40|-2|True
2|VP|RE|2|VP|DE|40|-2|True
2|ADJP|RE|2|ADJP|DE|40|0|True
2|ADVP|RE|2|VP|ADVP|40|0|True
2|CONJP|RE|2|CONJP|DE|40|0|True
2|INTJ|RE|2|INTJ|DE|40|0|True
2|LST|RE|2|LST|DE|40|0|True
2|PP|RE|2|PP|DE|40|0|True
2|PRT|RE|2|PRT|DE|40|0|True
3|NP|RE|3|NP|DE|40|-2|True
3|VP|RE|3|VP|DE|40|-2|True
3|ADJP|RE|3|ADJP|DE|40|0|True
3|ADVP|RE|3|VP|ADVP|40|0|True
3|CONJP|RE|3|CONJP|DE|40|0|True
3|INTJ|RE|3|INTJ|DE|40|0|True
3|LST|RE|3|LST|DE|40|0|True
3|PP|RE|3|PP|DE|40|0|True
3|PRT|RE|3|PRT|DE|40|0|True
4|NP|RE|4|NP|DE|40|-2|True
4|VP|RE|4|VP|DE|40|-2|True
4|ADJP|RE|4|ADJP|DE|40|0|True
4|ADVP|RE|4|VP|ADVP|40|0|True
4|CONJP|RE|4|CONJP|DE|40|0|True
4|INTJ|RE|4|INTJ|DE|40|0|True
4|LST|RE|4|LST|DE|40|0|True
4|PP|RE|4|PP|DE|40|0|True
4|PRT|RE|4|PRT|DE|40|0|True
5|NP|RE|5|NP|DE|40|-2|True
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5|ADJP|RE|5|ADJP|DE|40|0|True
5|ADVP|RE|5|VP|ADVP|40|0|True
5|CONJP|RE|5|CONJP|DE|40|0|True
5|INTJ|RE|5|INTJ|DE|40|0|True
5|LST|RE|5|LST|DE|40|0|True
5|PP|RE|5|PP|DE|40|0|True
5|PRT|RE|5|PRT|DE|40|0|True
6|NP|RE|6|NP|DE|40|-2|True
6|VP|RE|6|VP|DE|40|-2|True
6|ADJP|RE|6|ADJP|DE|40|0|True
6|ADVP|RE|6|VP|ADVP|40|0|True
6|CONJP|RE|6|CONJP|DE|40|0|True
6|INTJ|RE|6|INTJ|DE|40|0|True
6|LST|RE|6|LST|DE|40|0|True
6|PP|RE|6|PP|DE|40|0|True
6|PRT|RE|6|PRT|DE|40|0|True

7|NP|RE|7|NP|DE|40|-2|True
7|VP|RE|7|VP|DE|40|-2|True
7|ADJP|RE|7|ADJP|DE|40|0|True
7|ADVP|RE|7|VP|ADVP|40|0|True
7|CONJP|RE|7|CONJP|DE|40|0|True
7|INTJ|RE|7|INTJ|DE|40|0|True
7|LST|RE|7|LST|DE|40|0|True
7|PP|RE|7|PP|DE|40|0|True
7|PRT|RE|7|PRT|DE|40|0|True

1|NP|RE|1|NP|DE|40|-2|True
1|VP|RE|1|VP|DE|40|-2|True
1|ADJP|RE|1|ADJP|DE|40|-2|True
1|ADVP|RE|1|VP|ADVP|40|-2|True
1|CONJP|RE|1|CONJP|DE|40|0|True
1|INTJ|RE|1|INTJ|DE|40|0|True
1|LST|RE|1|LST|DE|40|0|True
1|PP|RE|1|PP|DE|40|0|True
1|PRT|RE|1|PRT|DE|40|0|True
2|NP|RE|2|NP|DE|40|-2|True
2|VP|RE|2|VP|DE|40|-2|True
2|ADJP|RE|2|ADJP|DE|40|-2|True
2|ADVP|RE|2|VP|ADVP|40|-2|True
2|CONJP|RE|2|CONJP|DE|40|0|True
2|INTJ|RE|2|INTJ|DE|40|0|True
2|LST|RE|2|LST|DE|40|0|True
2|PP|RE|2|PP|DE|40|0|True
2|PRT|RE|2|PRT|DE|40|0|True
3|NP|RE|3|NP|DE|40|-2|True
3|VP|RE|3|VP|DE|40|-2|True
3|ADJP|RE|3|ADJP|DE|40|-2|True
3|ADVP|RE|3|VP|ADVP|40|-2|True
3|CONJP|RE|3|CONJP|DE|40|0|True
3|INTJ|RE|3|INTJ|DE|40|0|True
3|LST|RE|3|LST|DE|40|0|True
3|PP|RE|3|PP|DE|40|0|True
3|PRT|RE|3|PRT|DE|40|0|True
4|NP|RE|4|NP|DE|40|-2|True
4|VP|RE|4|VP|DE|40|-2|True
4|ADJP|RE|4|ADJP|DE|40|-2|True
4|ADVP|RE|4|VP|ADVP|40|-2|True
4|CONJP|RE|4|CONJP|DE|40|0|True
4|INTJ|RE|4|INTJ|DE|40|0|True
4|LST|RE|4|LST|DE|40|0|True
4|PP|RE|4|PP|DE|40|0|True
4|PRT|RE|4|PRT|DE|40|0|True

5|NP|RE|5|NP|DE|40|-2|True
5|VP|RE|5|VP|DE|40|-2|True
5|ADJP|RE|5|ADJP|DE|40|-2|True
5|ADVP|RE|5|VP|ADVP|40|-2|True
5|CONJP|RE|5|CONJP|DE|40|0|True
5|INTJ|RE|5|INTJ|DE|40|0|True
5|LST|RE|5|LST|DE|40|0|True
5|PP|RE|5|PP|DE|40|0|True
5|PRT|RE|5|PRT|DE|40|0|True
6|NP|RE|6|NP|DE|40|-2|True
6|VP|RE|6|VP|DE|40|-2|True
6|ADJP|RE|6|ADJP|DE|40|-2|True
6|ADVP|RE|6|VP|ADVP|40|-2|True
6|CONJP|RE|6|CONJP|DE|40|0|True
6|INTJ|RE|6|INTJ|DE|40|0|True
6|LST|RE|6|LST|DE|40|0|True
6|PP|RE|6|PP|DE|40|0|True
6|PRT|RE|6|PRT|DE|40|0|True
7|NP|RE|7|NP|DE|40|-2|True
7|VP|RE|7|VP|DE|40|-2|True
7|ADJP|RE|7|ADJP|DE|40|-2|True
7|ADVP|RE|7|VP|ADVP|40|-2|True
7|CONJP|RE|7|CONJP|DE|40|0|True
7|INTJ|RE|7|INTJ|DE|40|0|True
7|LST|RE|7|LST|DE|40|0|True
7|PP|RE|7|PP|DE|40|0|True
7|PRT|RE|7|PRT|DE|40|0|True

0|NP|RE|0|NP|DE|40|0|True
0|VP|RE|0|VP|DE|40|0|True
0|ADJP|RE|0|ADJP|DE|40|0|True
0|ADVP|RE|0|VP|ADVP|40|0|True
0|CONJP|RE|0|CONJP|DE|40|0|True
0|INTJ|RE|0|INTJ|DE|40|0|True
0|LST|RE|0|LST|DE|40|0|True
0|PP|RE|0|PP|DE|40|0|True
0|PRT|RE|0|PRT|DE|40|0|True

0|NP|RE|0|NP|DE|40|25|True
0|VP|RE|0|VP|DE|40|25|True
0|ADJP|RE|0|ADJP|DE|40|25|True
0|ADVP|RE|0|VP|ADVP|40|25|True
0|CONJP|RE|0|CONJP|DE|40|25|True
0|INTJ|RE|0|INTJ|DE|40|25|True
0|LST|RE|0|LST|DE|40|25|True
0|PP|RE|0|PP|DE|40|25|True

0|PRT|RE|0|PRT|DE|40|25|True

1|NP|RE|1|NP|DE|40|0|True
1|VP|RE|1|VP|DE|40|0|True
1|ADJP|RE|1|ADJP|DE|40|0|True
1|ADVP|RE|1|VP|ADVP|40|0|True
1|CONJP|RE|1|CONJP|DE|40|0|True
1|INTJ|RE|1|INTJ|DE|40|0|True
1|LST|RE|1|LST|DE|40|0|True
1|PP|RE|1|PP|DE|40|0|True
1|PRT|RE|1|PRT|DE|40|0|True
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2|ADJP|RE|2|ADJP|DE|40|0|True
2|ADVP|RE|2|VP|ADVP|40|0|True
2|CONJP|RE|2|CONJP|DE|40|0|True
2|INTJ|RE|2|INTJ|DE|40|0|True
2|LST|RE|2|LST|DE|40|0|True
2|PP|RE|2|PP|DE|40|0|True
2|PRT|RE|2|PRT|DE|40|0|True
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3|VP|RE|3|VP|DE|40|0|True
3|ADJP|RE|3|ADJP|DE|40|0|True
3|ADVP|RE|3|VP|ADVP|40|0|True
3|CONJP|RE|3|CONJP|DE|40|0|True
3|INTJ|RE|3|INTJ|DE|40|0|True
3|LST|RE|3|LST|DE|40|0|True
3|PP|RE|3|PP|DE|40|0|True
3|PRT|RE|3|PRT|DE|40|0|True
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4|ADJP|RE|4|ADJP|DE|40|0|True
4|ADVP|RE|4|VP|ADVP|40|0|True
4|CONJP|RE|4|CONJP|DE|40|0|True
4|INTJ|RE|4|INTJ|DE|40|0|True
4|LST|RE|4|LST|DE|40|0|True
4|PP|RE|4|PP|DE|40|0|True
4|PRT|RE|4|PRT|DE|40|0|True
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5|ADJP|RE|5|ADJP|DE|40|0|True
5|ADVP|RE|5|VP|ADVP|40|0|True
5|CONJP|RE|5|CONJP|DE|40|0|True
5|INTJ|RE|5|INTJ|DE|40|0|True
5|LST|RE|5|LST|DE|40|0|True
5|PP|RE|5|PP|DE|40|0|True

5|PRT|RE|5|PRT|DE|40|0|True
6|NP|RE|6|NP|DE|40|0|True
6|VP|RE|6|VP|DE|40|0|True
6|ADJP|RE|6|ADJP|DE|40|0|True
6|ADVP|RE|6|VP|ADVP|40|0|True
6|CONJP|RE|6|CONJP|DE|40|0|True
6|INTJ|RE|6|INTJ|DE|40|0|True
6|LST|RE|6|LST|DE|40|0|True
6|PP|RE|6|PP|DE|40|0|True
6|PRT|RE|6|PRT|DE|40|0|True
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7|ADVP|RE|7|VP|ADVP|40|0|True
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7|INTJ|RE|7|INTJ|DE|40|0|True
7|LST|RE|7|LST|DE|40|0|True
7|PP|RE|7|PP|DE|40|0|True
7|PRT|RE|7|PRT|DE|40|0|True

1|NP|RE|1|NP|DE|40|25|True
1|VP|RE|1|VP|DE|40|25|True
1|ADJP|RE|1|ADJP|DE|40|25|True
1|ADVP|RE|1|VP|ADVP|40|25|True
1|CONJP|RE|1|CONJP|DE|40|25|True
1|INTJ|RE|1|INTJ|DE|40|25|True
1|LST|RE|1|LST|DE|40|25|True
1|PP|RE|1|PP|DE|40|25|True
1|PRT|RE|1|PRT|DE|40|25|True
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2|ADJP|RE|2|ADJP|DE|40|25|True
2|ADVP|RE|2|VP|ADVP|40|25|True
2|CONJP|RE|2|CONJP|DE|40|25|True
2|INTJ|RE|2|INTJ|DE|40|25|True
2|LST|RE|2|LST|DE|40|25|True
2|PP|RE|2|PP|DE|40|25|True
2|PRT|RE|2|PRT|DE|40|25|True
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3|ADJP|RE|3|ADJP|DE|40|25|True
3|ADVP|RE|3|VP|ADVP|40|25|True
3|CONJP|RE|3|CONJP|DE|40|25|True
3|INTJ|RE|3|INTJ|DE|40|25|True
3|LST|RE|3|LST|DE|40|25|True
3|PP|RE|3|PP|DE|40|25|True

3|PRT|RE|3|PRT|DE|40|25|True
4|NP|RE|4|NP|DE|40|25|True
4|VP|RE|4|VP|DE|40|25|True
4|ADJP|RE|4|ADJP|DE|40|25|True
4|ADVP|RE|4|VP|ADVP|40|25|True
4|CONJP|RE|4|CONJP|DE|40|25|True
4|INTJ|RE|4|INTJ|DE|40|25|True
4|LST|RE|4|LST|DE|40|25|True
4|PP|RE|4|PP|DE|40|25|True
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5|NP|RE|5|NP|DE|40|25|True
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5|ADJP|RE|5|ADJP|DE|40|25|True
5|ADVP|RE|5|VP|ADVP|40|25|True
5|CONJP|RE|5|CONJP|DE|40|25|True
5|INTJ|RE|5|INTJ|DE|40|25|True
5|LST|RE|5|LST|DE|40|25|True
5|PP|RE|5|PP|DE|40|25|True
5|PRT|RE|5|PRT|DE|40|25|True
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6|VP|RE|6|VP|DE|40|25|True
6|ADJP|RE|6|ADJP|DE|40|25|True
6|ADVP|RE|6|VP|ADVP|40|25|True
6|CONJP|RE|6|CONJP|DE|40|25|True
6|INTJ|RE|6|INTJ|DE|40|25|True
6|LST|RE|6|LST|DE|40|25|True
6|PP|RE|6|PP|DE|40|25|True
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7|ADVP|RE|7|VP|ADVP|40|25|True
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7|INTJ|RE|7|INTJ|DE|40|25|True
7|LST|RE|7|LST|DE|40|25|True
7|PP|RE|7|PP|DE|40|25|True
7|PRT|RE|7|PRT|DE|40|25|True

0|NP|RE|0|NP|DE|40|25|True
0|VP|RE|0|VP|DE|40|25|True
1|NP|RE|1|NP|DE|40|25|True
1|VP|RE|1|VP|DE|40|25|True
1|ADJP|RE|1|ADJP|DE|40|25|True
1|ADVP|RE|1|VP|ADVP|40|25|True
1|CONJP|RE|1|CONJP|DE|40|25|True
1|INTJ|RE|1|INTJ|DE|40|25|True

1|LST|RE|1|LST|DE|40|25|True
1|PP|RE|1|PP|DE|40|25|True
1|PRT|RE|1|PRT|DE|40|25|True
2|NP|RE|2|NP|DE|40|25|True
2|VP|RE|2|VP|DE|40|25|True
2|ADJP|RE|2|ADJP|DE|40|25|True
2|ADVP|RE|2|VP|ADVP|40|25|True
2|CONJP|RE|2|CONJP|DE|40|25|True
2|INTJ|RE|2|INTJ|DE|40|25|True
2|LST|RE|2|LST|DE|40|25|True
2|PP|RE|2|PP|DE|40|25|True
2|PRT|RE|2|PRT|DE|40|25|True
3|NP|RE|3|NP|DE|40|25|True
3|VP|RE|3|VP|DE|40|25|True
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4|LST|RE|4|LST|DE|40|25|True
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0|ADVP|RE|0|ADVP|DE|50|0|True
0|ADVP|RE|0|ADJP|DE|50|0|True
0|ADJP|RE|0|ADVP|DE|50|0|True

0|NP|RE|0|NP|DE|50|25|True
0|VP|RE|0|VP|DE|50|25|True
0|VP|RE|0|NP|DE|50|25|True
0|NP|RE|0|VP|DE|50|25|True
0|ADJP|RE|0|ADJP|DE|50|25|True
0|VP|RE|0|VP|DE|50|25|True
0|VP|RE|0|ADJP|DE|50|25|True
0|ADJP|RE|0|VP|DE|50|25|True
0|NP|RE|0|NP|DE|50|25|True
0|ADJP|RE|0|ADJP|DE|50|25|True
0|ADJP|RE|0|NP|DE|50|25|True
0|NP|RE|0|ADJP|DE|50|25|True
0|ADVP|RE|0|ADVP|DE|50|25|True
0|VP|RE|0|VP|DE|50|25|True
0|VP|RE|0|ADVP|DE|50|25|True
0|ADVP|RE|0|VP|DE|50|25|True
0|NP|RE|0|NP|DE|50|25|True
0|ADVP|RE|0|ADVP|DE|50|25|True
0|ADVP|RE|0|NP|DE|50|25|True

0|NP|RE|0|ADVP|DE|50|25|True
0|ADJP|RE|0|ADJP|DE|50|25|True
0|ADVP|RE|0|ADVP|DE|50|25|True
0|ADVP|RE|0|ADJP|DE|50|25|True
0|ADJP|RE|0|ADVP|DE|50|25|True

1|NP|RE|1|NP|DE|50|-2|True
1|VP|RE|1|VP|DE|50|-2|True
1|ADJP|RE|1|ADJP|DE|50|0|True
1|ADVP|RE|1|VP|ADVP|50|0|True
1|CONJP|RE|1|CONJP|DE|50|0|True
1|INTJ|RE|1|INTJ|DE|50|0|True
1|LST|RE|1|LST|DE|50|0|True
1|PP|RE|1|PP|DE|50|0|True
1|PRT|RE|1|PRT|DE|50|0|True
2|NP|RE|2|NP|DE|50|-2|True
2|VP|RE|2|VP|DE|50|-2|True
2|ADJP|RE|2|ADJP|DE|50|0|True
2|ADVP|RE|2|VP|ADVP|50|0|True
2|CONJP|RE|2|CONJP|DE|50|0|True
2|INTJ|RE|2|INTJ|DE|50|0|True
2|LST|RE|2|LST|DE|50|0|True
2|PP|RE|2|PP|DE|50|0|True
2|PRT|RE|2|PRT|DE|50|0|True
3|NP|RE|3|NP|DE|50|-2|True
3|VP|RE|3|VP|DE|50|-2|True
3|ADJP|RE|3|ADJP|DE|50|0|True
3|ADVP|RE|3|VP|ADVP|50|0|True
3|CONJP|RE|3|CONJP|DE|50|0|True
3|INTJ|RE|3|INTJ|DE|50|0|True
3|LST|RE|3|LST|DE|50|0|True
3|PP|RE|3|PP|DE|50|0|True
3|PRT|RE|3|PRT|DE|50|0|True
4|NP|RE|4|NP|DE|50|-2|True
4|VP|RE|4|VP|DE|50|-2|True
4|ADJP|RE|4|ADJP|DE|50|0|True
4|ADVP|RE|4|VP|ADVP|50|0|True
4|CONJP|RE|4|CONJP|DE|50|0|True
4|INTJ|RE|4|INTJ|DE|50|0|True
4|LST|RE|4|LST|DE|50|0|True
4|PP|RE|4|PP|DE|50|0|True
4|PRT|RE|4|PRT|DE|50|0|True
5|NP|RE|5|NP|DE|50|-2|True
5|VP|RE|5|VP|DE|50|-2|True
5|ADJP|RE|5|ADJP|DE|50|0|True
5|ADVP|RE|5|VP|ADVP|50|0|True

5|CONJP|RE|5|CONJP|DE|50|0|True
5|INTJ|RE|5|INTJ|DE|50|0|True
5|LST|RE|5|LST|DE|50|0|True
5|PP|RE|5|PP|DE|50|0|True
5|PRT|RE|5|PRT|DE|50|0|True
6|NP|RE|6|NP|DE|50|-2|True
6|VP|RE|6|VP|DE|50|-2|True
6|ADJP|RE|6|ADJP|DE|50|0|True
6|ADVP|RE|6|VP|ADVP|50|0|True
6|CONJP|RE|6|CONJP|DE|50|0|True
6|INTJ|RE|6|INTJ|DE|50|0|True
6|LST|RE|6|LST|DE|50|0|True
6|PP|RE|6|PP|DE|50|0|True
6|PRT|RE|6|PRT|DE|50|0|True
7|NP|RE|7|NP|DE|50|-2|True
7|VP|RE|7|VP|DE|50|-2|True
7|ADJP|RE|7|ADJP|DE|50|0|True
7|ADVP|RE|7|VP|ADVP|50|0|True
7|CONJP|RE|7|CONJP|DE|50|0|True
7|INTJ|RE|7|INTJ|DE|50|0|True
7|LST|RE|7|LST|DE|50|0|True
7|PP|RE|7|PP|DE|50|0|True
7|PRT|RE|7|PRT|DE|50|0|True

1|NP|RE|1|NP|DE|50|-2|True
1|VP|RE|1|VP|DE|50|-2|True
1|ADJP|RE|1|ADJP|DE|50|-2|True
1|ADVP|RE|1|VP|ADVP|50|-2|True
1|CONJP|RE|1|CONJP|DE|50|0|True
1|INTJ|RE|1|INTJ|DE|50|0|True
1|LST|RE|1|LST|DE|50|0|True
1|PP|RE|1|PP|DE|50|0|True
1|PRT|RE|1|PRT|DE|50|0|True
2|NP|RE|2|NP|DE|50|-2|True
2|VP|RE|2|VP|DE|50|-2|True
2|ADJP|RE|2|ADJP|DE|50|-2|True
2|ADVP|RE|2|VP|ADVP|50|-2|True
2|CONJP|RE|2|CONJP|DE|50|0|True
2|INTJ|RE|2|INTJ|DE|50|0|True
2|LST|RE|2|LST|DE|50|0|True
2|PP|RE|2|PP|DE|50|0|True
2|PRT|RE|2|PRT|DE|50|0|True
3|NP|RE|3|NP|DE|50|-2|True
3|VP|RE|3|VP|DE|50|-2|True
3|ADJP|RE|3|ADJP|DE|50|-2|True
3|ADVP|RE|3|VP|ADVP|50|-2|True

3|CONJP|RE|3|CONJP|DE|50|0|True
3|INTJ|RE|3|INTJ|DE|50|0|True
3|LST|RE|3|LST|DE|50|0|True
3|PP|RE|3|PP|DE|50|0|True
3|PRT|RE|3|PRT|DE|50|0|True
4|NP|RE|4|NP|DE|50|-2|True
4|VP|RE|4|VP|DE|50|-2|True
4|ADJP|RE|4|ADJP|DE|50|-2|True
4|ADVP|RE|4|VP|ADVP|50|-2|True
4|CONJP|RE|4|CONJP|DE|50|0|True
4|INTJ|RE|4|INTJ|DE|50|0|True
4|LST|RE|4|LST|DE|50|0|True
4|PP|RE|4|PP|DE|50|0|True
4|PRT|RE|4|PRT|DE|50|0|True
5|NP|RE|5|NP|DE|50|-2|True
5|VP|RE|5|VP|DE|50|-2|True
5|ADJP|RE|5|ADJP|DE|50|-2|True
5|ADVP|RE|5|VP|ADVP|50|-2|True
5|CONJP|RE|5|CONJP|DE|50|0|True
5|INTJ|RE|5|INTJ|DE|50|0|True
5|LST|RE|5|LST|DE|50|0|True
5|PP|RE|5|PP|DE|50|0|True
5|PRT|RE|5|PRT|DE|50|0|True
6|NP|RE|6|NP|DE|50|-2|True
6|VP|RE|6|VP|DE|50|-2|True
6|ADJP|RE|6|ADJP|DE|50|-2|True
6|ADVP|RE|6|VP|ADVP|50|-2|True
6|CONJP|RE|6|CONJP|DE|50|0|True
6|INTJ|RE|6|INTJ|DE|50|0|True
6|LST|RE|6|LST|DE|50|0|True
6|PP|RE|6|PP|DE|50|0|True
6|PRT|RE|6|PRT|DE|50|0|True
7|NP|RE|7|NP|DE|50|-2|True
7|VP|RE|7|VP|DE|50|-2|True
7|ADJP|RE|7|ADJP|DE|50|-2|True
7|ADVP|RE|7|VP|ADVP|50|-2|True
7|CONJP|RE|7|CONJP|DE|50|0|True
7|INTJ|RE|7|INTJ|DE|50|0|True
7|LST|RE|7|LST|DE|50|0|True
7|PP|RE|7|PP|DE|50|0|True
7|PRT|RE|7|PRT|DE|50|0|True

0|NP|RE|0|NP|DE|50|0|True
0|VP|RE|0|VP|DE|50|0|True
0|ADJP|RE|0|ADJP|DE|50|0|True
0|ADVP|RE|0|VP|ADVP|50|0|True

0|CONJP|RE|0|CONJP|DE|50|0|True
0|INTJ|RE|0|INTJ|DE|50|0|True
0|LST|RE|0|LST|DE|50|0|True
0|PP|RE|0|PP|DE|50|0|True
0|PRT|RE|0|PRT|DE|50|0|True

0|NP|RE|0|NP|DE|50|25|True
0|VP|RE|0|VP|DE|50|25|True
0|ADJP|RE|0|ADJP|DE|50|25|True
0|ADVP|RE|0|VP|ADVP|50|25|True
0|CONJP|RE|0|CONJP|DE|50|25|True
0|INTJ|RE|0|INTJ|DE|50|25|True
0|LST|RE|0|LST|DE|50|25|True
0|PP|RE|0|PP|DE|50|25|True
0|PRT|RE|0|PRT|DE|50|25|True

1|NP|RE|1|NP|DE|50|0|True
1|VP|RE|1|VP|DE|50|0|True
1|ADJP|RE|1|ADJP|DE|50|0|True
1|ADVP|RE|1|VP|ADVP|50|0|True
1|CONJP|RE|1|CONJP|DE|50|0|True
1|INTJ|RE|1|INTJ|DE|50|0|True
1|LST|RE|1|LST|DE|50|0|True
1|PP|RE|1|PP|DE|50|0|True
1|PRT|RE|1|PRT|DE|50|0|True
2|NP|RE|2|NP|DE|50|0|True
2|VP|RE|2|VP|DE|50|0|True
2|ADJP|RE|2|ADJP|DE|50|0|True
2|ADVP|RE|2|VP|ADVP|50|0|True
2|CONJP|RE|2|CONJP|DE|50|0|True
2|INTJ|RE|2|INTJ|DE|50|0|True
2|LST|RE|2|LST|DE|50|0|True
2|PP|RE|2|PP|DE|50|0|True
2|PRT|RE|2|PRT|DE|50|0|True
3|NP|RE|3|NP|DE|50|0|True
3|VP|RE|3|VP|DE|50|0|True
3|ADJP|RE|3|ADJP|DE|50|0|True
3|ADVP|RE|3|VP|ADVP|50|0|True
3|CONJP|RE|3|CONJP|DE|50|0|True
3|INTJ|RE|3|INTJ|DE|50|0|True
3|LST|RE|3|LST|DE|50|0|True
3|PP|RE|3|PP|DE|50|0|True
3|PRT|RE|3|PRT|DE|50|0|True
4|NP|RE|4|NP|DE|50|0|True
4|VP|RE|4|VP|DE|50|0|True
4|ADJP|RE|4|ADJP|DE|50|0|True

4|ADVP|RE|4|VP|ADVP|50|0|True
4|CONJP|RE|4|CONJP|DE|50|0|True
4|INTJ|RE|4|INTJ|DE|50|0|True
4|LST|RE|4|LST|DE|50|0|True
4|PP|RE|4|PP|DE|50|0|True
4|PRT|RE|4|PRT|DE|50|0|True
5|NP|RE|5|NP|DE|50|0|True
5|VP|RE|5|VP|DE|50|0|True
5|ADJP|RE|5|ADJP|DE|50|0|True
5|ADVP|RE|5|VP|ADVP|50|0|True
5|CONJP|RE|5|CONJP|DE|50|0|True
5|INTJ|RE|5|INTJ|DE|50|0|True
5|LST|RE|5|LST|DE|50|0|True
5|PP|RE|5|PP|DE|50|0|True
5|PRT|RE|5|PRT|DE|50|0|True
6|NP|RE|6|NP|DE|50|0|True
6|VP|RE|6|VP|DE|50|0|True
6|ADJP|RE|6|ADJP|DE|50|0|True
6|ADVP|RE|6|VP|ADVP|50|0|True
6|CONJP|RE|6|CONJP|DE|50|0|True
6|INTJ|RE|6|INTJ|DE|50|0|True
6|LST|RE|6|LST|DE|50|0|True
6|PP|RE|6|PP|DE|50|0|True
6|PRT|RE|6|PRT|DE|50|0|True
7|NP|RE|7|NP|DE|50|0|True
7|VP|RE|7|VP|DE|50|0|True
7|ADJP|RE|7|ADJP|DE|50|0|True
7|ADVP|RE|7|VP|ADVP|50|0|True
7|CONJP|RE|7|CONJP|DE|50|0|True
7|INTJ|RE|7|INTJ|DE|50|0|True
7|LST|RE|7|LST|DE|50|0|True
7|PP|RE|7|PP|DE|50|0|True
7|PRT|RE|7|PRT|DE|50|0|True

1|NP|RE|1|NP|DE|50|25|True
1|VP|RE|1|VP|DE|50|25|True
1|ADJP|RE|1|ADJP|DE|50|25|True
1|ADVP|RE|1|VP|ADVP|50|25|True
1|CONJP|RE|1|CONJP|DE|50|25|True
1|INTJ|RE|1|INTJ|DE|50|25|True
1|LST|RE|1|LST|DE|50|25|True
1|PP|RE|1|PP|DE|50|25|True
1|PRT|RE|1|PRT|DE|50|25|True
2|NP|RE|2|NP|DE|50|25|True
2|VP|RE|2|VP|DE|50|25|True
2|ADJP|RE|2|ADJP|DE|50|25|True

2|ADVP|RE|2|VP|ADVP|50|25|True
2|CONJP|RE|2|CONJP|DE|50|25|True
2|INTJ|RE|2|INTJ|DE|50|25|True
2|LST|RE|2|LST|DE|50|25|True
2|PP|RE|2|PP|DE|50|25|True
2|PRT|RE|2|PRT|DE|50|25|True
3|NP|RE|3|NP|DE|50|25|True
3|VP|RE|3|VP|DE|50|25|True
3|ADJP|RE|3|ADJP|DE|50|25|True
3|ADVP|RE|3|VP|ADVP|50|25|True
3|CONJP|RE|3|CONJP|DE|50|25|True
3|INTJ|RE|3|INTJ|DE|50|25|True
3|LST|RE|3|LST|DE|50|25|True
3|PP|RE|3|PP|DE|50|25|True
3|PRT|RE|3|PRT|DE|50|25|True
4|NP|RE|4|NP|DE|50|25|True
4|VP|RE|4|VP|DE|50|25|True
4|ADJP|RE|4|ADJP|DE|50|25|True
4|ADVP|RE|4|VP|ADVP|50|25|True
4|CONJP|RE|4|CONJP|DE|50|25|True
4|INTJ|RE|4|INTJ|DE|50|25|True
4|LST|RE|4|LST|DE|50|25|True
4|PP|RE|4|PP|DE|50|25|True
4|PRT|RE|4|PRT|DE|50|25|True
5|NP|RE|5|NP|DE|50|25|True
5|VP|RE|5|VP|DE|50|25|True
5|ADJP|RE|5|ADJP|DE|50|25|True
5|ADVP|RE|5|VP|ADVP|50|25|True
5|CONJP|RE|5|CONJP|DE|50|25|True
5|INTJ|RE|5|INTJ|DE|50|25|True
5|LST|RE|5|LST|DE|50|25|True
5|PP|RE|5|PP|DE|50|25|True
5|PRT|RE|5|PRT|DE|50|25|True
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6|VP|RE|6|VP|DE|50|25|True
6|ADJP|RE|6|ADJP|DE|50|25|True
6|ADVP|RE|6|VP|ADVP|50|25|True
6|CONJP|RE|6|CONJP|DE|50|25|True
6|INTJ|RE|6|INTJ|DE|50|25|True
6|LST|RE|6|LST|DE|50|25|True
6|PP|RE|6|PP|DE|50|25|True
6|PRT|RE|6|PRT|DE|50|25|True
7|NP|RE|7|NP|DE|50|25|True
7|VP|RE|7|VP|DE|50|25|True
7|ADJP|RE|7|ADJP|DE|50|25|True
7|ADVP|RE|7|VP|ADVP|50|25|True

7|CONJP|RE|7|CONJP|DE|50|25|True
7|INTJ|RE|7|INTJ|DE|50|25|True
7|LST|RE|7|LST|DE|50|25|True
7|PP|RE|7|PP|DE|50|25|True
7|PRT|RE|7|PRT|DE|50|25|True

0|NP|RE|0|NP|DE|50|25|True
0|VP|RE|0|VP|DE|50|25|True
1|NP|RE|1|NP|DE|50|25|True
1|VP|RE|1|VP|DE|50|25|True
1|ADJP|RE|1|ADJP|DE|50|25|True
1|ADVP|RE|1|VP|ADVP|50|25|True
1|CONJP|RE|1|CONJP|DE|50|25|True
1|INTJ|RE|1|INTJ|DE|50|25|True
1|LST|RE|1|LST|DE|50|25|True
1|PP|RE|1|PP|DE|50|25|True
1|PRT|RE|1|PRT|DE|50|25|True
2|NP|RE|2|NP|DE|50|25|True
2|VP|RE|2|VP|DE|50|25|True
2|ADJP|RE|2|ADJP|DE|50|25|True
2|ADVP|RE|2|VP|ADVP|50|25|True
2|CONJP|RE|2|CONJP|DE|50|25|True
2|INTJ|RE|2|INTJ|DE|50|25|True
2|LST|RE|2|LST|DE|50|25|True
2|PP|RE|2|PP|DE|50|25|True
2|PRT|RE|2|PRT|DE|50|25|True
3|NP|RE|3|NP|DE|50|25|True
3|VP|RE|3|VP|DE|50|25|True
3|ADJP|RE|3|ADJP|DE|50|25|True
3|ADVP|RE|3|VP|ADVP|50|25|True
3|CONJP|RE|3|CONJP|DE|50|25|True
3|INTJ|RE|3|INTJ|DE|50|25|True
3|LST|RE|3|LST|DE|50|25|True
3|PP|RE|3|PP|DE|50|25|True
3|PRT|RE|3|PRT|DE|50|25|True
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4|VP|RE|4|VP|DE|50|25|True
4|ADJP|RE|4|ADJP|DE|50|25|True
4|ADVP|RE|4|VP|ADVP|50|25|True
4|CONJP|RE|4|CONJP|DE|50|25|True
4|INTJ|RE|4|INTJ|DE|50|25|True
4|LST|RE|4|LST|DE|50|25|True
4|PP|RE|4|PP|DE|50|25|True
4|PRT|RE|4|PRT|DE|50|25|True
5|NP|RE|5|NP|DE|50|25|True
5|VP|RE|5|VP|DE|50|25|True

5|ADJP|RE|5|ADJP|DE|50|25|True
5|ADVP|RE|5|VP|ADVP|50|25|True
5|CONJP|RE|5|CONJP|DE|50|25|True
5|INTJ|RE|5|INTJ|DE|50|25|True
5|LST|RE|5|LST|DE|50|25|True
5|PP|RE|5|PP|DE|50|25|True
5|PRT|RE|5|PRT|DE|50|25|True
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6|VP|RE|6|VP|DE|50|25|True
6|ADJP|RE|6|ADJP|DE|50|25|True
6|ADVP|RE|6|VP|ADVP|50|25|True
6|CONJP|RE|6|CONJP|DE|50|25|True
6|INTJ|RE|6|INTJ|DE|50|25|True
6|LST|RE|6|LST|DE|50|25|True
6|PP|RE|6|PP|DE|50|25|True
6|PRT|RE|6|PRT|DE|50|25|True
7|NP|RE|7|NP|DE|50|25|True
7|VP|RE|7|VP|DE|50|25|True
7|ADJP|RE|7|ADJP|DE|50|25|True
7|ADVP|RE|7|VP|ADVP|50|25|True
7|CONJP|RE|7|CONJP|DE|50|25|True
7|INTJ|RE|7|INTJ|DE|50|25|True
7|LST|RE|7|LST|DE|50|25|True
7|PP|RE|7|PP|DE|50|25|True
7|PRT|RE|7|PRT|DE|50|25|True

0|NP|RE|0|NP|DE|60|-2|True
0|VP|RE|0|VP|DE|60|-2|True
0|ADJP|RE|0|ADJP|DE|60|0|True
0|ADVP|RE|0|VP|ADVP|60|0|True
0|CONJP|RE|0|CONJP|DE|60|0|True
0|INTJ|RE|0|INTJ|DE|60|0|True
0|LST|RE|0|LST|DE|60|0|True
0|PP|RE|0|PP|DE|60|0|True
0|PRT|RE|0|PRT|DE|60|0|True

0|NP|RE|0|NP|DE|60|25|True
0|VP|RE|0|VP|DE|60|25|True
0|ADJP|RE|0|ADJP|DE|60|25|True
0|ADVP|RE|0|ADVP|DE|60|25|True
1|NP|RE|1|NP|DE|60|25|True
1|VP|RE|1|VP|DE|60|25|True
1|ADJP|RE|1|ADJP|DE|60|25|True
1|ADVP|RE|1|VP|ADVP|60|25|True
1|CONJP|RE|1|CONJP|DE|60|25|True
1|INTJ|RE|1|INTJ|DE|60|25|True

1|LST|RE|1|LST|DE|60|25|True
1|PP|RE|1|PP|DE|60|25|True
1|PRT|RE|1|PRT|DE|60|25|True
2|NP|RE|2|NP|DE|60|25|True
2|VP|RE|2|VP|DE|60|25|True
2|ADJP|RE|2|ADJP|DE|60|25|True
2|ADVP|RE|2|VP|ADVP|60|25|True
2|CONJP|RE|2|CONJP|DE|60|25|True
2|INTJ|RE|2|INTJ|DE|60|25|True
2|LST|RE|2|LST|DE|60|25|True
2|PP|RE|2|PP|DE|60|25|True
2|PRT|RE|2|PRT|DE|60|25|True
3|NP|RE|3|NP|DE|60|25|True
3|VP|RE|3|VP|DE|60|25|True
3|ADJP|RE|3|ADJP|DE|60|25|True
3|ADVP|RE|3|VP|ADVP|60|25|True
3|CONJP|RE|3|CONJP|DE|60|25|True
3|INTJ|RE|3|INTJ|DE|60|25|True
3|LST|RE|3|LST|DE|60|25|True
3|PP|RE|3|PP|DE|60|25|True
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4|VP|RE|4|VP|DE|60|25|True
4|ADJP|RE|4|ADJP|DE|60|25|True
4|ADVP|RE|4|VP|ADVP|60|25|True
4|CONJP|RE|4|CONJP|DE|60|25|True
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4|PP|RE|4|PP|DE|60|25|True
4|PRT|RE|4|PRT|DE|60|25|True
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5|ADVP|RE|5|VP|ADVP|60|25|True
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5|LST|RE|5|LST|DE|60|25|True
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6|ADVP|RE|6|VP|ADVP|60|25|True
6|CONJP|RE|6|CONJP|DE|60|25|True
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6|LST|RE|6|LST|DE|60|25|True

6|PP|RE|6|PP|DE|60|25|True
6|PRT|RE|6|PRT|DE|60|25|True
7|NP|RE|7|NP|DE|60|25|True
7|VP|RE|7|VP|DE|60|25|True
7|ADJP|RE|7|ADJP|DE|60|25|True
7|ADVP|RE|7|VP|ADVP|60|25|True
7|CONJP|RE|7|CONJP|DE|60|25|True
7|INTJ|RE|7|INTJ|DE|60|25|True
7|LST|RE|7|LST|DE|60|25|True
7|PP|RE|7|PP|DE|60|25|True
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1|ADVP|RE|1|VP|ADVP|60|0|True
1|CONJP|RE|1|CONJP|DE|60|0|True
1|INTJ|RE|1|INTJ|DE|60|0|True
1|LST|RE|1|LST|DE|60|0|True
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1|PRT|RE|1|PRT|DE|60|0|True
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4|VP|RE|4|VP|DE|60|0|True
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4|ADVP|RE|4|VP|ADVP|60|0|True
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4|INTJ|RE|4|INTJ|DE|60|0|True
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5|ADVP|RE|5|VP|ADVP|60|0|True
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2|ADVP|RE|2|VP|ADVP|60|0|True
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6|ADVP|RE|6|VP|ADVP|60|0|True
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7|NP|RE|7|NP|DE|60|0|True
7|VP|RE|7|VP|DE|60|0|True

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7|INTJ|RE|7|INTJ|DE|60|0|True
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0|PP|RE|0|PP|DE|60|0|True
0|PRT|RE|0|PRT|DE|60|0|True

0|NP|RE|0|NP|DE|60|0|True
0|VP|RE|0|VP|DE|60|0|True
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1|NP|RE|1|NP|DE|60|0|True
1|VP|RE|1|VP|DE|60|0|True
1|VP|RE|1|NP|DE|60|0|True
1|NP|RE|1|VP|DE|60|0|True
2|NP|RE|2|NP|DE|60|0|True
2|VP|RE|2|VP|DE|60|0|True
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3|VP|RE|3|NP|DE|60|0|True
3|NP|RE|3|VP|DE|60|0|True
4|NP|RE|4|NP|DE|60|0|True
4|VP|RE|4|VP|DE|60|0|True
4|VP|RE|4|NP|DE|60|0|True

4|NP|RE|4|VP|DE|60|0|True
5|NP|RE|5|NP|DE|60|0|True
5|VP|RE|5|VP|DE|60|0|True
5|VP|RE|5|NP|DE|60|0|True
5|NP|RE|5|VP|DE|60|0|True
6|NP|RE|6|NP|DE|60|0|True
6|VP|RE|6|VP|DE|60|0|True
6|VP|RE|6|NP|DE|60|0|True
6|NP|RE|6|VP|DE|60|0|True
7|NP|RE|7|NP|DE|60|0|True
7|VP|RE|7|VP|DE|60|0|True
7|VP|RE|7|NP|DE|60|0|True
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1|ADJP|RE|1|VP|DE|60|0|True
2|ADJP|RE|2|ADJP|DE|60|0|True
2|VP|RE|2|VP|DE|60|0|True
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3|ADJP|RE|3|ADJP|DE|60|0|True
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3|ADJP|RE|3|VP|DE|60|0|True
4|ADJP|RE|4|ADJP|DE|60|0|True
4|VP|RE|4|VP|DE|60|0|True
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4|ADJP|RE|4|VP|DE|60|0|True
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7|VP|RE|7|VP|DE|60|0|True
7|VP|RE|7|ADJP|DE|60|0|True
7|ADJP|RE|7|VP|DE|60|0|True
0|ADJP|RE|0|ADJP|DE|60|0|True

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0|ADJP|RE|0|ADVP|DE|60|0|True
1|ADJP|RE|1|ADJP|DE|60|0|True
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7|ADJP|RE|7|ADJP|DE|60|0|True
7|ADVP|RE|7|ADVP|DE|60|0|True
7|ADVP|RE|7|ADJP|DE|60|0|True
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1|NP|RE|1|NP|DE|60|0|True
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1|NP|RE|1|ADVP|DE|60|0|True
2|NP|RE|2|NP|DE|60|0|True
2|ADVP|RE|2|ADVP|DE|60|0|True
2|ADVP|RE|2|NP|DE|60|0|True
2|NP|RE|2|ADVP|DE|60|0|True
3|NP|RE|3|NP|DE|60|0|True
3|ADVP|RE|3|ADVP|DE|60|0|True
3|ADVP|RE|3|NP|DE|60|0|True

3|NP|RE|3|ADVP|DE|60|0|True
4|NP|RE|4|NP|DE|60|0|True
4|ADVP|RE|4|ADVP|DE|60|0|True
4|ADVP|RE|4|NP|DE|60|0|True
4|NP|RE|4|ADVP|DE|60|0|True
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6|NP|RE|6|NP|DE|60|0|True
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6|NP|RE|6|ADVP|DE|60|0|True
7|NP|RE|7|NP|DE|60|0|True
7|ADVP|RE|7|ADVP|DE|60|0|True
7|ADVP|RE|7|NP|DE|60|0|True
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1|VP|RE|1|NP|DE|60|0|True
1|NP|RE|1|VP|DE|60|0|True
2|NP|RE|2|NP|DE|60|0|True
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7|NP|RE|7|NP|DE|60|0|True
7|VP|RE|7|VP|DE|60|0|True
7|VP|RE|7|NP|DE|60|0|True
7|NP|RE|7|VP|DE|60|0|True

1|NP|RE|1|NP|DE|60|25|True
1|VP|RE|1|VP|DE|60|25|True
1|VP|RE|1|NP|DE|60|25|True
1|NP|RE|1|VP|DE|60|25|True
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7|NP|RE|7|NP|DE|60|25|True
7|VP|RE|7|VP|DE|60|25|True
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1|NP|RE|1|VP|DE|60|0|True
2|NP|RE|2|NP|DE|60|0|True
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4|VP|RE|4|VP|DE|60|0|True
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4|NP|RE|4|VP|DE|60|0|True

5|NP|RE|5|NP|DE|60|0|True
5|VP|RE|5|VP|DE|60|0|True
5|VP|RE|5|NP|DE|60|0|True
5|NP|RE|5|VP|DE|60|0|True
6|NP|RE|6|NP|DE|60|0|True
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7|ADVP|RE|7|ADJP|DE|60|0|True
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1|NP|RE|1|NP|DE|60|25|True
1|VP|RE|1|VP|DE|60|25|True
1|VP|RE|1|NP|DE|60|25|True
1|NP|RE|1|VP|DE|60|25|True
2|NP|RE|2|NP|DE|60|25|True

2|VP|RE|2|VP|DE|60|25|True
2|VP|RE|2|NP|DE|60|25|True
2|NP|RE|2|VP|DE|60|25|True
3|NP|RE|3|NP|DE|60|25|True
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6|NP|RE|6|VP|DE|60|25|True
7|NP|RE|7|NP|DE|60|25|True
7|VP|RE|7|VP|DE|60|25|True
7|VP|RE|7|NP|DE|60|25|True
7|NP|RE|7|VP|DE|60|25|True
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1|ADVP|RE|1|ADVP|DE|60|25|True
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4|ADJP|RE|4|ADVP|DE|60|25|True
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5|ADJP|RE|5|ADVP|DE|60|25|True
6|ADJP|RE|6|ADJP|DE|60|25|True
6|ADVP|RE|6|ADVP|DE|60|25|True
6|ADVP|RE|6|ADJP|DE|60|25|True

6|ADJP|RE|6|ADVP|DE|60|25|True
7|ADJP|RE|7|ADJP|DE|60|25|True
7|ADVP|RE|7|ADVP|DE|60|25|True
7|ADVP|RE|7|ADJP|DE|60|25|True
7|ADJP|RE|7|ADVP|DE|60|25|True

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0|NP|RE|0|NP|DE|60|25|True
0|VP|RE|0|VP|DE|60|25|True
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0|NP|RE|0|NP|DE|60|0|True
0|VP|RE|0|VP|DE|60|0|True
0|VP|RE|0|NP|DE|60|0|True
0|NP|RE|0|VP|DE|60|0|True
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0|NP|RE|0|NP|DE|60|25|True
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0|VP|RE|0|VP|DE|60|25|True
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0|ADJP|RE|0|ADJP|DE|60|25|True
0|ADVP|RE|0|ADVP|DE|60|25|True
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1|NP|RE|1|NP|DE|60|-2|True
1|VP|RE|1|VP|DE|60|-2|True
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1|ADVP|RE|1|VP|ADVP|60|0|True
1|CONJP|RE|1|CONJP|DE|60|0|True
1|INTJ|RE|1|INTJ|DE|60|0|True
1|LST|RE|1|LST|DE|60|0|True
1|PP|RE|1|PP|DE|60|0|True
1|PRT|RE|1|PRT|DE|60|0|True
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2|ADJP|RE|2|ADJP|DE|60|0|True
2|ADVP|RE|2|VP|ADVP|60|0|True
2|CONJP|RE|2|CONJP|DE|60|0|True
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2|LST|RE|2|LST|DE|60|0|True
2|PP|RE|2|PP|DE|60|0|True
2|PRT|RE|2|PRT|DE|60|0|True
3|NP|RE|3|NP|DE|60|-2|True
3|VP|RE|3|VP|DE|60|-2|True
3|ADJP|RE|3|ADJP|DE|60|0|True
3|ADVP|RE|3|VP|ADVP|60|0|True
3|CONJP|RE|3|CONJP|DE|60|0|True
3|INTJ|RE|3|INTJ|DE|60|0|True
3|LST|RE|3|LST|DE|60|0|True
3|PP|RE|3|PP|DE|60|0|True

3|PRT|RE|3|PRT|DE|60|0|True
4|NP|RE|4|NP|DE|60|-2|True
4|VP|RE|4|VP|DE|60|-2|True
4|ADJP|RE|4|ADJP|DE|60|0|True
4|ADVP|RE|4|VP|ADVP|60|0|True
4|CONJP|RE|4|CONJP|DE|60|0|True
4|INTJ|RE|4|INTJ|DE|60|0|True
4|LST|RE|4|LST|DE|60|0|True
4|PP|RE|4|PP|DE|60|0|True
4|PRT|RE|4|PRT|DE|60|0|True
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5|ADJP|RE|5|ADJP|DE|60|0|True
5|ADVP|RE|5|VP|ADVP|60|0|True
5|CONJP|RE|5|CONJP|DE|60|0|True
5|INTJ|RE|5|INTJ|DE|60|0|True
5|LST|RE|5|LST|DE|60|0|True
5|PP|RE|5|PP|DE|60|0|True
5|PRT|RE|5|PRT|DE|60|0|True
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6|ADJP|RE|6|ADJP|DE|60|0|True
6|ADVP|RE|6|VP|ADVP|60|0|True
6|CONJP|RE|6|CONJP|DE|60|0|True
6|INTJ|RE|6|INTJ|DE|60|0|True
6|LST|RE|6|LST|DE|60|0|True
6|PP|RE|6|PP|DE|60|0|True
6|PRT|RE|6|PRT|DE|60|0|True
7|NP|RE|7|NP|DE|60|-2|True
7|VP|RE|7|VP|DE|60|-2|True
7|ADJP|RE|7|ADJP|DE|60|0|True
7|ADVP|RE|7|VP|ADVP|60|0|True
7|CONJP|RE|7|CONJP|DE|60|0|True
7|INTJ|RE|7|INTJ|DE|60|0|True
7|LST|RE|7|LST|DE|60|0|True
7|PP|RE|7|PP|DE|60|0|True
7|PRT|RE|7|PRT|DE|60|0|True

1|NP|RE|1|NP|DE|60|-2|True
1|VP|RE|1|VP|DE|60|-2|True
1|ADJP|RE|1|ADJP|DE|60|-2|True
1|ADVP|RE|1|VP|ADVP|60|-2|True
1|CONJP|RE|1|CONJP|DE|60|0|True
1|INTJ|RE|1|INTJ|DE|60|0|True
1|LST|RE|1|LST|DE|60|0|True
1|PP|RE|1|PP|DE|60|0|True

1|PRT|RE|1|PRT|DE|60|0|True
2|NP|RE|2|NP|DE|60|-2|True
2|VP|RE|2|VP|DE|60|-2|True
2|ADJP|RE|2|ADJP|DE|60|-2|True
2|ADVP|RE|2|VP|ADVP|60|-2|True
2|CONJP|RE|2|CONJP|DE|60|0|True
2|INTJ|RE|2|INTJ|DE|60|0|True
2|LST|RE|2|LST|DE|60|0|True
2|PP|RE|2|PP|DE|60|0|True
2|PRT|RE|2|PRT|DE|60|0|True
3|NP|RE|3|NP|DE|60|-2|True
3|VP|RE|3|VP|DE|60|-2|True
3|ADJP|RE|3|ADJP|DE|60|-2|True
3|ADVP|RE|3|VP|ADVP|60|-2|True
3|CONJP|RE|3|CONJP|DE|60|0|True
3|INTJ|RE|3|INTJ|DE|60|0|True
3|LST|RE|3|LST|DE|60|0|True
3|PP|RE|3|PP|DE|60|0|True
3|PRT|RE|3|PRT|DE|60|0|True
4|NP|RE|4|NP|DE|60|-2|True
4|VP|RE|4|VP|DE|60|-2|True
4|ADJP|RE|4|ADJP|DE|60|-2|True
4|ADVP|RE|4|VP|ADVP|60|-2|True
4|CONJP|RE|4|CONJP|DE|60|0|True
4|INTJ|RE|4|INTJ|DE|60|0|True
4|LST|RE|4|LST|DE|60|0|True
4|PP|RE|4|PP|DE|60|0|True
4|PRT|RE|4|PRT|DE|60|0|True
5|NP|RE|5|NP|DE|60|-2|True
5|VP|RE|5|VP|DE|60|-2|True
5|ADJP|RE|5|ADJP|DE|60|-2|True
5|ADVP|RE|5|VP|ADVP|60|-2|True
5|CONJP|RE|5|CONJP|DE|60|0|True
5|INTJ|RE|5|INTJ|DE|60|0|True
5|LST|RE|5|LST|DE|60|0|True
5|PP|RE|5|PP|DE|60|0|True
5|PRT|RE|5|PRT|DE|60|0|True
6|NP|RE|6|NP|DE|60|-2|True
6|VP|RE|6|VP|DE|60|-2|True
6|ADJP|RE|6|ADJP|DE|60|-2|True
6|ADVP|RE|6|VP|ADVP|60|-2|True
6|CONJP|RE|6|CONJP|DE|60|0|True
6|INTJ|RE|6|INTJ|DE|60|0|True
6|LST|RE|6|LST|DE|60|0|True
6|PP|RE|6|PP|DE|60|0|True
6|PRT|RE|6|PRT|DE|60|0|True

7|NP|RE|7|NP|DE|60|-2|True
7|VP|RE|7|VP|DE|60|-2|True
7|ADJP|RE|7|ADJP|DE|60|-2|True
7|ADVP|RE|7|VP|ADVP|60|-2|True
7|CONJP|RE|7|CONJP|DE|60|0|True
7|INTJ|RE|7|INTJ|DE|60|0|True
7|LST|RE|7|LST|DE|60|0|True
7|PP|RE|7|PP|DE|60|0|True
7|PRT|RE|7|PRT|DE|60|0|True

0|NP|RE|0|NP|DE|60|0|True
0|VP|RE|0|VP|DE|60|0|True
0|ADJP|RE|0|ADJP|DE|60|0|True
0|ADVP|RE|0|VP|ADVP|60|0|True
0|CONJP|RE|0|CONJP|DE|60|0|True
0|INTJ|RE|0|INTJ|DE|60|0|True
0|LST|RE|0|LST|DE|60|0|True
0|PP|RE|0|PP|DE|60|0|True
0|PRT|RE|0|PRT|DE|60|0|True

0|NP|RE|0|NP|DE|60|25|True
0|VP|RE|0|VP|DE|60|25|True
0|ADJP|RE|0|ADJP|DE|60|25|True
0|ADVP|RE|0|VP|ADVP|60|25|True
0|CONJP|RE|0|CONJP|DE|60|25|True
0|INTJ|RE|0|INTJ|DE|60|25|True
0|LST|RE|0|LST|DE|60|25|True
0|PP|RE|0|PP|DE|60|25|True
0|PRT|RE|0|PRT|DE|60|25|True

1|NP|RE|1|NP|DE|60|0|True
1|VP|RE|1|VP|DE|60|0|True
1|ADJP|RE|1|ADJP|DE|60|0|True
1|ADVP|RE|1|VP|ADVP|60|0|True
1|CONJP|RE|1|CONJP|DE|60|0|True
1|INTJ|RE|1|INTJ|DE|60|0|True
1|LST|RE|1|LST|DE|60|0|True
1|PP|RE|1|PP|DE|60|0|True
1|PRT|RE|1|PRT|DE|60|0|True
2|NP|RE|2|NP|DE|60|0|True
2|VP|RE|2|VP|DE|60|0|True
2|ADJP|RE|2|ADJP|DE|60|0|True
2|ADVP|RE|2|VP|ADVP|60|0|True
2|CONJP|RE|2|CONJP|DE|60|0|True
2|INTJ|RE|2|INTJ|DE|60|0|True
2|LST|RE|2|LST|DE|60|0|True

2|PP|RE|2|PP|DE|60|0|True
2|PRT|RE|2|PRT|DE|60|0|True
3|NP|RE|3|NP|DE|60|0|True
3|VP|RE|3|VP|DE|60|0|True
3|ADJP|RE|3|ADJP|DE|60|0|True
3|ADVP|RE|3|VP|ADVP|60|0|True
3|CONJP|RE|3|CONJP|DE|60|0|True
3|INTJ|RE|3|INTJ|DE|60|0|True
3|LST|RE|3|LST|DE|60|0|True
3|PP|RE|3|PP|DE|60|0|True
3|PRT|RE|3|PRT|DE|60|0|True
4|NP|RE|4|NP|DE|60|0|True
4|VP|RE|4|VP|DE|60|0|True
4|ADJP|RE|4|ADJP|DE|60|0|True
4|ADVP|RE|4|VP|ADVP|60|0|True
4|CONJP|RE|4|CONJP|DE|60|0|True
4|INTJ|RE|4|INTJ|DE|60|0|True
4|LST|RE|4|LST|DE|60|0|True
4|PP|RE|4|PP|DE|60|0|True
4|PRT|RE|4|PRT|DE|60|0|True
5|NP|RE|5|NP|DE|60|0|True
5|VP|RE|5|VP|DE|60|0|True
5|ADJP|RE|5|ADJP|DE|60|0|True
5|ADVP|RE|5|VP|ADVP|60|0|True
5|CONJP|RE|5|CONJP|DE|60|0|True
5|INTJ|RE|5|INTJ|DE|60|0|True
5|LST|RE|5|LST|DE|60|0|True
5|PP|RE|5|PP|DE|60|0|True
5|PRT|RE|5|PRT|DE|60|0|True
6|NP|RE|6|NP|DE|60|0|True
6|VP|RE|6|VP|DE|60|0|True
6|ADJP|RE|6|ADJP|DE|60|0|True
6|ADVP|RE|6|VP|ADVP|60|0|True
6|CONJP|RE|6|CONJP|DE|60|0|True
6|INTJ|RE|6|INTJ|DE|60|0|True
6|LST|RE|6|LST|DE|60|0|True
6|PP|RE|6|PP|DE|60|0|True
6|PRT|RE|6|PRT|DE|60|0|True
7|NP|RE|7|NP|DE|60|0|True
7|VP|RE|7|VP|DE|60|0|True
7|ADJP|RE|7|ADJP|DE|60|0|True
7|ADVP|RE|7|VP|ADVP|60|0|True
7|CONJP|RE|7|CONJP|DE|60|0|True
7|INTJ|RE|7|INTJ|DE|60|0|True
7|LST|RE|7|LST|DE|60|0|True
7|PP|RE|7|PP|DE|60|0|True

7|PRT|RE|7|PRT|DE|60|0|True

1|NP|RE|1|NP|DE|60|25|True
1|VP|RE|1|VP|DE|60|25|True
1|ADJP|RE|1|ADJP|DE|60|25|True
1|ADVP|RE|1|VP|ADVP|60|25|True
1|CONJP|RE|1|CONJP|DE|60|25|True
1|INTJ|RE|1|INTJ|DE|60|25|True
1|LST|RE|1|LST|DE|60|25|True
1|PP|RE|1|PP|DE|60|25|True
1|PRT|RE|1|PRT|DE|60|25|True
2|NP|RE|2|NP|DE|60|25|True
2|VP|RE|2|VP|DE|60|25|True
2|ADJP|RE|2|ADJP|DE|60|25|True
2|ADVP|RE|2|VP|ADVP|60|25|True
2|CONJP|RE|2|CONJP|DE|60|25|True
2|INTJ|RE|2|INTJ|DE|60|25|True
2|LST|RE|2|LST|DE|60|25|True
2|PP|RE|2|PP|DE|60|25|True
2|PRT|RE|2|PRT|DE|60|25|True
3|NP|RE|3|NP|DE|60|25|True
3|VP|RE|3|VP|DE|60|25|True
3|ADJP|RE|3|ADJP|DE|60|25|True
3|ADVP|RE|3|VP|ADVP|60|25|True
3|CONJP|RE|3|CONJP|DE|60|25|True
3|INTJ|RE|3|INTJ|DE|60|25|True
3|LST|RE|3|LST|DE|60|25|True
3|PP|RE|3|PP|DE|60|25|True
3|PRT|RE|3|PRT|DE|60|25|True
4|NP|RE|4|NP|DE|60|25|True
4|VP|RE|4|VP|DE|60|25|True
4|ADJP|RE|4|ADJP|DE|60|25|True
4|ADVP|RE|4|VP|ADVP|60|25|True
4|CONJP|RE|4|CONJP|DE|60|25|True
4|INTJ|RE|4|INTJ|DE|60|25|True
4|LST|RE|4|LST|DE|60|25|True
4|PP|RE|4|PP|DE|60|25|True
4|PRT|RE|4|PRT|DE|60|25|True
5|NP|RE|5|NP|DE|60|25|True
5|VP|RE|5|VP|DE|60|25|True
5|ADJP|RE|5|ADJP|DE|60|25|True
5|ADVP|RE|5|VP|ADVP|60|25|True
5|CONJP|RE|5|CONJP|DE|60|25|True
5|INTJ|RE|5|INTJ|DE|60|25|True
5|LST|RE|5|LST|DE|60|25|True
5|PP|RE|5|PP|DE|60|25|True

5|PRT|RE|5|PRT|DE|60|25|True
6|NP|RE|6|NP|DE|60|25|True
6|VP|RE|6|VP|DE|60|25|True
6|ADJP|RE|6|ADJP|DE|60|25|True
6|ADVP|RE|6|VP|ADVP|60|25|True
6|CONJP|RE|6|CONJP|DE|60|25|True
6|INTJ|RE|6|INTJ|DE|60|25|True
6|LST|RE|6|LST|DE|60|25|True
6|PP|RE|6|PP|DE|60|25|True
6|PRT|RE|6|PRT|DE|60|25|True
7|NP|RE|7|NP|DE|60|25|True
7|VP|RE|7|VP|DE|60|25|True
7|ADJP|RE|7|ADJP|DE|60|25|True
7|ADVP|RE|7|VP|ADVP|60|25|True
7|CONJP|RE|7|CONJP|DE|60|25|True
7|INTJ|RE|7|INTJ|DE|60|25|True
7|LST|RE|7|LST|DE|60|25|True
7|PP|RE|7|PP|DE|60|25|True
7|PRT|RE|7|PRT|DE|60|25|True

0|NP|RE|0|NP|DE|60|25|True
0|VP|RE|0|VP|DE|60|25|True
1|NP|RE|1|NP|DE|60|25|True
1|VP|RE|1|VP|DE|60|25|True
1|ADJP|RE|1|ADJP|DE|60|25|True
1|ADVP|RE|1|VP|ADVP|60|25|True
1|CONJP|RE|1|CONJP|DE|60|25|True
1|INTJ|RE|1|INTJ|DE|60|25|True
1|LST|RE|1|LST|DE|60|25|True
1|PP|RE|1|PP|DE|60|25|True
1|PRT|RE|1|PRT|DE|60|25|True
2|NP|RE|2|NP|DE|60|25|True
2|VP|RE|2|VP|DE|60|25|True
2|ADJP|RE|2|ADJP|DE|60|25|True
2|ADVP|RE|2|VP|ADVP|60|25|True
2|CONJP|RE|2|CONJP|DE|60|25|True
2|INTJ|RE|2|INTJ|DE|60|25|True
2|LST|RE|2|LST|DE|60|25|True
2|PP|RE|2|PP|DE|60|25|True
2|PRT|RE|2|PRT|DE|60|25|True
3|NP|RE|3|NP|DE|60|25|True
3|VP|RE|3|VP|DE|60|25|True
3|ADJP|RE|3|ADJP|DE|60|25|True
3|ADVP|RE|3|VP|ADVP|60|25|True
3|CONJP|RE|3|CONJP|DE|60|25|True
3|INTJ|RE|3|INTJ|DE|60|25|True

3|LST|RE|3|LST|DE|60|25|True
3|PP|RE|3|PP|DE|60|25|True
3|PRT|RE|3|PRT|DE|60|25|True
4|NP|RE|4|NP|DE|60|25|True
4|VP|RE|4|VP|DE|60|25|True
4|ADJP|RE|4|ADJP|DE|60|25|True
4|ADVP|RE|4|VP|ADVP|60|25|True
4|CONJP|RE|4|CONJP|DE|60|25|True
4|INTJ|RE|4|INTJ|DE|60|25|True
4|LST|RE|4|LST|DE|60|25|True
4|PP|RE|4|PP|DE|60|25|True
4|PRT|RE|4|PRT|DE|60|25|True
5|NP|RE|5|NP|DE|60|25|True
5|VP|RE|5|VP|DE|60|25|True
5|ADJP|RE|5|ADJP|DE|60|25|True
5|ADVP|RE|5|VP|ADVP|60|25|True
5|CONJP|RE|5|CONJP|DE|60|25|True
5|INTJ|RE|5|INTJ|DE|60|25|True
5|LST|RE|5|LST|DE|60|25|True
5|PP|RE|5|PP|DE|60|25|True
5|PRT|RE|5|PRT|DE|60|25|True
6|NP|RE|6|NP|DE|60|25|True
6|VP|RE|6|VP|DE|60|25|True
6|ADJP|RE|6|ADJP|DE|60|25|True
6|ADVP|RE|6|VP|ADVP|60|25|True
6|CONJP|RE|6|CONJP|DE|60|25|True
6|INTJ|RE|6|INTJ|DE|60|25|True
6|LST|RE|6|LST|DE|60|25|True
6|PP|RE|6|PP|DE|60|25|True
6|PRT|RE|6|PRT|DE|60|25|True
7|NP|RE|7|NP|DE|60|25|True
7|VP|RE|7|VP|DE|60|25|True
7|ADJP|RE|7|ADJP|DE|60|25|True
7|ADVP|RE|7|VP|ADVP|60|25|True
7|CONJP|RE|7|CONJP|DE|60|25|True
7|INTJ|RE|7|INTJ|DE|60|25|True
7|LST|RE|7|LST|DE|60|25|True
7|PP|RE|7|PP|DE|60|25|True
7|PRT|RE|7|PRT|DE|60|25|True

0|NP|RE|0|NP|DE|70|-2|True
0|VP|RE|0|VP|DE|70|-2|True
0|ADJP|RE|0|ADJP|DE|70|0|True
0|ADVP|RE|0|VP|ADVP|70|0|True
0|CONJP|RE|0|CONJP|DE|70|0|True
0|INTJ|RE|0|INTJ|DE|70|0|True

0|LST|RE|0|LST|DE|70|0|True
0|PP|RE|0|PP|DE|70|0|True
0|PRT|RE|0|PRT|DE|70|0|True

0|NP|RE|0|NP|DE|70|25|True
0|VP|RE|0|VP|DE|70|25|True
0|ADJP|RE|0|ADJP|DE|70|25|True
0|ADVP|RE|0|ADVP|DE|70|25|True
1|NP|RE|1|NP|DE|70|25|True
1|VP|RE|1|VP|DE|70|25|True
1|ADJP|RE|1|ADJP|DE|70|25|True
1|ADVP|RE|1|VP|ADVP|70|25|True
1|CONJP|RE|1|CONJP|DE|70|25|True
1|INTJ|RE|1|INTJ|DE|70|25|True
1|LST|RE|1|LST|DE|70|25|True
1|PP|RE|1|PP|DE|70|25|True
1|PRT|RE|1|PRT|DE|70|25|True
2|NP|RE|2|NP|DE|70|25|True
2|VP|RE|2|VP|DE|70|25|True
2|ADJP|RE|2|ADJP|DE|70|25|True
2|ADVP|RE|2|VP|ADVP|70|25|True
2|CONJP|RE|2|CONJP|DE|70|25|True
2|INTJ|RE|2|INTJ|DE|70|25|True
2|LST|RE|2|LST|DE|70|25|True
2|PP|RE|2|PP|DE|70|25|True
2|PRT|RE|2|PRT|DE|70|25|True
3|NP|RE|3|NP|DE|70|25|True
3|VP|RE|3|VP|DE|70|25|True
3|ADJP|RE|3|ADJP|DE|70|25|True
3|ADVP|RE|3|VP|ADVP|70|25|True
3|CONJP|RE|3|CONJP|DE|70|25|True
3|INTJ|RE|3|INTJ|DE|70|25|True
3|LST|RE|3|LST|DE|70|25|True
3|PP|RE|3|PP|DE|70|25|True
3|PRT|RE|3|PRT|DE|70|25|True
4|NP|RE|4|NP|DE|70|25|True
4|VP|RE|4|VP|DE|70|25|True
4|ADJP|RE|4|ADJP|DE|70|25|True
4|ADVP|RE|4|VP|ADVP|70|25|True
4|CONJP|RE|4|CONJP|DE|70|25|True
4|INTJ|RE|4|INTJ|DE|70|25|True
4|LST|RE|4|LST|DE|70|25|True
4|PP|RE|4|PP|DE|70|25|True
4|PRT|RE|4|PRT|DE|70|25|True
5|NP|RE|5|NP|DE|70|25|True
5|VP|RE|5|VP|DE|70|25|True

5|ADJP|RE|5|ADJP|DE|70|25|True
5|ADVP|RE|5|VP|ADVP|70|25|True
5|CONJP|RE|5|CONJP|DE|70|25|True
5|INTJ|RE|5|INTJ|DE|70|25|True
5|LST|RE|5|LST|DE|70|25|True
5|PP|RE|5|PP|DE|70|25|True
5|PRT|RE|5|PRT|DE|70|25|True
6|NP|RE|6|NP|DE|70|25|True
6|VP|RE|6|VP|DE|70|25|True
6|ADJP|RE|6|ADJP|DE|70|25|True
6|ADVP|RE|6|VP|ADVP|70|25|True
6|CONJP|RE|6|CONJP|DE|70|25|True
6|INTJ|RE|6|INTJ|DE|70|25|True
6|LST|RE|6|LST|DE|70|25|True
6|PP|RE|6|PP|DE|70|25|True
6|PRT|RE|6|PRT|DE|70|25|True
7|NP|RE|7|NP|DE|70|25|True
7|VP|RE|7|VP|DE|70|25|True
7|ADJP|RE|7|ADJP|DE|70|25|True
7|ADVP|RE|7|VP|ADVP|70|25|True
7|CONJP|RE|7|CONJP|DE|70|25|True
7|INTJ|RE|7|INTJ|DE|70|25|True
7|LST|RE|7|LST|DE|70|25|True
7|PP|RE|7|PP|DE|70|25|True
7|PRT|RE|7|PRT|DE|70|25|True

0|NP|RE|0|NP|DE|70|0|True
0|VP|RE|0|VP|DE|70|0|True
1|NP|RE|1|NP|DE|70|0|True
1|VP|RE|1|VP|DE|70|0|True
1|ADJP|RE|1|ADJP|DE|70|0|True
1|ADVP|RE|1|VP|ADVP|70|0|True
1|CONJP|RE|1|CONJP|DE|70|0|True
1|INTJ|RE|1|INTJ|DE|70|0|True
1|LST|RE|1|LST|DE|70|0|True
1|PP|RE|1|PP|DE|70|0|True
1|PRT|RE|1|PRT|DE|70|0|True
2|NP|RE|2|NP|DE|70|0|True
2|VP|RE|2|VP|DE|70|0|True
2|ADJP|RE|2|ADJP|DE|70|0|True
2|ADVP|RE|2|VP|ADVP|70|0|True
2|CONJP|RE|2|CONJP|DE|70|0|True
2|INTJ|RE|2|INTJ|DE|70|0|True
2|LST|RE|2|LST|DE|70|0|True
2|PP|RE|2|PP|DE|70|0|True
2|PRT|RE|2|PRT|DE|70|0|True

3|NP|RE|3|NP|DE|70|0|True
3|VP|RE|3|VP|DE|70|0|True
3|ADJP|RE|3|ADJP|DE|70|0|True
3|ADVP|RE|3|VP|ADVP|70|0|True
3|CONJP|RE|3|CONJP|DE|70|0|True
3|INTJ|RE|3|INTJ|DE|70|0|True
3|LST|RE|3|LST|DE|70|0|True
3|PP|RE|3|PP|DE|70|0|True
3|PRT|RE|3|PRT|DE|70|0|True
4|NP|RE|4|NP|DE|70|0|True
4|VP|RE|4|VP|DE|70|0|True
4|ADJP|RE|4|ADJP|DE|70|0|True
4|ADVP|RE|4|VP|ADVP|70|0|True
4|CONJP|RE|4|CONJP|DE|70|0|True
4|INTJ|RE|4|INTJ|DE|70|0|True
4|LST|RE|4|LST|DE|70|0|True
4|PP|RE|4|PP|DE|70|0|True
4|PRT|RE|4|PRT|DE|70|0|True
5|NP|RE|5|NP|DE|70|0|True
5|VP|RE|5|VP|DE|70|0|True
5|ADJP|RE|5|ADJP|DE|70|0|True
5|ADVP|RE|5|VP|ADVP|70|0|True
5|CONJP|RE|5|CONJP|DE|70|0|True
5|INTJ|RE|5|INTJ|DE|70|0|True
5|LST|RE|5|LST|DE|70|0|True
5|PP|RE|5|PP|DE|70|0|True
5|PRT|RE|5|PRT|DE|70|0|True
6|NP|RE|6|NP|DE|70|0|True
6|VP|RE|6|VP|DE|70|0|True
6|ADJP|RE|6|ADJP|DE|70|0|True
6|ADVP|RE|6|VP|ADVP|70|0|True
6|CONJP|RE|6|CONJP|DE|70|0|True
6|INTJ|RE|6|INTJ|DE|70|0|True
6|LST|RE|6|LST|DE|70|0|True
6|PP|RE|6|PP|DE|70|0|True
6|PRT|RE|6|PRT|DE|70|0|True
7|NP|RE|7|NP|DE|70|0|True
7|VP|RE|7|VP|DE|70|0|True
7|ADJP|RE|7|ADJP|DE|70|0|True
7|ADVP|RE|7|VP|ADVP|70|0|True
7|CONJP|RE|7|CONJP|DE|70|0|True
7|INTJ|RE|7|INTJ|DE|70|0|True
7|LST|RE|7|LST|DE|70|0|True
7|PP|RE|7|PP|DE|70|0|True
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0|ADJP|RE|0|ADJP|DE|70|0|True
0|ADVP|RE|0|ADVP|DE|70|0|True
1|NP|RE|1|NP|DE|70|0|True
1|VP|RE|1|VP|DE|70|0|True
1|ADJP|RE|1|ADJP|DE|70|0|True
1|ADVP|RE|1|VP|ADVP|70|0|True
1|CONJP|RE|1|CONJP|DE|70|0|True
1|INTJ|RE|1|INTJ|DE|70|0|True
1|LST|RE|1|LST|DE|70|0|True
1|PP|RE|1|PP|DE|70|0|True
1|PRT|RE|1|PRT|DE|70|0|True
2|NP|RE|2|NP|DE|70|0|True
2|VP|RE|2|VP|DE|70|0|True
2|ADJP|RE|2|ADJP|DE|70|0|True
2|ADVP|RE|2|VP|ADVP|70|0|True
2|CONJP|RE|2|CONJP|DE|70|0|True
2|INTJ|RE|2|INTJ|DE|70|0|True
2|LST|RE|2|LST|DE|70|0|True
2|PP|RE|2|PP|DE|70|0|True
2|PRT|RE|2|PRT|DE|70|0|True
3|NP|RE|3|NP|DE|70|0|True
3|VP|RE|3|VP|DE|70|0|True
3|ADJP|RE|3|ADJP|DE|70|0|True
3|ADVP|RE|3|VP|ADVP|70|0|True
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3|INTJ|RE|3|INTJ|DE|70|0|True
3|LST|RE|3|LST|DE|70|0|True
3|PP|RE|3|PP|DE|70|0|True
3|PRT|RE|3|PRT|DE|70|0|True
4|NP|RE|4|NP|DE|70|0|True
4|VP|RE|4|VP|DE|70|0|True
4|ADJP|RE|4|ADJP|DE|70|0|True
4|ADVP|RE|4|VP|ADVP|70|0|True
4|CONJP|RE|4|CONJP|DE|70|0|True
4|INTJ|RE|4|INTJ|DE|70|0|True
4|LST|RE|4|LST|DE|70|0|True
4|PP|RE|4|PP|DE|70|0|True
4|PRT|RE|4|PRT|DE|70|0|True
5|NP|RE|5|NP|DE|70|0|True
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5|ADJP|RE|5|ADJP|DE|70|0|True
5|ADVP|RE|5|VP|ADVP|70|0|True
5|CONJP|RE|5|CONJP|DE|70|0|True
5|INTJ|RE|5|INTJ|DE|70|0|True

5|LST|RE|5|LST|DE|70|0|True
5|PP|RE|5|PP|DE|70|0|True
5|PRT|RE|5|PRT|DE|70|0|True
6|NP|RE|6|NP|DE|70|0|True
6|VP|RE|6|VP|DE|70|0|True
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6|ADVP|RE|6|VP|ADVP|70|0|True
6|CONJP|RE|6|CONJP|DE|70|0|True
6|INTJ|RE|6|INTJ|DE|70|0|True
6|LST|RE|6|LST|DE|70|0|True
6|PP|RE|6|PP|DE|70|0|True
6|PRT|RE|6|PRT|DE|70|0|True
7|NP|RE|7|NP|DE|70|0|True
7|VP|RE|7|VP|DE|70|0|True
7|ADJP|RE|7|ADJP|DE|70|0|True
7|ADVP|RE|7|VP|ADVP|70|0|True
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7|INTJ|RE|7|INTJ|DE|70|0|True
7|LST|RE|7|LST|DE|70|0|True
7|PP|RE|7|PP|DE|70|0|True
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0|VP|RE|0|VP|DE|70|0|True
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7|NP|RE|7|NP|DE|70|25|True
7|VP|RE|7|VP|DE|70|25|True
7|VP|RE|7|NP|DE|70|25|True
7|NP|RE|7|VP|DE|70|25|True

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4|ADJP|RE|4|ADJP|DE|70|0|True
4|ADVP|RE|4|ADVP|DE|70|0|True
4|ADVP|RE|4|ADJP|DE|70|0|True
4|ADJP|RE|4|ADVP|DE|70|0|True
5|ADJP|RE|5|ADJP|DE|70|0|True
5|ADVP|RE|5|ADVP|DE|70|0|True
5|ADVP|RE|5|ADJP|DE|70|0|True
5|ADJP|RE|5|ADVP|DE|70|0|True
6|ADJP|RE|6|ADJP|DE|70|0|True
6|ADVP|RE|6|ADVP|DE|70|0|True
6|ADVP|RE|6|ADJP|DE|70|0|True
6|ADJP|RE|6|ADVP|DE|70|0|True
7|ADJP|RE|7|ADJP|DE|70|0|True
7|ADVP|RE|7|ADVP|DE|70|0|True
7|ADVP|RE|7|ADJP|DE|70|0|True
7|ADJP|RE|7|ADVP|DE|70|0|True
0|NP|RE|0|NP|DE|70|0|True

0|ADVP|RE|0|ADVP|DE|70|0|True
0|ADVP|RE|0|NP|DE|70|0|True
0|NP|RE|0|ADVP|DE|70|0|True
1|NP|RE|1|NP|DE|70|0|True
1|ADVP|RE|1|ADVP|DE|70|0|True
1|ADVP|RE|1|NP|DE|70|0|True
1|NP|RE|1|ADVP|DE|70|0|True
2|NP|RE|2|NP|DE|70|0|True
2|ADVP|RE|2|ADVP|DE|70|0|True
2|ADVP|RE|2|NP|DE|70|0|True
2|NP|RE|2|ADVP|DE|70|0|True
3|NP|RE|3|NP|DE|70|0|True
3|ADVP|RE|3|ADVP|DE|70|0|True
3|ADVP|RE|3|NP|DE|70|0|True
3|NP|RE|3|ADVP|DE|70|0|True
4|NP|RE|4|NP|DE|70|0|True
4|ADVP|RE|4|ADVP|DE|70|0|True
4|ADVP|RE|4|NP|DE|70|0|True
4|NP|RE|4|ADVP|DE|70|0|True
5|NP|RE|5|NP|DE|70|0|True
5|ADVP|RE|5|ADVP|DE|70|0|True
5|ADVP|RE|5|NP|DE|70|0|True
5|NP|RE|5|ADVP|DE|70|0|True
6|NP|RE|6|NP|DE|70|0|True
6|ADVP|RE|6|ADVP|DE|70|0|True
6|ADVP|RE|6|NP|DE|70|0|True
6|NP|RE|6|ADVP|DE|70|0|True
7|NP|RE|7|NP|DE|70|0|True
7|ADVP|RE|7|ADVP|DE|70|0|True
7|ADVP|RE|7|NP|DE|70|0|True
7|NP|RE|7|ADVP|DE|70|0|True

1|NP|RE|1|NP|DE|70|0|True
1|VP|RE|1|VP|DE|70|0|True
1|VP|RE|1|NP|DE|70|0|True
1|NP|RE|1|VP|DE|70|0|True
2|NP|RE|2|NP|DE|70|0|True
2|VP|RE|2|VP|DE|70|0|True
2|VP|RE|2|NP|DE|70|0|True
2|NP|RE|2|VP|DE|70|0|True
3|NP|RE|3|NP|DE|70|0|True
3|VP|RE|3|VP|DE|70|0|True
3|VP|RE|3|NP|DE|70|0|True
3|NP|RE|3|VP|DE|70|0|True
4|NP|RE|4|NP|DE|70|0|True
4|VP|RE|4|VP|DE|70|0|True

4|VP|RE|4|NP|DE|70|0|True
4|NP|RE|4|VP|DE|70|0|True
50|NP|RE|70|NP|DE|70|0|True
50|VP|RE|70|VP|DE|70|0|True
50|VP|RE|70|NP|DE|70|0|True
50|NP|RE|70|VP|DE|70|0|True
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6|VP|RE|6|NP|DE|70|0|True
6|NP|RE|6|VP|DE|70|0|True
7|NP|RE|7|NP|DE|70|0|True
7|VP|RE|7|VP|DE|70|0|True
7|VP|RE|7|NP|DE|70|0|True
7|NP|RE|7|VP|DE|70|0|True

1|NP|RE|1|NP|DE|70|25|True
1|VP|RE|1|VP|DE|70|25|True
1|VP|RE|1|NP|DE|70|25|True
1|NP|RE|1|VP|DE|70|25|True
2|NP|RE|2|NP|DE|70|25|True
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7|NP|RE|7|NP|DE|70|25|True
7|VP|RE|7|VP|DE|70|25|True
7|VP|RE|7|NP|DE|70|25|True
7|NP|RE|7|VP|DE|70|25|True

1|NP|RE|1|NP|DE|70|0|True
1|VP|RE|1|VP|DE|70|0|True

1|VP|RE|1|NP|DE|70|0|True
1|NP|RE|1|VP|DE|70|0|True
2|NP|RE|2|NP|DE|70|0|True
2|VP|RE|2|VP|DE|70|0|True
2|VP|RE|2|NP|DE|70|0|True
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3|VP|RE|3|NP|DE|70|0|True
3|NP|RE|3|VP|DE|70|0|True
4|NP|RE|4|NP|DE|70|0|True
4|VP|RE|4|VP|DE|70|0|True
4|VP|RE|4|NP|DE|70|0|True
4|NP|RE|4|VP|DE|70|0|True
5|NP|RE|5|NP|DE|70|0|True
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6|VP|RE|6|NP|DE|70|0|True
6|NP|RE|6|VP|DE|70|0|True
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7|VP|RE|7|NP|DE|70|0|True
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1|ADJP|RE|1|ADJP|DE|70|0|True
1|ADVP|RE|1|ADVP|DE|70|0|True
1|ADVP|RE|1|ADJP|DE|70|0|True
1|ADJP|RE|1|ADVP|DE|70|0|True
2|ADJP|RE|2|ADJP|DE|70|0|True
2|ADVP|RE|2|ADVP|DE|70|0|True
2|ADVP|RE|2|ADJP|DE|70|0|True
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3|ADVP|RE|3|ADJP|DE|70|0|True
3|ADJP|RE|3|ADVP|DE|70|0|True
4|ADJP|RE|4|ADJP|DE|70|0|True
4|ADVP|RE|4|ADVP|DE|70|0|True
4|ADVP|RE|4|ADJP|DE|70|0|True
4|ADJP|RE|4|ADVP|DE|70|0|True
5|ADJP|RE|5|ADJP|DE|70|0|True
5|ADVP|RE|5|ADVP|DE|70|0|True
5|ADVP|RE|5|ADJP|DE|70|0|True
5|ADJP|RE|5|ADVP|DE|70|0|True

6|ADJP|RE|6|ADJP|DE|70|0|True
6|ADVP|RE|6|ADVP|DE|70|0|True
6|ADVP|RE|6|ADJP|DE|70|0|True
6|ADJP|RE|6|ADVP|DE|70|0|True
7|ADJP|RE|7|ADJP|DE|70|0|True
7|ADVP|RE|7|ADVP|DE|70|0|True
7|ADVP|RE|7|ADJP|DE|70|0|True
7|ADJP|RE|7|ADVP|DE|70|0|True

1|NP|RE|1|NP|DE|70|25|True
1|VP|RE|1|VP|DE|70|25|True
1|VP|RE|1|NP|DE|70|25|True
1|NP|RE|1|VP|DE|70|25|True
2|NP|RE|2|NP|DE|70|25|True
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7|NP|RE|7|VP|DE|70|25|True
1|ADJP|RE|1|ADJP|DE|70|25|True
1|ADVP|RE|1|ADVP|DE|70|25|True
1|ADVP|RE|1|ADJP|DE|70|25|True
1|ADJP|RE|1|ADVP|DE|70|25|True
2|ADJP|RE|2|ADJP|DE|70|25|True
2|ADVP|RE|2|ADVP|DE|70|25|True
2|ADVP|RE|2|ADJP|DE|70|25|True
2|ADJP|RE|2|ADVP|DE|70|25|True
3|ADJP|RE|3|ADJP|DE|70|25|True

3|ADVP|RE|3|ADVP|DE|70|25|True
3|ADVP|RE|3|ADJP|DE|70|25|True
3|ADJP|RE|3|ADVP|DE|70|25|True
4|ADJP|RE|4|ADJP|DE|70|25|True
4|ADVP|RE|4|ADVP|DE|70|25|True
4|ADVP|RE|4|ADJP|DE|70|25|True
4|ADJP|RE|4|ADVP|DE|70|25|True
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6|ADVP|RE|6|ADVP|DE|70|25|True
6|ADVP|RE|6|ADJP|DE|70|25|True
6|ADJP|RE|6|ADVP|DE|70|25|True
7|ADJP|RE|7|ADJP|DE|70|25|True
7|ADVP|RE|7|ADVP|DE|70|25|True
7|ADVP|RE|7|ADJP|DE|70|25|True
7|ADJP|RE|7|ADVP|DE|70|25|True

0|NP|RE|0|NP|DE|70|0|True
0|VP|RE|0|VP|DE|70|0|True
0|VP|RE|0|NP|DE|70|0|True
0|NP|RE|0|VP|DE|70|0|True

0|NP|RE|0|NP|DE|70|25|True
0|VP|RE|0|VP|DE|70|25|True
0|VP|RE|0|NP|DE|70|25|True
0|NP|RE|0|VP|DE|70|25|True

0|NP|RE|0|NP|DE|70|0|True
0|VP|RE|0|VP|DE|70|0|True
0|VP|RE|0|NP|DE|70|0|True
0|NP|RE|0|VP|DE|70|0|True
0|ADJP|RE|0|ADJP|DE|70|0|True
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0|ADJP|RE|0|VP|DE|70|0|True
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0|ADJP|RE|0|ADJP|DE|70|0|True
0|ADJP|RE|0|NP|DE|70|0|True
0|NP|RE|0|ADJP|DE|70|0|True
0|ADVP|RE|0|ADVP|DE|70|0|True
0|VP|RE|0|VP|DE|70|0|True
0|VP|RE|0|ADVP|DE|70|0|True
0|ADVP|RE|0|VP|DE|70|0|True

0|NP|RE|0|NP|DE|70|0|True
0|ADVP|RE|0|ADVP|DE|70|0|True
0|ADVP|RE|0|NP|DE|70|0|True
0|NP|RE|0|ADVP|DE|70|0|True
0|ADJP|RE|0|ADJP|DE|70|0|True
0|ADVP|RE|0|ADVP|DE|70|0|True
0|ADVP|RE|0|ADJP|DE|70|0|True
0|ADJP|RE|0|ADVP|DE|70|0|True

0|NP|RE|0|NP|DE|70|25|True
0|VP|RE|0|VP|DE|70|25|True
0|VP|RE|0|NP|DE|70|25|True
0|NP|RE|0|VP|DE|70|25|True
0|ADJP|RE|0|ADJP|DE|70|25|True
0|VP|RE|0|VP|DE|70|25|True
0|VP|RE|0|ADJP|DE|70|25|True
0|ADJP|RE|0|VP|DE|70|25|True
0|NP|RE|0|NP|DE|70|25|True
0|ADJP|RE|0|ADJP|DE|70|25|True
0|ADJP|RE|0|NP|DE|70|25|True
0|NP|RE|0|ADJP|DE|70|25|True
0|ADVP|RE|0|ADVP|DE|70|25|True
0|VP|RE|0|VP|DE|70|25|True
0|VP|RE|0|ADVP|DE|70|25|True
0|ADVP|RE|0|VP|DE|70|25|True
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0|ADVP|RE|0|ADVP|DE|70|25|True
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0|ADJP|RE|0|ADJP|DE|70|25|True
0|ADVP|RE|0|ADVP|DE|70|25|True
0|ADVP|RE|0|ADJP|DE|70|25|True
0|ADJP|RE|0|ADVP|DE|70|25|True

1|NP|RE|1|NP|DE|70|-2|True
1|VP|RE|1|VP|DE|70|-2|True
1|ADJP|RE|1|ADJP|DE|70|0|True
1|ADVP|RE|1|VP|ADVP|70|0|True
1|CONJP|RE|1|CONJP|DE|70|0|True
1|INTJ|RE|1|INTJ|DE|70|0|True
1|LST|RE|1|LST|DE|70|0|True
1|PP|RE|1|PP|DE|70|0|True
1|PRT|RE|1|PRT|DE|70|0|True
2|NP|RE|2|NP|DE|70|-2|True
2|VP|RE|2|VP|DE|70|-2|True
2|ADJP|RE|2|ADJP|DE|70|0|True

2|ADVP|RE|2|VP|ADVP|70|0|True
2|CONJP|RE|2|CONJP|DE|70|0|True
2|INTJ|RE|2|INTJ|DE|70|0|True
2|LST|RE|2|LST|DE|70|0|True
2|PP|RE|2|PP|DE|70|0|True
2|PRT|RE|2|PRT|DE|70|0|True
3|NP|RE|3|NP|DE|70|-2|True
3|VP|RE|3|VP|DE|70|-2|True
3|ADJP|RE|3|ADJP|DE|70|0|True
3|ADVP|RE|3|VP|ADVP|70|0|True
3|CONJP|RE|3|CONJP|DE|70|0|True
3|INTJ|RE|3|INTJ|DE|70|0|True
3|LST|RE|3|LST|DE|70|0|True
3|PP|RE|3|PP|DE|70|0|True
3|PRT|RE|3|PRT|DE|70|0|True
4|NP|RE|4|NP|DE|70|-2|True
4|VP|RE|4|VP|DE|70|-2|True
4|ADJP|RE|4|ADJP|DE|70|0|True
4|ADVP|RE|4|VP|ADVP|70|0|True
4|CONJP|RE|4|CONJP|DE|70|0|True
4|INTJ|RE|4|INTJ|DE|70|0|True
4|LST|RE|4|LST|DE|70|0|True
4|PP|RE|4|PP|DE|70|0|True
4|PRT|RE|4|PRT|DE|70|0|True
5|NP|RE|5|NP|DE|70|-2|True
5|VP|RE|5|VP|DE|70|-2|True
5|ADJP|RE|5|ADJP|DE|70|0|True
5|ADVP|RE|5|VP|ADVP|70|0|True
5|CONJP|RE|5|CONJP|DE|70|0|True
5|INTJ|RE|5|INTJ|DE|70|0|True
5|LST|RE|5|LST|DE|70|0|True
5|PP|RE|5|PP|DE|70|0|True
5|PRT|RE|5|PRT|DE|70|0|True
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6|VP|RE|6|VP|DE|70|-2|True
6|ADJP|RE|6|ADJP|DE|70|0|True
6|ADVP|RE|6|VP|ADVP|70|0|True
6|CONJP|RE|6|CONJP|DE|70|0|True
6|INTJ|RE|6|INTJ|DE|70|0|True
6|LST|RE|6|LST|DE|70|0|True
6|PP|RE|6|PP|DE|70|0|True
6|PRT|RE|6|PRT|DE|70|0|True
7|NP|RE|7|NP|DE|70|-2|True
7|VP|RE|7|VP|DE|70|-2|True
7|ADJP|RE|7|ADJP|DE|70|0|True
7|ADVP|RE|7|VP|ADVP|70|0|True

7|CONJP|RE|7|CONJP|DE|70|0|True
7|INTJ|RE|7|INTJ|DE|70|0|True
7|LST|RE|7|LST|DE|70|0|True
7|PP|RE|7|PP|DE|70|0|True
7|PRT|RE|7|PRT|DE|70|0|True

1|NP|RE|1|NP|DE|70|-2|True
1|VP|RE|1|VP|DE|70|-2|True
1|ADJP|RE|1|ADJP|DE|70|-2|True
1|ADVP|RE|1|VP|ADVP|70|-2|True
1|CONJP|RE|1|CONJP|DE|70|0|True
1|INTJ|RE|1|INTJ|DE|70|0|True
1|LST|RE|1|LST|DE|70|0|True
1|PP|RE|1|PP|DE|70|0|True
1|PRT|RE|1|PRT|DE|70|0|True
2|NP|RE|2|NP|DE|70|-2|True
2|VP|RE|2|VP|DE|70|-2|True
2|ADJP|RE|2|ADJP|DE|70|-2|True
2|ADVP|RE|2|VP|ADVP|70|-2|True
2|CONJP|RE|2|CONJP|DE|70|0|True
2|INTJ|RE|2|INTJ|DE|70|0|True
2|LST|RE|2|LST|DE|70|0|True
2|PP|RE|2|PP|DE|70|0|True
2|PRT|RE|2|PRT|DE|70|0|True
3|NP|RE|3|NP|DE|70|-2|True
3|VP|RE|3|VP|DE|70|-2|True
3|ADJP|RE|3|ADJP|DE|70|-2|True
3|ADVP|RE|3|VP|ADVP|70|-2|True
3|CONJP|RE|3|CONJP|DE|70|0|True
3|INTJ|RE|3|INTJ|DE|70|0|True
3|LST|RE|3|LST|DE|70|0|True
3|PP|RE|3|PP|DE|70|0|True
3|PRT|RE|3|PRT|DE|70|0|True
4|NP|RE|4|NP|DE|70|-2|True
4|VP|RE|4|VP|DE|70|-2|True
4|ADJP|RE|4|ADJP|DE|70|-2|True
4|ADVP|RE|4|VP|ADVP|70|-2|True
4|CONJP|RE|4|CONJP|DE|70|0|True
4|INTJ|RE|4|INTJ|DE|70|0|True
4|LST|RE|4|LST|DE|70|0|True
4|PP|RE|4|PP|DE|70|0|True
4|PRT|RE|4|PRT|DE|70|0|True
5|NP|RE|5|NP|DE|70|-2|True
5|VP|RE|5|VP|DE|70|-2|True
5|ADJP|RE|5|ADJP|DE|70|-2|True
5|ADVP|RE|5|VP|ADVP|70|-2|True

5|CONJP|RE|5|CONJP|DE|70|0|True
5|INTJ|RE|5|INTJ|DE|70|0|True
5|LST|RE|5|LST|DE|70|0|True
5|PP|RE|5|PP|DE|70|0|True
5|PRT|RE|5|PRT|DE|70|0|True
6|NP|RE|6|NP|DE|70|-2|True
6|VP|RE|6|VP|DE|70|-2|True
6|ADJP|RE|6|ADJP|DE|70|-2|True
6|ADVP|RE|6|VP|ADVP|70|-2|True
6|CONJP|RE|6|CONJP|DE|70|0|True
6|INTJ|RE|6|INTJ|DE|70|0|True
6|LST|RE|6|LST|DE|70|0|True
6|PP|RE|6|PP|DE|70|0|True
6|PRT|RE|6|PRT|DE|70|0|True
7|NP|RE|7|NP|DE|70|-2|True
7|VP|RE|7|VP|DE|70|-2|True
7|ADJP|RE|7|ADJP|DE|70|-2|True
7|ADVP|RE|7|VP|ADVP|70|-2|True
7|CONJP|RE|7|CONJP|DE|70|0|True
7|INTJ|RE|7|INTJ|DE|70|0|True
7|LST|RE|7|LST|DE|70|0|True
7|PP|RE|7|PP|DE|70|0|True
7|PRT|RE|7|PRT|DE|70|0|True

0|NP|RE|0|NP|DE|70|0|True
0|VP|RE|0|VP|DE|70|0|True
0|ADJP|RE|0|ADJP|DE|70|0|True
0|ADVP|RE|0|VP|ADVP|70|0|True
0|CONJP|RE|0|CONJP|DE|70|0|True
0|INTJ|RE|0|INTJ|DE|70|0|True
0|LST|RE|0|LST|DE|70|0|True
0|PP|RE|0|PP|DE|70|0|True
0|PRT|RE|0|PRT|DE|70|0|True

0|NP|RE|0|NP|DE|70|25|True
0|VP|RE|0|VP|DE|70|25|True
0|ADJP|RE|0|ADJP|DE|70|25|True
0|ADVP|RE|0|VP|ADVP|70|25|True
0|CONJP|RE|0|CONJP|DE|70|25|True
0|INTJ|RE|0|INTJ|DE|70|25|True
0|LST|RE|0|LST|DE|70|25|True
0|PP|RE|0|PP|DE|70|25|True
0|PRT|RE|0|PRT|DE|70|25|True

1|NP|RE|1|NP|DE|70|0|True
1|VP|RE|1|VP|DE|70|0|True

1|ADJP|RE|1|ADJP|DE|70|0|True
1|ADVP|RE|1|VP|ADVP|70|0|True
1|CONJP|RE|1|CONJP|DE|70|0|True
1|INTJ|RE|1|INTJ|DE|70|0|True
1|LST|RE|1|LST|DE|70|0|True
1|PP|RE|1|PP|DE|70|0|True
1|PRT|RE|1|PRT|DE|70|0|True
2|NP|RE|2|NP|DE|70|0|True
2|VP|RE|2|VP|DE|70|0|True
2|ADJP|RE|2|ADJP|DE|70|0|True
2|ADVP|RE|2|VP|ADVP|70|0|True
2|CONJP|RE|2|CONJP|DE|70|0|True
2|INTJ|RE|2|INTJ|DE|70|0|True
2|LST|RE|2|LST|DE|70|0|True
2|PP|RE|2|PP|DE|70|0|True
2|PRT|RE|2|PRT|DE|70|0|True
3|NP|RE|3|NP|DE|70|0|True
3|VP|RE|3|VP|DE|70|0|True
3|ADJP|RE|3|ADJP|DE|70|0|True
3|ADVP|RE|3|VP|ADVP|70|0|True
3|CONJP|RE|3|CONJP|DE|70|0|True
3|INTJ|RE|3|INTJ|DE|70|0|True
3|LST|RE|3|LST|DE|70|0|True
3|PP|RE|3|PP|DE|70|0|True
3|PRT|RE|3|PRT|DE|70|0|True
4|NP|RE|4|NP|DE|70|0|True
4|VP|RE|4|VP|DE|70|0|True
4|ADJP|RE|4|ADJP|DE|70|0|True
4|ADVP|RE|4|VP|ADVP|70|0|True
4|CONJP|RE|4|CONJP|DE|70|0|True
4|INTJ|RE|4|INTJ|DE|70|0|True
4|LST|RE|4|LST|DE|70|0|True
4|PP|RE|4|PP|DE|70|0|True
4|PRT|RE|4|PRT|DE|70|0|True
5|NP|RE|5|NP|DE|70|0|True
5|VP|RE|5|VP|DE|70|0|True
5|ADJP|RE|5|ADJP|DE|70|0|True
5|ADVP|RE|5|VP|ADVP|70|0|True
5|CONJP|RE|5|CONJP|DE|70|0|True
5|INTJ|RE|5|INTJ|DE|70|0|True
5|LST|RE|5|LST|DE|70|0|True
5|PP|RE|5|PP|DE|70|0|True
5|PRT|RE|5|PRT|DE|70|0|True
6|NP|RE|6|NP|DE|70|0|True
6|VP|RE|6|VP|DE|70|0|True
6|ADJP|RE|6|ADJP|DE|70|0|True

6|ADVP|RE|6|VP|ADVP|70|0|True
6|CONJP|RE|6|CONJP|DE|70|0|True
6|INTJ|RE|6|INTJ|DE|70|0|True
6|LST|RE|6|LST|DE|70|0|True
6|PP|RE|6|PP|DE|70|0|True
6|PRT|RE|6|PRT|DE|70|0|True
7|NP|RE|7|NP|DE|70|0|True
7|VP|RE|7|VP|DE|70|0|True
7|ADJP|RE|7|ADJP|DE|70|0|True
7|ADVP|RE|7|VP|ADVP|70|0|True
7|CONJP|RE|7|CONJP|DE|70|0|True
7|INTJ|RE|7|INTJ|DE|70|0|True
7|LST|RE|7|LST|DE|70|0|True
7|PP|RE|7|PP|DE|70|0|True
7|PRT|RE|7|PRT|DE|70|0|True

1|NP|RE|1|NP|DE|70|25|True
1|VP|RE|1|VP|DE|70|25|True
1|ADJP|RE|1|ADJP|DE|70|25|True
1|ADVP|RE|1|VP|ADVP|70|25|True
1|CONJP|RE|1|CONJP|DE|70|25|True
1|INTJ|RE|1|INTJ|DE|70|25|True
1|LST|RE|1|LST|DE|70|25|True
1|PP|RE|1|PP|DE|70|25|True
1|PRT|RE|1|PRT|DE|70|25|True
2|NP|RE|2|NP|DE|70|25|True
2|VP|RE|2|VP|DE|70|25|True
2|ADJP|RE|2|ADJP|DE|70|25|True
2|ADVP|RE|2|VP|ADVP|70|25|True
2|CONJP|RE|2|CONJP|DE|70|25|True
2|INTJ|RE|2|INTJ|DE|70|25|True
2|LST|RE|2|LST|DE|70|25|True
2|PP|RE|2|PP|DE|70|25|True
2|PRT|RE|2|PRT|DE|70|25|True
3|NP|RE|3|NP|DE|70|25|True
3|VP|RE|3|VP|DE|70|25|True
3|ADJP|RE|3|ADJP|DE|70|25|True
3|ADVP|RE|3|VP|ADVP|70|25|True
3|CONJP|RE|3|CONJP|DE|70|25|True
3|INTJ|RE|3|INTJ|DE|70|25|True
3|LST|RE|3|LST|DE|70|25|True
3|PP|RE|3|PP|DE|70|25|True
3|PRT|RE|3|PRT|DE|70|25|True
4|NP|RE|4|NP|DE|70|25|True
4|VP|RE|4|VP|DE|70|25|True
4|ADJP|RE|4|ADJP|DE|70|25|True

4|ADVP|RE|4|VP|ADVP|70|25|True
4|CONJP|RE|4|CONJP|DE|70|25|True
4|INTJ|RE|4|INTJ|DE|70|25|True
4|LST|RE|4|LST|DE|70|25|True
4|PP|RE|4|PP|DE|70|25|True
4|PRT|RE|4|PRT|DE|70|25|True
5|NP|RE|5|NP|DE|70|25|True
5|VP|RE|5|VP|DE|70|25|True
5|ADJP|RE|5|ADJP|DE|70|25|True
5|ADVP|RE|5|VP|ADVP|70|25|True
5|CONJP|RE|5|CONJP|DE|70|25|True
5|INTJ|RE|5|INTJ|DE|70|25|True
5|LST|RE|5|LST|DE|70|25|True
5|PP|RE|5|PP|DE|70|25|True
5|PRT|RE|5|PRT|DE|70|25|True
6|NP|RE|6|NP|DE|70|25|True
6|VP|RE|6|VP|DE|70|25|True
6|ADJP|RE|6|ADJP|DE|70|25|True
6|ADVP|RE|6|VP|ADVP|70|25|True
6|CONJP|RE|6|CONJP|DE|70|25|True
6|INTJ|RE|6|INTJ|DE|70|25|True
6|LST|RE|6|LST|DE|70|25|True
6|PP|RE|6|PP|DE|70|25|True
6|PRT|RE|6|PRT|DE|70|25|True
7|NP|RE|7|NP|DE|70|25|True
7|VP|RE|7|VP|DE|70|25|True
7|ADJP|RE|7|ADJP|DE|70|25|True
7|ADVP|RE|7|VP|ADVP|70|25|True
7|CONJP|RE|7|CONJP|DE|70|25|True
7|INTJ|RE|7|INTJ|DE|70|25|True
7|LST|RE|7|LST|DE|70|25|True
7|PP|RE|7|PP|DE|70|25|True
7|PRT|RE|7|PRT|DE|70|25|True

0|NP|RE|0|NP|DE|70|25|True
0|VP|RE|0|VP|DE|70|25|True
1|NP|RE|1|NP|DE|70|25|True
1|VP|RE|1|VP|DE|70|25|True
1|ADJP|RE|1|ADJP|DE|70|25|True
1|ADVP|RE|1|VP|ADVP|70|25|True
1|CONJP|RE|1|CONJP|DE|70|25|True
1|INTJ|RE|1|INTJ|DE|70|25|True
1|LST|RE|1|LST|DE|70|25|True
1|PP|RE|1|PP|DE|70|25|True
1|PRT|RE|1|PRT|DE|70|25|True
2|NP|RE|2|NP|DE|70|25|True

2|VP|RE|2|VP|DE|70|25|True
2|ADJP|RE|2|ADJP|DE|70|25|True
2|ADVP|RE|2|VP|ADVP|70|25|True
2|CONJP|RE|2|CONJP|DE|70|25|True
2|INTJ|RE|2|INTJ|DE|70|25|True
2|LST|RE|2|LST|DE|70|25|True
2|PP|RE|2|PP|DE|70|25|True
2|PRT|RE|2|PRT|DE|70|25|True
3|NP|RE|3|NP|DE|70|25|True
3|VP|RE|3|VP|DE|70|25|True
3|ADJP|RE|3|ADJP|DE|70|25|True
3|ADVP|RE|3|VP|ADVP|70|25|True
3|CONJP|RE|3|CONJP|DE|70|25|True
3|INTJ|RE|3|INTJ|DE|70|25|True
3|LST|RE|3|LST|DE|70|25|True
3|PP|RE|3|PP|DE|70|25|True
3|PRT|RE|3|PRT|DE|70|25|True
4|NP|RE|4|NP|DE|70|25|True
4|VP|RE|4|VP|DE|70|25|True
4|ADJP|RE|4|ADJP|DE|70|25|True
4|ADVP|RE|4|VP|ADVP|70|25|True
4|CONJP|RE|4|CONJP|DE|70|25|True
4|INTJ|RE|4|INTJ|DE|70|25|True
4|LST|RE|4|LST|DE|70|25|True
4|PP|RE|4|PP|DE|70|25|True
4|PRT|RE|4|PRT|DE|70|25|True
5|NP|RE|5|NP|DE|70|25|True
5|VP|RE|5|VP|DE|70|25|True
5|ADJP|RE|5|ADJP|DE|70|25|True
5|ADVP|RE|5|VP|ADVP|70|25|True
5|CONJP|RE|5|CONJP|DE|70|25|True
5|INTJ|RE|5|INTJ|DE|70|25|True
5|LST|RE|5|LST|DE|70|25|True
5|PP|RE|5|PP|DE|70|25|True
5|PRT|RE|5|PRT|DE|70|25|True
6|NP|RE|6|NP|DE|70|25|True
6|VP|RE|6|VP|DE|70|25|True
6|ADJP|RE|6|ADJP|DE|70|25|True
6|ADVP|RE|6|VP|ADVP|70|25|True
6|CONJP|RE|6|CONJP|DE|70|25|True
6|INTJ|RE|6|INTJ|DE|70|25|True
6|LST|RE|6|LST|DE|70|25|True
6|PP|RE|6|PP|DE|70|25|True
6|PRT|RE|6|PRT|DE|70|25|True
7|NP|RE|7|NP|DE|70|25|True
7|VP|RE|7|VP|DE|70|25|True

7|ADJP|RE|7|ADJP|DE|70|25|True
7|ADVP|RE|7|VP|ADVP|70|25|True
7|CONJP|RE|7|CONJP|DE|70|25|True
7|INTJ|RE|7|INTJ|DE|70|25|True
7|LST|RE|7|LST|DE|70|25|True
7|PP|RE|7|PP|DE|70|25|True
7|PRT|RE|7|PRT|DE|70|25|True

0|NP|RE|0|NP|DE|80|-2|True
0|VP|RE|0|VP|DE|80|-2|True
0|ADJP|RE|0|ADJP|DE|80|0|True
0|ADVP|RE|0|VP|ADVP|80|0|True
0|CONJP|RE|0|CONJP|DE|80|0|True
0|INTJ|RE|0|INTJ|DE|80|0|True
0|LST|RE|0|LST|DE|80|0|True
0|PP|RE|0|PP|DE|80|0|True
0|PRT|RE|0|PRT|DE|80|0|True

0|NP|RE|0|NP|DE|80|25|True
0|VP|RE|0|VP|DE|80|25|True
0|ADJP|RE|0|ADJP|DE|80|25|True
0|ADVP|RE|0|ADVP|DE|80|25|True
1|NP|RE|1|NP|DE|80|25|True
1|VP|RE|1|VP|DE|80|25|True
1|ADJP|RE|1|ADJP|DE|80|25|True
1|ADVP|RE|1|VP|ADVP|80|25|True
1|CONJP|RE|1|CONJP|DE|80|25|True
1|INTJ|RE|1|INTJ|DE|80|25|True
1|LST|RE|1|LST|DE|80|25|True
1|PP|RE|1|PP|DE|80|25|True
1|PRT|RE|1|PRT|DE|80|25|True
2|NP|RE|2|NP|DE|80|25|True
2|VP|RE|2|VP|DE|80|25|True
2|ADJP|RE|2|ADJP|DE|80|25|True
2|ADVP|RE|2|VP|ADVP|80|25|True
2|CONJP|RE|2|CONJP|DE|80|25|True
2|INTJ|RE|2|INTJ|DE|80|25|True
2|LST|RE|2|LST|DE|80|25|True
2|PP|RE|2|PP|DE|80|25|True
2|PRT|RE|2|PRT|DE|80|25|True
3|NP|RE|3|NP|DE|80|25|True
3|VP|RE|3|VP|DE|80|25|True
3|ADJP|RE|3|ADJP|DE|80|25|True
3|ADVP|RE|3|VP|ADVP|80|25|True
3|CONJP|RE|3|CONJP|DE|80|25|True
3|INTJ|RE|3|INTJ|DE|80|25|True

3|LST|RE|3|LST|DE|80|25|True
3|PP|RE|3|PP|DE|80|25|True
3|PRT|RE|3|PRT|DE|80|25|True
4|NP|RE|4|NP|DE|80|25|True
4|VP|RE|4|VP|DE|80|25|True
4|ADJP|RE|4|ADJP|DE|80|25|True
4|ADVP|RE|4|VP|ADVP|80|25|True
4|CONJP|RE|4|CONJP|DE|80|25|True
4|INTJ|RE|4|INTJ|DE|80|25|True
4|LST|RE|4|LST|DE|80|25|True
4|PP|RE|4|PP|DE|80|25|True
4|PRT|RE|4|PRT|DE|80|25|True
5|NP|RE|5|NP|DE|80|25|True
5|VP|RE|5|VP|DE|80|25|True
5|ADJP|RE|5|ADJP|DE|80|25|True
5|ADVP|RE|5|VP|ADVP|80|25|True
5|CONJP|RE|5|CONJP|DE|80|25|True
5|INTJ|RE|5|INTJ|DE|80|25|True
5|LST|RE|5|LST|DE|80|25|True
5|PP|RE|5|PP|DE|80|25|True
5|PRT|RE|5|PRT|DE|80|25|True
6|NP|RE|6|NP|DE|80|25|True
6|VP|RE|6|VP|DE|80|25|True
6|ADJP|RE|6|ADJP|DE|80|25|True
6|ADVP|RE|6|VP|ADVP|80|25|True
6|CONJP|RE|6|CONJP|DE|80|25|True
6|INTJ|RE|6|INTJ|DE|80|25|True
6|LST|RE|6|LST|DE|80|25|True
6|PP|RE|6|PP|DE|80|25|True
6|PRT|RE|6|PRT|DE|80|25|True
7|NP|RE|7|NP|DE|80|25|True
7|VP|RE|7|VP|DE|80|25|True
7|ADJP|RE|7|ADJP|DE|80|25|True
7|ADVP|RE|7|VP|ADVP|80|25|True
7|CONJP|RE|7|CONJP|DE|80|25|True
7|INTJ|RE|7|INTJ|DE|80|25|True
7|LST|RE|7|LST|DE|80|25|True
7|PP|RE|7|PP|DE|80|25|True
7|PRT|RE|7|PRT|DE|80|25|True

0|NP|RE|0|NP|DE|80|0|True
0|VP|RE|0|VP|DE|80|0|True
1|NP|RE|1|NP|DE|80|0|True
1|VP|RE|1|VP|DE|80|0|True
1|ADJP|RE|1|ADJP|DE|80|0|True
1|ADVP|RE|1|VP|ADVP|80|0|True

1|CONJP|RE|1|CONJP|DE|80|0|True
1|INTJ|RE|1|INTJ|DE|80|0|True
1|LST|RE|1|LST|DE|80|0|True
1|PP|RE|1|PP|DE|80|0|True
1|PRT|RE|1|PRT|DE|80|0|True
2|NP|RE|2|NP|DE|80|0|True
2|VP|RE|2|VP|DE|80|0|True
2|ADJP|RE|2|ADJP|DE|80|0|True
2|ADVP|RE|2|VP|ADVP|80|0|True
2|CONJP|RE|2|CONJP|DE|80|0|True
2|INTJ|RE|2|INTJ|DE|80|0|True
2|LST|RE|2|LST|DE|80|0|True
2|PP|RE|2|PP|DE|80|0|True
2|PRT|RE|2|PRT|DE|80|0|True
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3|ADJP|RE|3|ADJP|DE|80|0|True
3|ADVP|RE|3|VP|ADVP|80|0|True
3|CONJP|RE|3|CONJP|DE|80|0|True
3|INTJ|RE|3|INTJ|DE|80|0|True
3|LST|RE|3|LST|DE|80|0|True
3|PP|RE|3|PP|DE|80|0|True
3|PRT|RE|3|PRT|DE|80|0|True
4|NP|RE|4|NP|DE|80|0|True
4|VP|RE|4|VP|DE|80|0|True
4|ADJP|RE|4|ADJP|DE|80|0|True
4|ADVP|RE|4|VP|ADVP|80|0|True
4|CONJP|RE|4|CONJP|DE|80|0|True
4|INTJ|RE|4|INTJ|DE|80|0|True
4|LST|RE|4|LST|DE|80|0|True
4|PP|RE|4|PP|DE|80|0|True
4|PRT|RE|4|PRT|DE|80|0|True
5|NP|RE|5|NP|DE|80|0|True
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5|ADJP|RE|5|ADJP|DE|80|0|True
5|ADVP|RE|5|VP|ADVP|80|0|True
5|CONJP|RE|5|CONJP|DE|80|0|True
5|INTJ|RE|5|INTJ|DE|80|0|True
5|LST|RE|5|LST|DE|80|0|True
5|PP|RE|5|PP|DE|80|0|True
5|PRT|RE|5|PRT|DE|80|0|True
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6|VP|RE|6|VP|DE|80|0|True
6|ADJP|RE|6|ADJP|DE|80|0|True
6|ADVP|RE|6|VP|ADVP|80|0|True
6|CONJP|RE|6|CONJP|DE|80|0|True

6|INTJ|RE|6|INTJ|DE|80|0|True
6|LST|RE|6|LST|DE|80|0|True
6|PP|RE|6|PP|DE|80|0|True
6|PRT|RE|6|PRT|DE|80|0|True
7|NP|RE|7|NP|DE|80|0|True
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7|ADJP|RE|7|ADJP|DE|80|0|True
7|ADVP|RE|7|VP|ADVP|80|0|True
7|CONJP|RE|7|CONJP|DE|80|0|True
7|INTJ|RE|7|INTJ|DE|80|0|True
7|LST|RE|7|LST|DE|80|0|True
7|PP|RE|7|PP|DE|80|0|True
7|PRT|RE|7|PRT|DE|80|0|True

0|NP|RE|0|NP|DE|80|0|True
0|VP|RE|0|VP|DE|80|0|True
0|ADJP|RE|0|ADJP|DE|80|0|True
0|ADVP|RE|0|ADVP|DE|80|0|True
1|NP|RE|1|NP|DE|80|0|True
1|VP|RE|1|VP|DE|80|0|True
1|ADJP|RE|1|ADJP|DE|80|0|True
1|ADVP|RE|1|VP|ADVP|80|0|True
1|CONJP|RE|1|CONJP|DE|80|0|True
1|INTJ|RE|1|INTJ|DE|80|0|True
1|LST|RE|1|LST|DE|80|0|True
1|PP|RE|1|PP|DE|80|0|True
1|PRT|RE|1|PRT|DE|80|0|True
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2|ADJP|RE|2|ADJP|DE|80|0|True
2|ADVP|RE|2|VP|ADVP|80|0|True
2|CONJP|RE|2|CONJP|DE|80|0|True
2|INTJ|RE|2|INTJ|DE|80|0|True
2|LST|RE|2|LST|DE|80|0|True
2|PP|RE|2|PP|DE|80|0|True
2|PRT|RE|2|PRT|DE|80|0|True
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3|ADJP|RE|3|ADJP|DE|80|0|True
3|ADVP|RE|3|VP|ADVP|80|0|True
3|CONJP|RE|3|CONJP|DE|80|0|True
3|INTJ|RE|3|INTJ|DE|80|0|True
3|LST|RE|3|LST|DE|80|0|True
3|PP|RE|3|PP|DE|80|0|True
3|PRT|RE|3|PRT|DE|80|0|True
4|NP|RE|4|NP|DE|80|0|True

4|VP|RE|4|VP|DE|80|0|True
4|ADJP|RE|4|ADJP|DE|80|0|True
4|ADVP|RE|4|VP|ADVP|80|0|True
4|CONJP|RE|4|CONJP|DE|80|0|True
4|INTJ|RE|4|INTJ|DE|80|0|True
4|LST|RE|4|LST|DE|80|0|True
4|PP|RE|4|PP|DE|80|0|True
4|PRT|RE|4|PRT|DE|80|0|True
5|NP|RE|5|NP|DE|80|0|True
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5|ADVP|RE|5|VP|ADVP|80|0|True
5|CONJP|RE|5|CONJP|DE|80|0|True
5|INTJ|RE|5|INTJ|DE|80|0|True
5|LST|RE|5|LST|DE|80|0|True
5|PP|RE|5|PP|DE|80|0|True
5|PRT|RE|5|PRT|DE|80|0|True
6|NP|RE|6|NP|DE|80|0|True
6|VP|RE|6|VP|DE|80|0|True
6|ADJP|RE|6|ADJP|DE|80|0|True
6|ADVP|RE|6|VP|ADVP|80|0|True
6|CONJP|RE|6|CONJP|DE|80|0|True
6|INTJ|RE|6|INTJ|DE|80|0|True
6|LST|RE|6|LST|DE|80|0|True
6|PP|RE|6|PP|DE|80|0|True
6|PRT|RE|6|PRT|DE|80|0|True
7|NP|RE|7|NP|DE|80|0|True
7|VP|RE|7|VP|DE|80|0|True
7|ADJP|RE|7|ADJP|DE|80|0|True
7|ADVP|RE|7|VP|ADVP|80|0|True
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3|NP|RE|3|NP|DE|80|25|True
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3|VP|RE|3|NP|DE|80|25|True
3|NP|RE|3|VP|DE|80|25|True
4|NP|RE|4|NP|DE|80|25|True
4|VP|RE|4|VP|DE|80|25|True
4|VP|RE|4|NP|DE|80|25|True
4|NP|RE|4|VP|DE|80|25|True
5|NP|RE|5|NP|DE|80|25|True

5|VP|RE|5|VP|DE|80|25|True
5|VP|RE|5|NP|DE|80|25|True
5|NP|RE|5|VP|DE|80|25|True
6|NP|RE|6|NP|DE|80|25|True
6|VP|RE|6|VP|DE|80|25|True
6|VP|RE|6|NP|DE|80|25|True
6|NP|RE|6|VP|DE|80|25|True
7|NP|RE|7|NP|DE|80|25|True
7|VP|RE|7|VP|DE|80|25|True
7|VP|RE|7|NP|DE|80|25|True
7|NP|RE|7|VP|DE|80|25|True

1|NP|RE|1|NP|DE|80|0|True
1|VP|RE|1|VP|DE|80|0|True
1|VP|RE|1|NP|DE|80|0|True
1|NP|RE|1|VP|DE|80|0|True
2|NP|RE|2|NP|DE|80|0|True
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3|VP|RE|3|NP|DE|80|0|True
3|NP|RE|3|VP|DE|80|0|True
4|NP|RE|4|NP|DE|80|0|True
4|VP|RE|4|VP|DE|80|0|True
4|VP|RE|4|NP|DE|80|0|True
4|NP|RE|4|VP|DE|80|0|True
5|NP|RE|5|NP|DE|80|0|True
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5|VP|RE|5|NP|DE|80|0|True
5|NP|RE|5|VP|DE|80|0|True
6|NP|RE|6|NP|DE|80|0|True
6|VP|RE|6|VP|DE|80|0|True
6|VP|RE|6|NP|DE|80|0|True
6|NP|RE|6|VP|DE|80|0|True
7|NP|RE|7|NP|DE|80|0|True
7|VP|RE|7|VP|DE|80|0|True
7|VP|RE|7|NP|DE|80|0|True
7|NP|RE|7|VP|DE|80|0|True
1|ADJP|RE|1|ADJP|DE|80|0|True
1|ADVP|RE|1|ADVP|DE|80|0|True
1|ADVP|RE|1|ADJP|DE|80|0|True
1|ADJP|RE|1|ADVP|DE|80|0|True
2|ADJP|RE|2|ADJP|DE|80|0|True
2|ADVP|RE|2|ADVP|DE|80|0|True

2|ADVP|RE|2|ADJP|DE|80|0|True
2|ADJP|RE|2|ADVP|DE|80|0|True
3|ADJP|RE|3|ADJP|DE|80|0|True
3|ADVP|RE|3|ADVP|DE|80|0|True
3|ADVP|RE|3|ADJP|DE|80|0|True
3|ADJP|RE|3|ADVP|DE|80|0|True
4|ADJP|RE|4|ADJP|DE|80|0|True
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4|ADJP|RE|4|ADVP|DE|80|0|True
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7|ADJP|RE|7|ADJP|DE|80|0|True
7|ADVP|RE|7|ADVP|DE|80|0|True
7|ADVP|RE|7|ADJP|DE|80|0|True
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1|NP|RE|1|NP|DE|80|25|True
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1|VP|RE|1|NP|DE|80|25|True
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2|NP|RE|2|NP|DE|80|25|True
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3|VP|RE|3|NP|DE|80|25|True
3|NP|RE|3|VP|DE|80|25|True
4|NP|RE|4|NP|DE|80|25|True
4|VP|RE|4|VP|DE|80|25|True
4|VP|RE|4|NP|DE|80|25|True
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5|NP|RE|5|NP|DE|80|25|True
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5|NP|RE|5|VP|DE|80|25|True
6|NP|RE|6|NP|DE|80|25|True
6|VP|RE|6|VP|DE|80|25|True
6|VP|RE|6|NP|DE|80|25|True

6|NP|RE|6|VP|DE|80|25|True
7|NP|RE|7|NP|DE|80|25|True
7|VP|RE|7|VP|DE|80|25|True
7|VP|RE|7|NP|DE|80|25|True
7|NP|RE|7|VP|DE|80|25|True
1|ADJP|RE|1|ADJP|DE|80|25|True
1|ADVP|RE|1|ADVP|DE|80|25|True
1|ADVP|RE|1|ADJP|DE|80|25|True
1|ADJP|RE|1|ADVP|DE|80|25|True
2|ADJP|RE|2|ADJP|DE|80|25|True
2|ADVP|RE|2|ADVP|DE|80|25|True
2|ADVP|RE|2|ADJP|DE|80|25|True
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3|ADJP|RE|3|ADVP|DE|80|25|True
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4|ADJP|RE|4|ADVP|DE|80|25|True
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6|ADJP|RE|6|ADVP|DE|80|25|True
7|ADJP|RE|7|ADJP|DE|80|25|True
7|ADVP|RE|7|ADVP|DE|80|25|True
7|ADVP|RE|7|ADJP|DE|80|25|True
7|ADJP|RE|7|ADVP|DE|80|25|True

0|NP|RE|0|NP|DE|80|0|True
0|VP|RE|0|VP|DE|80|0|True
0|VP|RE|0|NP|DE|80|0|True
0|NP|RE|0|VP|DE|80|0|True

0|NP|RE|0|NP|DE|80|25|True
0|VP|RE|0|VP|DE|80|25|True
0|VP|RE|0|NP|DE|80|25|True
0|NP|RE|0|VP|DE|80|25|True

0|NP|RE|0|NP|DE|80|0|True
0|VP|RE|0|VP|DE|80|0|True

0|VP|RE|0|NP|DE|80|0|True
0|NP|RE|0|VP|DE|80|0|True
0|ADJP|RE|0|ADJP|DE|80|0|True
0|VP|RE|0|VP|DE|80|0|True
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0|ADVP|RE|0|ADVP|DE|80|0|True
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0|ADJP|RE|0|ADJP|DE|80|0|True
0|ADVP|RE|0|ADVP|DE|80|0|True
0|ADVP|RE|0|ADJP|DE|80|0|True
0|ADJP|RE|0|ADVP|DE|80|0|True

0|NP|RE|0|NP|DE|80|25|True
0|VP|RE|0|VP|DE|80|25|True
0|VP|RE|0|NP|DE|80|25|True
0|NP|RE|0|VP|DE|80|25|True
0|ADJP|RE|0|ADJP|DE|80|25|True
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0|ADJP|RE|0|ADJP|DE|80|25|True
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0|NP|RE|0|ADJP|DE|80|25|True
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0|VP|RE|0|VP|DE|80|25|True
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0|NP|RE|0|ADVP|DE|80|25|True
0|ADJP|RE|0|ADJP|DE|80|25|True
0|ADVP|RE|0|ADVP|DE|80|25|True
0|ADVP|RE|0|ADJP|DE|80|25|True

0|ADJP|RE|0|ADVP|DE|80|25|True

1|NP|RE|1|NP|DE|80|-2|True
1|VP|RE|1|VP|DE|80|-2|True
1|ADJP|RE|1|ADJP|DE|80|0|True
1|ADVP|RE|1|VP|ADVP|80|0|True
1|CONJP|RE|1|CONJP|DE|80|0|True
1|INTJ|RE|1|INTJ|DE|80|0|True
1|LST|RE|1|LST|DE|80|0|True
1|PP|RE|1|PP|DE|80|0|True
1|PRT|RE|1|PRT|DE|80|0|True
2|NP|RE|2|NP|DE|80|-2|True
2|VP|RE|2|VP|DE|80|-2|True
2|ADJP|RE|2|ADJP|DE|80|0|True
2|ADVP|RE|2|VP|ADVP|80|0|True
2|CONJP|RE|2|CONJP|DE|80|0|True
2|INTJ|RE|2|INTJ|DE|80|0|True
2|LST|RE|2|LST|DE|80|0|True
2|PP|RE|2|PP|DE|80|0|True
2|PRT|RE|2|PRT|DE|80|0|True
3|NP|RE|3|NP|DE|80|-2|True
3|VP|RE|3|VP|DE|80|-2|True
3|ADJP|RE|3|ADJP|DE|80|0|True
3|ADVP|RE|3|VP|ADVP|80|0|True
3|CONJP|RE|3|CONJP|DE|80|0|True
3|INTJ|RE|3|INTJ|DE|80|0|True
3|LST|RE|3|LST|DE|80|0|True
3|PP|RE|3|PP|DE|80|0|True
3|PRT|RE|3|PRT|DE|80|0|True
4|NP|RE|4|NP|DE|80|-2|True
4|VP|RE|4|VP|DE|80|-2|True
4|ADJP|RE|4|ADJP|DE|80|0|True
4|ADVP|RE|4|VP|ADVP|80|0|True
4|CONJP|RE|4|CONJP|DE|80|0|True
4|INTJ|RE|4|INTJ|DE|80|0|True
4|LST|RE|4|LST|DE|80|0|True
4|PP|RE|4|PP|DE|80|0|True
4|PRT|RE|4|PRT|DE|80|0|True
5|NP|RE|5|NP|DE|80|-2|True
5|VP|RE|5|VP|DE|80|-2|True
5|ADJP|RE|5|ADJP|DE|80|0|True
5|ADVP|RE|5|VP|ADVP|80|0|True
5|CONJP|RE|5|CONJP|DE|80|0|True
5|INTJ|RE|5|INTJ|DE|80|0|True
5|LST|RE|5|LST|DE|80|0|True
5|PP|RE|5|PP|DE|80|0|True

5|PRT|RE|5|PRT|DE|80|0|True
6|NP|RE|6|NP|DE|80|-2|True
6|VP|RE|6|VP|DE|80|-2|True
6|ADJP|RE|6|ADJP|DE|80|0|True
6|ADVP|RE|6|VP|ADVP|80|0|True
6|CONJP|RE|6|CONJP|DE|80|0|True
6|INTJ|RE|6|INTJ|DE|80|0|True
6|LST|RE|6|LST|DE|80|0|True
6|PP|RE|6|PP|DE|80|0|True
6|PRT|RE|6|PRT|DE|80|0|True
7|NP|RE|7|NP|DE|80|-2|True
7|VP|RE|7|VP|DE|80|-2|True
7|ADJP|RE|7|ADJP|DE|80|0|True
7|ADVP|RE|7|VP|ADVP|80|0|True
7|CONJP|RE|7|CONJP|DE|80|0|True
7|INTJ|RE|7|INTJ|DE|80|0|True
7|LST|RE|7|LST|DE|80|0|True
7|PP|RE|7|PP|DE|80|0|True
7|PRT|RE|7|PRT|DE|80|0|True

1|NP|RE|1|NP|DE|80|-2|True
1|VP|RE|1|VP|DE|80|-2|True
1|ADJP|RE|1|ADJP|DE|80|-2|True
1|ADVP|RE|1|VP|ADVP|80|-2|True
1|CONJP|RE|1|CONJP|DE|80|0|True
1|INTJ|RE|1|INTJ|DE|80|0|True
1|LST|RE|1|LST|DE|80|0|True
1|PP|RE|1|PP|DE|80|0|True
1|PRT|RE|1|PRT|DE|80|0|True
2|NP|RE|2|NP|DE|80|-2|True
2|VP|RE|2|VP|DE|80|-2|True
2|ADJP|RE|2|ADJP|DE|80|-2|True
2|ADVP|RE|2|VP|ADVP|80|-2|True
2|CONJP|RE|2|CONJP|DE|80|0|True
2|INTJ|RE|2|INTJ|DE|80|0|True
2|LST|RE|2|LST|DE|80|0|True
2|PP|RE|2|PP|DE|80|0|True
2|PRT|RE|2|PRT|DE|80|0|True
3|NP|RE|3|NP|DE|80|-2|True
3|VP|RE|3|VP|DE|80|-2|True
3|ADJP|RE|3|ADJP|DE|80|-2|True
3|ADVP|RE|3|VP|ADVP|80|-2|True
3|CONJP|RE|3|CONJP|DE|80|0|True
3|INTJ|RE|3|INTJ|DE|80|0|True
3|LST|RE|3|LST|DE|80|0|True
3|PP|RE|3|PP|DE|80|0|True

3|PRT|RE|3|PRT|DE|80|0|True
4|NP|RE|4|NP|DE|80|-2|True
4|VP|RE|4|VP|DE|80|-2|True
4|ADJP|RE|4|ADJP|DE|80|-2|True
4|ADVP|RE|4|VP|ADVP|80|-2|True
4|CONJP|RE|4|CONJP|DE|80|0|True
4|INTJ|RE|4|INTJ|DE|80|0|True
4|LST|RE|4|LST|DE|80|0|True
4|PP|RE|4|PP|DE|80|0|True
4|PRT|RE|4|PRT|DE|80|0|True
5|NP|RE|5|NP|DE|80|-2|True
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5|ADJP|RE|5|ADJP|DE|80|-2|True
5|ADVP|RE|5|VP|ADVP|80|-2|True
5|CONJP|RE|5|CONJP|DE|80|0|True
5|INTJ|RE|5|INTJ|DE|80|0|True
5|LST|RE|5|LST|DE|80|0|True
5|PP|RE|5|PP|DE|80|0|True
5|PRT|RE|5|PRT|DE|80|0|True
6|NP|RE|6|NP|DE|80|-2|True
6|VP|RE|6|VP|DE|80|-2|True
6|ADJP|RE|6|ADJP|DE|80|-2|True
6|ADVP|RE|6|VP|ADVP|80|-2|True
6|CONJP|RE|6|CONJP|DE|80|0|True
6|INTJ|RE|6|INTJ|DE|80|0|True
6|LST|RE|6|LST|DE|80|0|True
6|PP|RE|6|PP|DE|80|0|True
6|PRT|RE|6|PRT|DE|80|0|True
7|NP|RE|7|NP|DE|80|-2|True
7|VP|RE|7|VP|DE|80|-2|True
7|ADJP|RE|7|ADJP|DE|80|-2|True
7|ADVP|RE|7|VP|ADVP|80|-2|True
7|CONJP|RE|7|CONJP|DE|80|0|True
7|INTJ|RE|7|INTJ|DE|80|0|True
7|LST|RE|7|LST|DE|80|0|True
7|PP|RE|7|PP|DE|80|0|True
7|PRT|RE|7|PRT|DE|80|0|True

0|NP|RE|0|NP|DE|80|0|True
0|VP|RE|0|VP|DE|80|0|True
0|ADJP|RE|0|ADJP|DE|80|0|True
0|ADVP|RE|0|VP|ADVP|80|0|True
0|CONJP|RE|0|CONJP|DE|80|0|True
0|INTJ|RE|0|INTJ|DE|80|0|True
0|LST|RE|0|LST|DE|80|0|True
0|PP|RE|0|PP|DE|80|0|True

0|PRT|RE|0|PRT|DE|80|0|True

0|NP|RE|0|NP|DE|80|25|True
0|VP|RE|0|VP|DE|80|25|True
0|ADJP|RE|0|ADJP|DE|80|25|True
0|ADVP|RE|0|VP|ADVP|80|25|True
0|CONJP|RE|0|CONJP|DE|80|25|True
0|INTJ|RE|0|INTJ|DE|80|25|True
0|LST|RE|0|LST|DE|80|25|True
0|PP|RE|0|PP|DE|80|25|True
0|PRT|RE|0|PRT|DE|80|25|True

1|NP|RE|1|NP|DE|80|0|True
1|VP|RE|1|VP|DE|80|0|True
1|ADJP|RE|1|ADJP|DE|80|0|True
1|ADVP|RE|1|VP|ADVP|80|0|True
1|CONJP|RE|1|CONJP|DE|80|0|True
1|INTJ|RE|1|INTJ|DE|80|0|True
1|LST|RE|1|LST|DE|80|0|True
1|PP|RE|1|PP|DE|80|0|True
1|PRT|RE|1|PRT|DE|80|0|True
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2|ADJP|RE|2|ADJP|DE|80|0|True
2|ADVP|RE|2|VP|ADVP|80|0|True
2|CONJP|RE|2|CONJP|DE|80|0|True
2|INTJ|RE|2|INTJ|DE|80|0|True
2|LST|RE|2|LST|DE|80|0|True
2|PP|RE|2|PP|DE|80|0|True
2|PRT|RE|2|PRT|DE|80|0|True
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3|ADJP|RE|3|ADJP|DE|80|0|True
3|ADVP|RE|3|VP|ADVP|80|0|True
3|CONJP|RE|3|CONJP|DE|80|0|True
3|INTJ|RE|3|INTJ|DE|80|0|True
3|LST|RE|3|LST|DE|80|0|True
3|PP|RE|3|PP|DE|80|0|True
3|PRT|RE|3|PRT|DE|80|0|True
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4|ADVP|RE|4|VP|ADVP|80|0|True
4|CONJP|RE|4|CONJP|DE|80|0|True
4|INTJ|RE|4|INTJ|DE|80|0|True
4|LST|RE|4|LST|DE|80|0|True

4|PP|RE|4|PP|DE|80|0|True
4|PRT|RE|4|PRT|DE|80|0|True
5|NP|RE|5|NP|DE|80|0|True
5|VP|RE|5|VP|DE|80|0|True
5|ADJP|RE|5|ADJP|DE|80|0|True
5|ADVP|RE|5|VP|ADVP|80|0|True
5|CONJP|RE|5|CONJP|DE|80|0|True
5|INTJ|RE|5|INTJ|DE|80|0|True
5|LST|RE|5|LST|DE|80|0|True
5|PP|RE|5|PP|DE|80|0|True
5|PRT|RE|5|PRT|DE|80|0|True
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6|ADJP|RE|6|ADJP|DE|80|0|True
6|ADVP|RE|6|VP|ADVP|80|0|True
6|CONJP|RE|6|CONJP|DE|80|0|True
6|INTJ|RE|6|INTJ|DE|80|0|True
6|LST|RE|6|LST|DE|80|0|True
6|PP|RE|6|PP|DE|80|0|True
6|PRT|RE|6|PRT|DE|80|0|True
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7|ADVP|RE|7|VP|ADVP|80|0|True
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7|INTJ|RE|7|INTJ|DE|80|0|True
7|LST|RE|7|LST|DE|80|0|True
7|PP|RE|7|PP|DE|80|0|True
7|PRT|RE|7|PRT|DE|80|0|True

1|NP|RE|1|NP|DE|80|25|True
1|VP|RE|1|VP|DE|80|25|True
1|ADJP|RE|1|ADJP|DE|80|25|True
1|ADVP|RE|1|VP|ADVP|80|25|True
1|CONJP|RE|1|CONJP|DE|80|25|True
1|INTJ|RE|1|INTJ|DE|80|25|True
1|LST|RE|1|LST|DE|80|25|True
1|PP|RE|1|PP|DE|80|25|True
1|PRT|RE|1|PRT|DE|80|25|True
2|NP|RE|2|NP|DE|80|25|True
2|VP|RE|2|VP|DE|80|25|True
2|ADJP|RE|2|ADJP|DE|80|25|True
2|ADVP|RE|2|VP|ADVP|80|25|True
2|CONJP|RE|2|CONJP|DE|80|25|True
2|INTJ|RE|2|INTJ|DE|80|25|True
2|LST|RE|2|LST|DE|80|25|True

2|PP|RE|2|PP|DE|80|25|True
2|PRT|RE|2|PRT|DE|80|25|True
3|NP|RE|3|NP|DE|80|25|True
3|VP|RE|3|VP|DE|80|25|True
3|ADJP|RE|3|ADJP|DE|80|25|True
3|ADVP|RE|3|VP|ADVP|80|25|True
3|CONJP|RE|3|CONJP|DE|80|25|True
3|INTJ|RE|3|INTJ|DE|80|25|True
3|LST|RE|3|LST|DE|80|25|True
3|PP|RE|3|PP|DE|80|25|True
3|PRT|RE|3|PRT|DE|80|25|True
4|NP|RE|4|NP|DE|80|25|True
4|VP|RE|4|VP|DE|80|25|True
4|ADJP|RE|4|ADJP|DE|80|25|True
4|ADVP|RE|4|VP|ADVP|80|25|True
4|CONJP|RE|4|CONJP|DE|80|25|True
4|INTJ|RE|4|INTJ|DE|80|25|True
4|LST|RE|4|LST|DE|80|25|True
4|PP|RE|4|PP|DE|80|25|True
4|PRT|RE|4|PRT|DE|80|25|True
5|NP|RE|5|NP|DE|80|25|True
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5|ADJP|RE|5|ADJP|DE|80|25|True
5|ADVP|RE|5|VP|ADVP|80|25|True
5|CONJP|RE|5|CONJP|DE|80|25|True
5|INTJ|RE|5|INTJ|DE|80|25|True
5|LST|RE|5|LST|DE|80|25|True
5|PP|RE|5|PP|DE|80|25|True
5|PRT|RE|5|PRT|DE|80|25|True
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6|ADJP|RE|6|ADJP|DE|80|25|True
6|ADVP|RE|6|VP|ADVP|80|25|True
6|CONJP|RE|6|CONJP|DE|80|25|True
6|INTJ|RE|6|INTJ|DE|80|25|True
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6|PP|RE|6|PP|DE|80|25|True
6|PRT|RE|6|PRT|DE|80|25|True
7|NP|RE|7|NP|DE|80|25|True
7|VP|RE|7|VP|DE|80|25|True
7|ADJP|RE|7|ADJP|DE|80|25|True
7|ADVP|RE|7|VP|ADVP|80|25|True
7|CONJP|RE|7|CONJP|DE|80|25|True
7|INTJ|RE|7|INTJ|DE|80|25|True
7|LST|RE|7|LST|DE|80|25|True
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7|PRT|RE|7|PRT|DE|80|25|True

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1|ADJP|RE|1|ADJP|DE|80|25|True
1|ADVP|RE|1|VP|ADVP|80|25|True
1|CONJP|RE|1|CONJP|DE|80|25|True
1|INTJ|RE|1|INTJ|DE|80|25|True
1|LST|RE|1|LST|DE|80|25|True
1|PP|RE|1|PP|DE|80|25|True
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2|ADVP|RE|2|VP|ADVP|80|25|True
2|CONJP|RE|2|CONJP|DE|80|25|True
2|INTJ|RE|2|INTJ|DE|80|25|True
2|LST|RE|2|LST|DE|80|25|True
2|PP|RE|2|PP|DE|80|25|True
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3|ADVP|RE|3|VP|ADVP|80|25|True
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3|LST|RE|3|LST|DE|80|25|True
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4|ADVP|RE|4|VP|ADVP|80|25|True
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4|INTJ|RE|4|INTJ|DE|80|25|True
4|LST|RE|4|LST|DE|80|25|True
4|PP|RE|4|PP|DE|80|25|True
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7|INTJ|RE|7|INTJ|DE|80|25|True
7|LST|RE|7|LST|DE|80|25|True
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0|INTJ|RE|0|INTJ|DE|90|0|True
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0|VP|RE|0|VP|DE|90|25|True
0|ADJP|RE|0|ADJP|DE|90|25|True
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1|ADVP|RE|1|VP|ADVP|90|25|True
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1|INTJ|RE|1|INTJ|DE|90|25|True
1|LST|RE|1|LST|DE|90|25|True
1|PP|RE|1|PP|DE|90|25|True
1|PRT|RE|1|PRT|DE|90|25|True
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2|ADVP|RE|2|VP|ADVP|90|25|True
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2|INTJ|RE|2|INTJ|DE|90|25|True
2|LST|RE|2|LST|DE|90|25|True
2|PP|RE|2|PP|DE|90|25|True
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3|ADJP|RE|3|ADJP|DE|90|25|True
3|ADVP|RE|3|VP|ADVP|90|25|True
3|CONJP|RE|3|CONJP|DE|90|25|True
3|INTJ|RE|3|INTJ|DE|90|25|True
3|LST|RE|3|LST|DE|90|25|True
3|PP|RE|3|PP|DE|90|25|True
3|PRT|RE|3|PRT|DE|90|25|True
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4|ADVP|RE|4|VP|ADVP|90|25|True
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4|LST|RE|4|LST|DE|90|25|True
4|PP|RE|4|PP|DE|90|25|True
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6|LST|RE|6|LST|DE|90|25|True
6|PP|RE|6|PP|DE|90|25|True
6|PRT|RE|6|PRT|DE|90|25|True
7|NP|RE|7|NP|DE|90|25|True
7|VP|RE|7|VP|DE|90|25|True

7|ADJP|RE|7|ADJP|DE|90|25|True
7|ADVP|RE|7|VP|ADVP|90|25|True
7|CONJP|RE|7|CONJP|DE|90|25|True
7|INTJ|RE|7|INTJ|DE|90|25|True
7|LST|RE|7|LST|DE|90|25|True
7|PP|RE|7|PP|DE|90|25|True
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1|ADVP|RE|1|VP|ADVP|90|0|True
1|CONJP|RE|1|CONJP|DE|90|0|True
1|INTJ|RE|1|INTJ|DE|90|0|True
1|LST|RE|1|LST|DE|90|0|True
1|PP|RE|1|PP|DE|90|0|True
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2|ADVP|RE|2|VP|ADVP|90|0|True
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2|INTJ|RE|2|INTJ|DE|90|0|True
2|LST|RE|2|LST|DE|90|0|True
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3|ADJP|RE|3|ADJP|DE|90|0|True
3|ADVP|RE|3|VP|ADVP|90|0|True
3|CONJP|RE|3|CONJP|DE|90|0|True
3|INTJ|RE|3|INTJ|DE|90|0|True
3|LST|RE|3|LST|DE|90|0|True
3|PP|RE|3|PP|DE|90|0|True
3|PRT|RE|3|PRT|DE|90|0|True
4|NP|RE|4|NP|DE|90|0|True
4|VP|RE|4|VP|DE|90|0|True
4|ADJP|RE|4|ADJP|DE|90|0|True
4|ADVP|RE|4|VP|ADVP|90|0|True
4|CONJP|RE|4|CONJP|DE|90|0|True
4|INTJ|RE|4|INTJ|DE|90|0|True
4|LST|RE|4|LST|DE|90|0|True
4|PP|RE|4|PP|DE|90|0|True
4|PRT|RE|4|PRT|DE|90|0|True

5|NP|RE|5|NP|DE|90|0|True
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5|ADJP|RE|5|ADJP|DE|90|0|True
5|ADVP|RE|5|VP|ADVP|90|0|True
5|CONJP|RE|5|CONJP|DE|90|0|True
5|INTJ|RE|5|INTJ|DE|90|0|True
5|LST|RE|5|LST|DE|90|0|True
5|PP|RE|5|PP|DE|90|0|True
5|PRT|RE|5|PRT|DE|90|0|True
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6|ADVP|RE|6|VP|ADVP|90|0|True
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7|ADVP|RE|7|VP|ADVP|90|0|True
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7|INTJ|RE|7|INTJ|DE|90|0|True
7|LST|RE|7|LST|DE|90|0|True
7|PP|RE|7|PP|DE|90|0|True
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1|ADVP|RE|1|VP|ADVP|90|0|True
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1|INTJ|RE|1|INTJ|DE|90|0|True
1|LST|RE|1|LST|DE|90|0|True
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2|ADJP|RE|2|ADJP|DE|90|0|True
2|ADVP|RE|2|VP|ADVP|90|0|True
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2|INTJ|RE|2|INTJ|DE|90|0|True
2|LST|RE|2|LST|DE|90|0|True
2|PP|RE|2|PP|DE|90|0|True
2|PRT|RE|2|PRT|DE|90|0|True
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3|ADVP|RE|3|VP|ADVP|90|0|True
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3|INTJ|RE|3|INTJ|DE|90|0|True
3|LST|RE|3|LST|DE|90|0|True
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7|NP|RE|7|NP|DE|90|0|True
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7|ADVP|RE|7|VP|ADVP|90|0|True
7|CONJP|RE|7|CONJP|DE|90|0|True
7|INTJ|RE|7|INTJ|DE|90|0|True

7|LST|RE|7|LST|DE|90|0|True
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3|VP|RE|3|VP|DE|90|25|True
3|VP|RE|3|NP|DE|90|25|True
3|NP|RE|3|VP|DE|90|25|True
4|NP|RE|4|NP|DE|90|25|True
4|VP|RE|4|VP|DE|90|25|True
4|VP|RE|4|NP|DE|90|25|True
4|NP|RE|4|VP|DE|90|25|True
5|NP|RE|5|NP|DE|90|25|True
5|VP|RE|5|VP|DE|90|25|True
5|VP|RE|5|NP|DE|90|25|True
5|NP|RE|5|VP|DE|90|25|True
6|NP|RE|6|NP|DE|90|25|True
6|VP|RE|6|VP|DE|90|25|True
6|VP|RE|6|NP|DE|90|25|True
6|NP|RE|6|VP|DE|90|25|True
7|NP|RE|7|NP|DE|90|25|True
7|VP|RE|7|VP|DE|90|25|True
7|VP|RE|7|NP|DE|90|25|True
7|NP|RE|7|VP|DE|90|25|True
1|ADJP|RE|1|ADJP|DE|90|25|True
1|ADVP|RE|1|ADVP|DE|90|25|True
1|ADVP|RE|1|ADJP|DE|90|25|True
1|ADJP|RE|1|ADVP|DE|90|25|True
2|ADJP|RE|2|ADJP|DE|90|25|True
2|ADVP|RE|2|ADVP|DE|90|25|True
2|ADVP|RE|2|ADJP|DE|90|25|True
2|ADJP|RE|2|ADVP|DE|90|25|True
3|ADJP|RE|3|ADJP|DE|90|25|True
3|ADVP|RE|3|ADVP|DE|90|25|True
3|ADVP|RE|3|ADJP|DE|90|25|True
3|ADJP|RE|3|ADVP|DE|90|25|True
4|ADJP|RE|4|ADJP|DE|90|25|True
4|ADVP|RE|4|ADVP|DE|90|25|True
4|ADVP|RE|4|ADJP|DE|90|25|True
4|ADJP|RE|4|ADVP|DE|90|25|True
5|ADJP|RE|5|ADJP|DE|90|25|True
5|ADVP|RE|5|ADVP|DE|90|25|True
5|ADVP|RE|5|ADJP|DE|90|25|True
5|ADJP|RE|5|ADVP|DE|90|25|True
6|ADJP|RE|6|ADJP|DE|90|25|True
6|ADVP|RE|6|ADVP|DE|90|25|True
6|ADVP|RE|6|ADJP|DE|90|25|True
6|ADJP|RE|6|ADVP|DE|90|25|True
7|ADJP|RE|7|ADJP|DE|90|25|True
7|ADVP|RE|7|ADVP|DE|90|25|True
7|ADVP|RE|7|ADJP|DE|90|25|True

7|ADJP|RE|7|ADVP|DE|90|25|True

0|NP|RE|0|NP|DE|90|0|True
0|VP|RE|0|VP|DE|90|0|True
0|VP|RE|0|NP|DE|90|0|True
0|NP|RE|0|VP|DE|90|0|True

0|NP|RE|0|NP|DE|90|25|True
0|VP|RE|0|VP|DE|90|25|True
0|VP|RE|0|NP|DE|90|25|True
0|NP|RE|0|VP|DE|90|25|True

0|NP|RE|0|NP|DE|90|0|True
0|VP|RE|0|VP|DE|90|0|True
0|VP|RE|0|NP|DE|90|0|True
0|NP|RE|0|VP|DE|90|0|True
0|ADJP|RE|0|ADJP|DE|90|0|True
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0|NP|RE|0|NP|DE|90|0|True
0|ADJP|RE|0|ADJP|DE|90|0|True
0|ADJP|RE|0|NP|DE|90|0|True
0|NP|RE|0|ADJP|DE|90|0|True
0|ADVP|RE|0|ADVP|DE|90|0|True
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0|ADJP|RE|0|ADJP|DE|90|0|True
0|ADVP|RE|0|ADVP|DE|90|0|True
0|ADVP|RE|0|ADJP|DE|90|0|True
0|ADJP|RE|0|ADVP|DE|90|0|True

0|NP|RE|0|NP|DE|90|25|True
0|VP|RE|0|VP|DE|90|25|True
0|VP|RE|0|NP|DE|90|25|True
0|NP|RE|0|VP|DE|90|25|True
0|ADJP|RE|0|ADJP|DE|90|25|True
0|VP|RE|0|VP|DE|90|25|True
0|VP|RE|0|ADJP|DE|90|25|True
0|ADJP|RE|0|VP|DE|90|25|True
0|NP|RE|0|NP|DE|90|25|True

0|ADJP|RE|0|ADJP|DE|90|25|True
0|ADJP|RE|0|NP|DE|90|25|True
0|NP|RE|0|ADJP|DE|90|25|True
0|ADVP|RE|0|ADVP|DE|90|25|True
0|VP|RE|0|VP|DE|90|25|True
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0|ADJP|RE|0|ADJP|DE|90|25|True
0|ADVP|RE|0|ADVP|DE|90|25|True
0|ADVP|RE|0|ADJP|DE|90|25|True
0|ADJP|RE|0|ADVP|DE|90|25|True

1|NP|RE|1|NP|DE|90|-2|True
1|VP|RE|1|VP|DE|90|-2|True
1|ADJP|RE|1|ADJP|DE|90|0|True
1|ADVP|RE|1|VP|ADVP|90|0|True
1|CONJP|RE|1|CONJP|DE|90|0|True
1|INTJ|RE|1|INTJ|DE|90|0|True
1|LST|RE|1|LST|DE|90|0|True
1|PP|RE|1|PP|DE|90|0|True
1|PRT|RE|1|PRT|DE|90|0|True
2|NP|RE|2|NP|DE|90|-2|True
2|VP|RE|2|VP|DE|90|-2|True
2|ADJP|RE|2|ADJP|DE|90|0|True
2|ADVP|RE|2|VP|ADVP|90|0|True
2|CONJP|RE|2|CONJP|DE|90|0|True
2|INTJ|RE|2|INTJ|DE|90|0|True
2|LST|RE|2|LST|DE|90|0|True
2|PP|RE|2|PP|DE|90|0|True
2|PRT|RE|2|PRT|DE|90|0|True
3|NP|RE|3|NP|DE|90|-2|True
3|VP|RE|3|VP|DE|90|-2|True
3|ADJP|RE|3|ADJP|DE|90|0|True
3|ADVP|RE|3|VP|ADVP|90|0|True
3|CONJP|RE|3|CONJP|DE|90|0|True
3|INTJ|RE|3|INTJ|DE|90|0|True
3|LST|RE|3|LST|DE|90|0|True
3|PP|RE|3|PP|DE|90|0|True
3|PRT|RE|3|PRT|DE|90|0|True
4|NP|RE|4|NP|DE|90|-2|True
4|VP|RE|4|VP|DE|90|-2|True
4|ADJP|RE|4|ADJP|DE|90|0|True

4|ADVP|RE|4|VP|ADVP|90|0|True
4|CONJP|RE|4|CONJP|DE|90|0|True
4|INTJ|RE|4|INTJ|DE|90|0|True
4|LST|RE|4|LST|DE|90|0|True
4|PP|RE|4|PP|DE|90|0|True
4|PRT|RE|4|PRT|DE|90|0|True
5|NP|RE|5|NP|DE|90|-2|True
5|VP|RE|5|VP|DE|90|-2|True
5|ADJP|RE|5|ADJP|DE|90|0|True
5|ADVP|RE|5|VP|ADVP|90|0|True
5|CONJP|RE|5|CONJP|DE|90|0|True
5|INTJ|RE|5|INTJ|DE|90|0|True
5|LST|RE|5|LST|DE|90|0|True
5|PP|RE|5|PP|DE|90|0|True
5|PRT|RE|5|PRT|DE|90|0|True
6|NP|RE|6|NP|DE|90|-2|True
6|VP|RE|6|VP|DE|90|-2|True
6|ADJP|RE|6|ADJP|DE|90|0|True
6|ADVP|RE|6|VP|ADVP|90|0|True
6|CONJP|RE|6|CONJP|DE|90|0|True
6|INTJ|RE|6|INTJ|DE|90|0|True
6|LST|RE|6|LST|DE|90|0|True
6|PP|RE|6|PP|DE|90|0|True
6|PRT|RE|6|PRT|DE|90|0|True
7|NP|RE|7|NP|DE|90|-2|True
7|VP|RE|7|VP|DE|90|-2|True
7|ADJP|RE|7|ADJP|DE|90|0|True
7|ADVP|RE|7|VP|ADVP|90|0|True
7|CONJP|RE|7|CONJP|DE|90|0|True
7|INTJ|RE|7|INTJ|DE|90|0|True
7|LST|RE|7|LST|DE|90|0|True
7|PP|RE|7|PP|DE|90|0|True
7|PRT|RE|7|PRT|DE|90|0|True

1|NP|RE|1|NP|DE|90|-2|True
1|VP|RE|1|VP|DE|90|-2|True
1|ADJP|RE|1|ADJP|DE|90|-2|True
1|ADVP|RE|1|VP|ADVP|90|-2|True
1|CONJP|RE|1|CONJP|DE|90|0|True
1|INTJ|RE|1|INTJ|DE|90|0|True
1|LST|RE|1|LST|DE|90|0|True
1|PP|RE|1|PP|DE|90|0|True
1|PRT|RE|1|PRT|DE|90|0|True
2|NP|RE|2|NP|DE|90|-2|True
2|VP|RE|2|VP|DE|90|-2|True
2|ADJP|RE|2|ADJP|DE|90|-2|True

2|ADVP|RE|2|VP|ADVP|90|-2|True
2|CONJP|RE|2|CONJP|DE|90|0|True
2|INTJ|RE|2|INTJ|DE|90|0|True
2|LST|RE|2|LST|DE|90|0|True
2|PP|RE|2|PP|DE|90|0|True
2|PRT|RE|2|PRT|DE|90|0|True
3|NP|RE|3|NP|DE|90|-2|True
3|VP|RE|3|VP|DE|90|-2|True
3|ADJP|RE|3|ADJP|DE|90|-2|True
3|ADVP|RE|3|VP|ADVP|90|-2|True
3|CONJP|RE|3|CONJP|DE|90|0|True
3|INTJ|RE|3|INTJ|DE|90|0|True
3|LST|RE|3|LST|DE|90|0|True
3|PP|RE|3|PP|DE|90|0|True
3|PRT|RE|3|PRT|DE|90|0|True
4|NP|RE|4|NP|DE|90|-2|True
4|VP|RE|4|VP|DE|90|-2|True
4|ADJP|RE|4|ADJP|DE|90|-2|True
4|ADVP|RE|4|VP|ADVP|90|-2|True
4|CONJP|RE|4|CONJP|DE|90|0|True
4|INTJ|RE|4|INTJ|DE|90|0|True
4|LST|RE|4|LST|DE|90|0|True
4|PP|RE|4|PP|DE|90|0|True
4|PRT|RE|4|PRT|DE|90|0|True
5|NP|RE|5|NP|DE|90|-2|True
5|VP|RE|5|VP|DE|90|-2|True
5|ADJP|RE|5|ADJP|DE|90|-2|True
5|ADVP|RE|5|VP|ADVP|90|-2|True
5|CONJP|RE|5|CONJP|DE|90|0|True
5|INTJ|RE|5|INTJ|DE|90|0|True
5|LST|RE|5|LST|DE|90|0|True
5|PP|RE|5|PP|DE|90|0|True
5|PRT|RE|5|PRT|DE|90|0|True
6|NP|RE|6|NP|DE|90|-2|True
6|VP|RE|6|VP|DE|90|-2|True
6|ADJP|RE|6|ADJP|DE|90|-2|True
6|ADVP|RE|6|VP|ADVP|90|-2|True
6|CONJP|RE|6|CONJP|DE|90|0|True
6|INTJ|RE|6|INTJ|DE|90|0|True
6|LST|RE|6|LST|DE|90|0|True
6|PP|RE|6|PP|DE|90|0|True
6|PRT|RE|6|PRT|DE|90|0|True
7|NP|RE|7|NP|DE|90|-2|True
7|VP|RE|7|VP|DE|90|-2|True
7|ADJP|RE|7|ADJP|DE|90|-2|True
7|ADVP|RE|7|VP|ADVP|90|-2|True

7|CONJP|RE|7|CONJP|DE|90|0|True
7|INTJ|RE|7|INTJ|DE|90|0|True
7|LST|RE|7|LST|DE|90|0|True
7|PP|RE|7|PP|DE|90|0|True
7|PRT|RE|7|PRT|DE|90|0|True

0|NP|RE|0|NP|DE|90|0|True
0|VP|RE|0|VP|DE|90|0|True
0|ADJP|RE|0|ADJP|DE|90|0|True
0|ADVP|RE|0|VP|ADVP|90|0|True
0|CONJP|RE|0|CONJP|DE|90|0|True
0|INTJ|RE|0|INTJ|DE|90|0|True
0|LST|RE|0|LST|DE|90|0|True
0|PP|RE|0|PP|DE|90|0|True
0|PRT|RE|0|PRT|DE|90|0|True

0|NP|RE|0|NP|DE|90|25|True
0|VP|RE|0|VP|DE|90|25|True
0|ADJP|RE|0|ADJP|DE|90|25|True
0|ADVP|RE|0|VP|ADVP|90|25|True
0|CONJP|RE|0|CONJP|DE|90|25|True
0|INTJ|RE|0|INTJ|DE|90|25|True
0|LST|RE|0|LST|DE|90|25|True
0|PP|RE|0|PP|DE|90|25|True
0|PRT|RE|0|PRT|DE|90|25|True

1|NP|RE|1|NP|DE|90|0|True
1|VP|RE|1|VP|DE|90|0|True
1|ADJP|RE|1|ADJP|DE|90|0|True
1|ADVP|RE|1|VP|ADVP|90|0|True
1|CONJP|RE|1|CONJP|DE|90|0|True
1|INTJ|RE|1|INTJ|DE|90|0|True
1|LST|RE|1|LST|DE|90|0|True
1|PP|RE|1|PP|DE|90|0|True
1|PRT|RE|1|PRT|DE|90|0|True
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2|VP|RE|2|VP|DE|90|0|True
2|ADJP|RE|2|ADJP|DE|90|0|True
2|ADVP|RE|2|VP|ADVP|90|0|True
2|CONJP|RE|2|CONJP|DE|90|0|True
2|INTJ|RE|2|INTJ|DE|90|0|True
2|LST|RE|2|LST|DE|90|0|True
2|PP|RE|2|PP|DE|90|0|True
2|PRT|RE|2|PRT|DE|90|0|True
3|NP|RE|3|NP|DE|90|0|True
3|VP|RE|3|VP|DE|90|0|True

3|ADJP|RE|3|ADJP|DE|90|0|True
3|ADVP|RE|3|VP|ADVP|90|0|True
3|CONJP|RE|3|CONJP|DE|90|0|True
3|INTJ|RE|3|INTJ|DE|90|0|True
3|LST|RE|3|LST|DE|90|0|True
3|PP|RE|3|PP|DE|90|0|True
3|PRT|RE|3|PRT|DE|90|0|True
4|NP|RE|4|NP|DE|90|0|True
4|VP|RE|4|VP|DE|90|0|True
4|ADJP|RE|4|ADJP|DE|90|0|True
4|ADVP|RE|4|VP|ADVP|90|0|True
4|CONJP|RE|4|CONJP|DE|90|0|True
4|INTJ|RE|4|INTJ|DE|90|0|True
4|LST|RE|4|LST|DE|90|0|True
4|PP|RE|4|PP|DE|90|0|True
4|PRT|RE|4|PRT|DE|90|0|True
5|NP|RE|5|NP|DE|90|0|True
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5|ADJP|RE|5|ADJP|DE|90|0|True
5|ADVP|RE|5|VP|ADVP|90|0|True
5|CONJP|RE|5|CONJP|DE|90|0|True
5|INTJ|RE|5|INTJ|DE|90|0|True
5|LST|RE|5|LST|DE|90|0|True
5|PP|RE|5|PP|DE|90|0|True
5|PRT|RE|5|PRT|DE|90|0|True
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6|ADJP|RE|6|ADJP|DE|90|0|True
6|ADVP|RE|6|VP|ADVP|90|0|True
6|CONJP|RE|6|CONJP|DE|90|0|True
6|INTJ|RE|6|INTJ|DE|90|0|True
6|LST|RE|6|LST|DE|90|0|True
6|PP|RE|6|PP|DE|90|0|True
6|PRT|RE|6|PRT|DE|90|0|True
7|NP|RE|7|NP|DE|90|0|True
7|VP|RE|7|VP|DE|90|0|True
7|ADJP|RE|7|ADJP|DE|90|0|True
7|ADVP|RE|7|VP|ADVP|90|0|True
7|CONJP|RE|7|CONJP|DE|90|0|True
7|INTJ|RE|7|INTJ|DE|90|0|True
7|LST|RE|7|LST|DE|90|0|True
7|PP|RE|7|PP|DE|90|0|True
7|PRT|RE|7|PRT|DE|90|0|True

1|NP|RE|1|NP|DE|90|25|True
1|VP|RE|1|VP|DE|90|25|True

1|ADJP|RE|1|ADJP|DE|90|25|True
1|ADVP|RE|1|VP|ADVP|90|25|True
1|CONJP|RE|1|CONJP|DE|90|25|True
1|INTJ|RE|1|INTJ|DE|90|25|True
1|LST|RE|1|LST|DE|90|25|True
1|PP|RE|1|PP|DE|90|25|True
1|PRT|RE|1|PRT|DE|90|25|True
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2|ADJP|RE|2|ADJP|DE|90|25|True
2|ADVP|RE|2|VP|ADVP|90|25|True
2|CONJP|RE|2|CONJP|DE|90|25|True
2|INTJ|RE|2|INTJ|DE|90|25|True
2|LST|RE|2|LST|DE|90|25|True
2|PP|RE|2|PP|DE|90|25|True
2|PRT|RE|2|PRT|DE|90|25|True
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3|ADJP|RE|3|ADJP|DE|90|25|True
3|ADVP|RE|3|VP|ADVP|90|25|True
3|CONJP|RE|3|CONJP|DE|90|25|True
3|INTJ|RE|3|INTJ|DE|90|25|True
3|LST|RE|3|LST|DE|90|25|True
3|PP|RE|3|PP|DE|90|25|True
3|PRT|RE|3|PRT|DE|90|25|True
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4|ADJP|RE|4|ADJP|DE|90|25|True
4|ADVP|RE|4|VP|ADVP|90|25|True
4|CONJP|RE|4|CONJP|DE|90|25|True
4|INTJ|RE|4|INTJ|DE|90|25|True
4|LST|RE|4|LST|DE|90|25|True
4|PP|RE|4|PP|DE|90|25|True
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5|ADJP|RE|5|ADJP|DE|90|25|True
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5|LST|RE|5|LST|DE|90|25|True
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5|PRT|RE|5|PRT|DE|90|25|True
6|NP|RE|6|NP|DE|90|25|True
6|VP|RE|6|VP|DE|90|25|True
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6|ADVP|RE|6|VP|ADVP|90|25|True
6|CONJP|RE|6|CONJP|DE|90|25|True
6|INTJ|RE|6|INTJ|DE|90|25|True
6|LST|RE|6|LST|DE|90|25|True
6|PP|RE|6|PP|DE|90|25|True
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7|NP|RE|7|NP|DE|90|25|True
7|VP|RE|7|VP|DE|90|25|True
7|ADJP|RE|7|ADJP|DE|90|25|True
7|ADVP|RE|7|VP|ADVP|90|25|True
7|CONJP|RE|7|CONJP|DE|90|25|True
7|INTJ|RE|7|INTJ|DE|90|25|True
7|LST|RE|7|LST|DE|90|25|True
7|PP|RE|7|PP|DE|90|25|True
7|PRT|RE|7|PRT|DE|90|25|True

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0|VP|RE|0|VP|DE|90|25|True
1|NP|RE|1|NP|DE|90|25|True
1|VP|RE|1|VP|DE|90|25|True
1|ADJP|RE|1|ADJP|DE|90|25|True
1|ADVP|RE|1|VP|ADVP|90|25|True
1|CONJP|RE|1|CONJP|DE|90|25|True
1|INTJ|RE|1|INTJ|DE|90|25|True
1|LST|RE|1|LST|DE|90|25|True
1|PP|RE|1|PP|DE|90|25|True
1|PRT|RE|1|PRT|DE|90|25|True
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2|ADJP|RE|2|ADJP|DE|90|25|True
2|ADVP|RE|2|VP|ADVP|90|25|True
2|CONJP|RE|2|CONJP|DE|90|25|True
2|INTJ|RE|2|INTJ|DE|90|25|True
2|LST|RE|2|LST|DE|90|25|True
2|PP|RE|2|PP|DE|90|25|True
2|PRT|RE|2|PRT|DE|90|25|True
3|NP|RE|3|NP|DE|90|25|True
3|VP|RE|3|VP|DE|90|25|True
3|ADJP|RE|3|ADJP|DE|90|25|True
3|ADVP|RE|3|VP|ADVP|90|25|True
3|CONJP|RE|3|CONJP|DE|90|25|True
3|INTJ|RE|3|INTJ|DE|90|25|True
3|LST|RE|3|LST|DE|90|25|True
3|PP|RE|3|PP|DE|90|25|True
3|PRT|RE|3|PRT|DE|90|25|True
4|NP|RE|4|NP|DE|90|25|True

4|VP|RE|4|VP|DE|90|25|True
4|ADJP|RE|4|ADJP|DE|90|25|True
4|ADVP|RE|4|VP|ADVP|90|25|True
4|CONJP|RE|4|CONJP|DE|90|25|True
4|INTJ|RE|4|INTJ|DE|90|25|True
4|LST|RE|4|LST|DE|90|25|True
4|PP|RE|4|PP|DE|90|25|True
4|PRT|RE|4|PRT|DE|90|25|True
5|NP|RE|5|NP|DE|90|25|True
5|VP|RE|5|VP|DE|90|25|True
5|ADJP|RE|5|ADJP|DE|90|25|True
5|ADVP|RE|5|VP|ADVP|90|25|True
5|CONJP|RE|5|CONJP|DE|90|25|True
5|INTJ|RE|5|INTJ|DE|90|25|True
5|LST|RE|5|LST|DE|90|25|True
5|PP|RE|5|PP|DE|90|25|True
5|PRT|RE|5|PRT|DE|90|25|True
6|NP|RE|6|NP|DE|90|25|True
6|VP|RE|6|VP|DE|90|25|True
6|ADJP|RE|6|ADJP|DE|90|25|True
6|ADVP|RE|6|VP|ADVP|90|25|True
6|CONJP|RE|6|CONJP|DE|90|25|True
6|INTJ|RE|6|INTJ|DE|90|25|True
6|LST|RE|6|LST|DE|90|25|True
6|PP|RE|6|PP|DE|90|25|True
6|PRT|RE|6|PRT|DE|90|25|True
7|NP|RE|7|NP|DE|90|25|True
7|VP|RE|7|VP|DE|90|25|True
7|ADJP|RE|7|ADJP|DE|90|25|True
7|ADVP|RE|7|VP|ADVP|90|25|True
7|CONJP|RE|7|CONJP|DE|90|25|True
7|INTJ|RE|7|INTJ|DE|90|25|True
7|LST|RE|7|LST|DE|90|25|True
7|PP|RE|7|PP|DE|90|25|True
7|PRT|RE|7|PRT|DE|90|25|True

0|NP|RE|0|NP|DE|10|-2|True
0|VP|RE|0|VP|DE|10|-2|True
0|ADJP|RE|0|ADJP|DE|10|0|True
0|ADVP|RE|0|VP|DE|10|0|True
0|CONJP|RE|0|CONJP|DE|10|0|True
0|INTJ|RE|0|INTJ|DE|10|0|True
0|LST|RE|0|LST|DE|10|0|True
0|PP|RE|0|PP|DE|10|0|True
0|PRT|RE|0|PRT|DE|10|0|True

0|WORD|RE|0|NP|DE|30|0|True
0|WORD|RE|0|VP|DE|30|0|True
0|WORD|RE|0|ADJP|DE|30|0|True
0|WORD|RE|0|VP|DE|30|0|True

0|WORD|RE|0|NP|DE|10|0|True
0|WORD|RE|0|VP|DE|10|0|True
0|WORD|RE|0|ADJP|DE|10|0|True
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0|WORD|RE|0|NP|DE|30|0|True
0|WORD|RE|0|VP|DE|30|0|True
0|WORD|RE|0|ADJP|DE|30|0|True
0|WORD|RE|0|VP|DE|30|0|True

0|WORD|RE|0|NP|DE|50|0|True
0|WORD|RE|0|VP|DE|50|0|True
0|WORD|RE|0|ADJP|DE|50|0|True
0|WORD|RE|0|VP|DE|50|0|True

0|WORD|RE|0|NP|DE|70|0|True
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0|WORD|RE|0|ADJP|DE|70|0|True
0|WORD|RE|0|VP|DE|70|0|True

0|WORD|RE|0|NP|DE|90|0|True
0|WORD|RE|0|VP|DE|90|0|True
0|WORD|RE|0|ADJP|DE|90|0|True
0|WORD|RE|0|VP|DE|90|0|True

0|WORD|RE|0|NP|DE|10|-4|True
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0|WORD|RE|0|VP|ADVP|10|0|True
0|WORD|RE|0|CONJP|DE|10|0|True
0|WORD|RE|0|INTJ|DE|10|0|True
0|WORD|RE|0|LST|DE|10|0|True
0|WORD|RE|0|PP|DE|10|0|True
0|WORD|RE|0|PRT|DE|10|0|True

0|WORD|RE|0|NP|DE|30|-4|True
0|WORD|RE|0|VP|DE|30|-4|True
0|WORD|RE|0|ADJP|DE|30|0|True
0|WORD|RE|0|VP|ADVP|30|0|True
0|WORD|RE|0|CONJP|DE|30|0|True
0|WORD|RE|0|INTJ|DE|30|0|True

0|WORD|RE|0|LST|DE|30|0|True
0|WORD|RE|0|PP|DE|30|0|True
0|WORD|RE|0|PRT|DE|30|0|True

0|WORD|RE|0|NP|DE|50|-4|True
0|WORD|RE|0|VP|DE|50|-4|True
0|WORD|RE|0|ADJP|DE|50|0|True
0|WORD|RE|0|VP|ADVP|50|0|True
0|WORD|RE|0|CONJP|DE|50|0|True
0|WORD|RE|0|INTJ|DE|50|0|True
0|WORD|RE|0|LST|DE|50|0|True
0|WORD|RE|0|PP|DE|50|0|True
0|WORD|RE|0|PRT|DE|50|0|True

0|WORD|RE|0|NP|DE|70|-4|True
0|WORD|RE|0|VP|DE|70|-4|True
0|WORD|RE|0|ADJP|DE|70|0|True
0|WORD|RE|0|VP|ADVP|70|0|True
0|WORD|RE|0|CONJP|DE|70|0|True
0|WORD|RE|0|INTJ|DE|70|0|True
0|WORD|RE|0|LST|DE|70|0|True
0|WORD|RE|0|PP|DE|70|0|True
0|WORD|RE|0|PRT|DE|70|0|True

0|WORD|RE|0|NP|DE|90|-4|True
0|WORD|RE|0|VP|DE|90|-4|True
0|WORD|RE|0|ADJP|DE|90|0|True
0|WORD|RE|0|VP|ADVP|90|0|True
0|WORD|RE|0|CONJP|DE|90|0|True
0|WORD|RE|0|INTJ|DE|90|0|True
0|WORD|RE|0|LST|DE|90|0|True
0|WORD|RE|0|PP|DE|90|0|True
0|WORD|RE|0|PRT|DE|90|0|True

0|ADJP|RE|0|WORD|DE|1|0|True|False|False
0|ADVP|RE|0|WORD|DE|1|0|True|False|False
0|CONJP|RE|0|WORD|DE|1|0|True|False|False
0|INTJ|RE|0|WORD|DE|1|0|True|False|False
0|LST|RE|0|WORD|DE|1|0|True|False|False
0|NP|RE|0|WORD|DE|1|0|True|False|False
0|PRT|RE|0|WORD|DE|1|0|True|False|False
0|PP|RE|0|WORD|DE|1|0|True|False|False
0|VP|RE|0|WORD|DE|1|0|True|False|False
0|ADJP|RE|0|WORD|DE|1|0|True|False|False
0|ADVP|RE|0|WORD|DE|1|0|True|False|False
0|CONJP|RE|0|WORD|DE|1|0|True|False|False

0|INTJ|RE|0|WORD|DE|1|0|True|False|False
0|LST|RE|0|WORD|DE|1|0|True|False|False
0|NP|RE|0|WORD|DE|1|0|True|False|False
0|PRT|RE|0|WORD|DE|1|0|True|False|False
0|PP|RE|0|WORD|DE|1|0|True|False|False
0|VP|RE|0|WORD|DE|1|0|True|False|False
0|ADJP|RE|0|WORD|DE|20|20|True|False|False
0|ADVP|RE|0|WORD|DE|20|20|True|False|False
0|CONJP|RE|0|WORD|DE|20|20|True|False|False
0|INTJ|RE|0|WORD|DE|20|20|True|False|False
0|LST|RE|0|WORD|DE|20|20|True|False|False
0|NP|RE|0|WORD|DE|20|20|True|False|False
0|PRT|RE|0|WORD|DE|20|20|True|False|False
0|PP|RE|0|WORD|DE|20|20|True|False|False
0|VP|RE|0|WORD|DE|20|20|True|False|False
0|ADJP|RE|0|WORD|DE|20|20|True|False|False
0|ADVP|RE|0|WORD|DE|20|20|True|False|False
0|CONJP|RE|0|WORD|DE|20|20|True|False|False
0|INTJ|RE|0|WORD|DE|20|20|True|False|False
0|LST|RE|0|WORD|DE|20|20|True|False|False
0|NP|RE|0|WORD|DE|20|20|True|False|False
0|PRT|RE|0|WORD|DE|20|20|True|False|False
0|PP|RE|0|WORD|DE|20|20|True|False|False
0|VP|RE|0|WORD|DE|20|20|True|False|False

Appendix G: Subset 1 Pilot Study Results

Method 0: Naïve Satisfaction Assessment

The naïve satisfaction assessment method serves as a baseline measure. It uses basic term matching and a threshold that is a percentage of matched terms between a requirement text chunk and a design element text chunk. Results for CM-1 Subset 1 using naïve satisfaction are presented below.

As shown in *Table G1*, naïve satisfaction assessment resulted in very high recall, but low precision. *Table G3* shows raw data used in these calculations (number of candidate matches, number of correct matches, total possible matches, and number of matches in the satisfaction answer set. *Figure G1* shows the recall and precision values for naïve satisfaction at various threshold values from 0.02 to 0.1. While the naïve method achieves high recall at low threshold values, the precision of results at these thresholds is very low. This means that a large number of correction matches were found, but a large number of false positives were also included in candidate satisfaction assessments for this method. This method was highly selective, as is shown in *Figure G2*, with only 6% of the possible matches being returned for a recall level of 62%.

The number of corrections for this method was very high, as is shown in Figure 12, requiring that an analyst look at between 1754 and 4733 pairs for thresholds 0.02 to 0.1. While these seem to be large values, it is generally easier to dismiss a false positive than to search for an omitted value among all possible requirement and design element chunk pairs. For CM-1 subset 1 there were 82,138 such possible pairs. Thus there is a significantly reduced workload for the analyst for verification from naïve satisfaction versus building a satisfaction answer set manually.

Method 1: Vector Space TF-IDF Satisfaction Assessment

Satisfaction assessment using vector space retrieval with term-frequency inverse document frequency weighting produced candidate satisfaction assessments with recall values that were similar to the naïve satisfaction assessment method, but with much higher precision. Selectivity values were very low for the TF-IDF satisfaction assessment method. The number of corrections value was relatively low, and was much lower than those for naïve satisfaction.

Table G4 shows the recall and precision for the TF-IDF satisfaction method. The recall values are much higher for this method at a given level of recall than for the naïve satisfaction method (i.e., at 56.38% recall, there is 30.1% precision). Precision is critical to automated satisfaction assessment because if a method determines that a requirement is satisfied, the analyst may accept this assessment. If the requirement was, in fact, not satisfied by the design, the final design will be incomplete. Higher recall values indicate that the analyst will have a more complete picture of the satisfaction assessment of a set of requirements and design elements. These values should improve significantly for future algorithms that combine the TF-IDF satisfaction assessment method with other methods such as rules-based NLP satisfaction assessment, as these methods will be able to capture satisfaction relationships that are not based on term frequencies within a document.

The TF-IDF satisfaction assessment method is also highly selective, as is shown in *Table G4*. For the TF-IDF method, less effort (based on number of corrections) would have to be spent by analysts who are verifying results from the automated method, as measured by number of corrections. Number of corrections for each threshold values from 0.1 to 0.9 is shown in *Figure G8*. *Table G4* shows the Recall, Precision, Number of Corrections and Selectivity for TF-IDF Satisfaction assessment at each threshold value tested. Recall varies from 56.38% to 12.32%, precision from 30.1% to 50.7%, and number of corrections from 1545 to 882. Selectivity for this method ranges from 0.26% to 2.02%. Raw data for TF-IDF satisfaction method measurements including the number of candidate matches returned by the answer set, the number of correct matches and the number of total matches possible and in the correct answer set is shown in *Table G6.*

Table G1. Recall, Precision, Number of Corrections, and Selectivity for CM-1 Subset 1 Naïve Satisfaction Assessment.

Threshold	Recall	Precision	Number of Corrections	Selectivity
0.02	62.94%	11.23%	4733	6.04%
0.03	62.49%	11.22%	4707	6.00%
0.04	60.23%	11.23%	4564	5.78%
0.05	55.59%	12.35%	3884	4.85%
0.06	52.77%	12.22%	3773	4.65%
0.07	45.42%	14.39%	2874	3.40%
0.08	44.29%	14.22%	2857	3.36%
0.09	32.77%	18.69%	1857	1.89%
0.1	27.80%	18.07%	1754	1.66%

Table G2. F-Measure and F-2 Measure for CM-1 Subset 1 Naïve Satisfaction Assessment.

Threshold	F-Measure	F-2 Measure
0.1	0.1905936	0.327654459
0.2	0.1902422	0.326505448
0.3	0.1893039	0.321627627
0.4	0.2021008	0.326953281
0.5	0.1984457	0.317191048
0.6	0.2185567	0.317340163
0.7	0.2152807	0.311260156
0.8	0.2380378	0.284790896
0.9	0.2190303	0.250972222

Table G3. Raw Data for CM-1 Subset 1 Naïve Satisfaction Assessment.

Threshold	# Candidate Matches	# Correct Matches	# Answer Set Matches	Possible # Matches
0.02	4962	557	885	82138
0.03	4928	553	885	82138
0.04	4745	533	885	82138
0.05	3983	492	885	82138
0.06	3822	467	885	82138
0.07	2793	402	885	82138
0.08	2756	392	885	82138
0.09	1552	290	885	82138
0.1	1361	246	885	82138

Table G4. Recall, Precision, Number of Corrections, and Selectivity for CM-1 Subset 1 TF-IDF Satisfaction Assessment.

Threshold	Recall	Precision	Number of Corrections	Selectivity
0.1	56.38%	30.10%	1545	2.02%
0.2	**53.56%**	**31.29%**	**1452**	**1.84%**
0.3	48.25%	33.18%	1318	1.57%
0.4	40.68%	37.42%	1127	1.17%
0.5	31.19%	42.27%	986	0.34%
0.6	22.60%	42.74%	953	0.57%
0.7	17.40%	44.90%	920	0.42%
0.8	13.90%	51.25%	879	0.29%
0.9	12.32%	50.70%	882	0.26%

Table G5. F-Measure and F-2 Measure for CM-1 Subset 1 TF-IDF Satisfaction Assessment.

Threshold	F-Measure	F-2 Measure
0.1	0.3924695	0.479985858
0.2	**0.3950247**	**0.468859781**
0.3	0.3932052	0.44232055
0.4	0.3898196	0.399833368
0.5	0.358944	0.329155964
0.6	0.2956609	0.249515396
0.7	0.2508058	0.19828934
0.8	0.2186876	0.162716994
0.9	0.1982304	0.145180364

Table G6. Raw Data for CM-1 Subset 1 TF-IDF Satisfaction Assessment.

Threshold	# Candidate Matches	# Correct Matches	# Answer Set Matches	Possible # Matches
0.1	1658	499	885	82138
0.2	**1515**	**474**	**885**	**82138**
0.3	1287	427	885	82138
0.4	962	360	885	82138
0.5	276	653	885	82138
0.6	468	200	885	82138
0.7	343	154	885	82138
0.8	240	123	885	82138
0.9	215	109	885	82138

Table G7. ANOVA Results for Recall for CM-1 Subset 1.

Source	Mean Square	F	Sig.
Corrected Model	1217.218	5.243	.036
Intercept	30469.930	131.237	.000
Method	1217.218	5.243	.036
Error	232.175		

Table G8. ANOVA Results for Precision for CM-1 Subset 1.

Source	Mean Square	F	Sig.
Corrected Model	3206.136	89.963	.000
Intercept	13201.500	370.428	.000
Method	3206.136	89.963	.000
Error	35.639		

Table G9. ANOVA Results for Number of Corrections for CM-1 Subset 1.

Source	Mean Square	F	Sig.
Corrected Model	24362526.722	34.230	.000
Intercept	93685234.722	131.630	.000
Method	24362526.722	34.230	.000
Error	711731.222		

Table G10. ANOVA Results for Selectivity for CM-1 Subset 1.

Source	Mean Square	F	Sig.
Corrected Model	47.207	28.021	.000
Intercept	118.118	70.112	.000
Method	47.207	28.021	.000
Error	1.685		

Table G11. ANOVA Results for Recall for CM-1 Subset 1.

Source	Mean Square	F	Sig.
Corrected Model	1217.218	5.243	.036
Intercept	30469.930	131.237	.000
Method	1217.218	5.243	.036
Error	232.175		

Table G12. ANOVA Results for Precision for CM-1 Subset 1.

Source	Mean Square	F	Sig.
Corrected Model	3206.136	89.963	.000
Intercept	13201.500	370.428	.000
Method	3206.136	89.963	.000
Error	35.639		

Table G13. ANOVA Results for Number of Corrections for CM-1 Subset 1.

Source	Mean Square	F	Sig.
Corrected Model	24362526.722	34.230	.000
Intercept	93685234.722	131.630	.000
Method	24362526.722	34.230	.000
Error	711731.222		

Table G14. ANOVA Results for Selectivity for CM-1 Subset 1.

Source	Mean Square	F	Sig.
Corrected Model	47.207	28.021	.000
Intercept	118.118	70.112	.000
Method	47.207	28.021	.000
Error	1.685		

Table G15. ANOVA Results for Recall for CM-1 Subset 1.

Source	Mean Square	F	Sig.
Corrected Model	1217.218	5.243	.036
Intercept	30469.930	131.237	.000
Method	1217.218	5.243	.036
Error	232.175		

Table G16. ANOVA Results for Precision for CM-1 Subset 1.

Source	Mean Square	F	Sig.
Corrected Model	3206.136	89.963	.000
Intercept	13201.500	370.428	.000
Method	3206.136	89.963	.000
Error	35.639		

Table G17. ANOVA Results for Number of Corrections for CM-1 Subset 1.

Source	Mean Square	F	Sig.
Corrected Model	24362526.722	34.230	.000
Intercept	93685234.722	131.630	.000
Method	24362526.722	34.230	.000
Error	711731.222		

Table G18. ANOVA Results for Selectivity for CM-1 Subset 1.

Source	Mean Square	F	Sig.
Corrected Model	47.207	28.021	.000
Intercept	118.118	70.112	.000
Method	47.207	28.021	.000
Error	1.685		

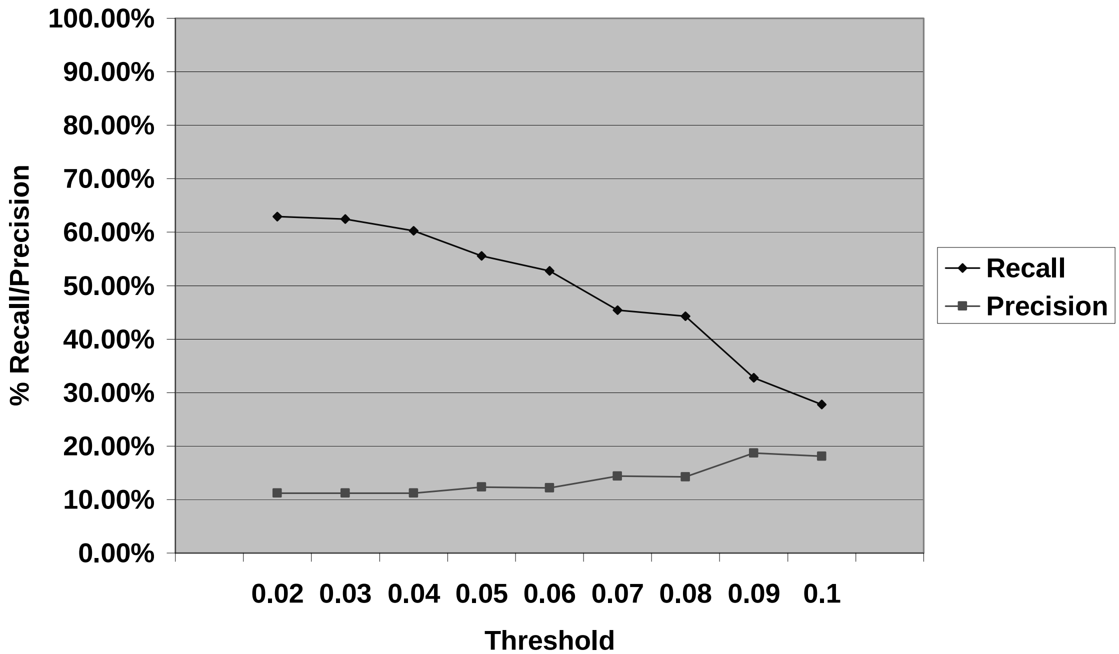

Figure G1. Recall and Precision for Naïve Satisfaction.

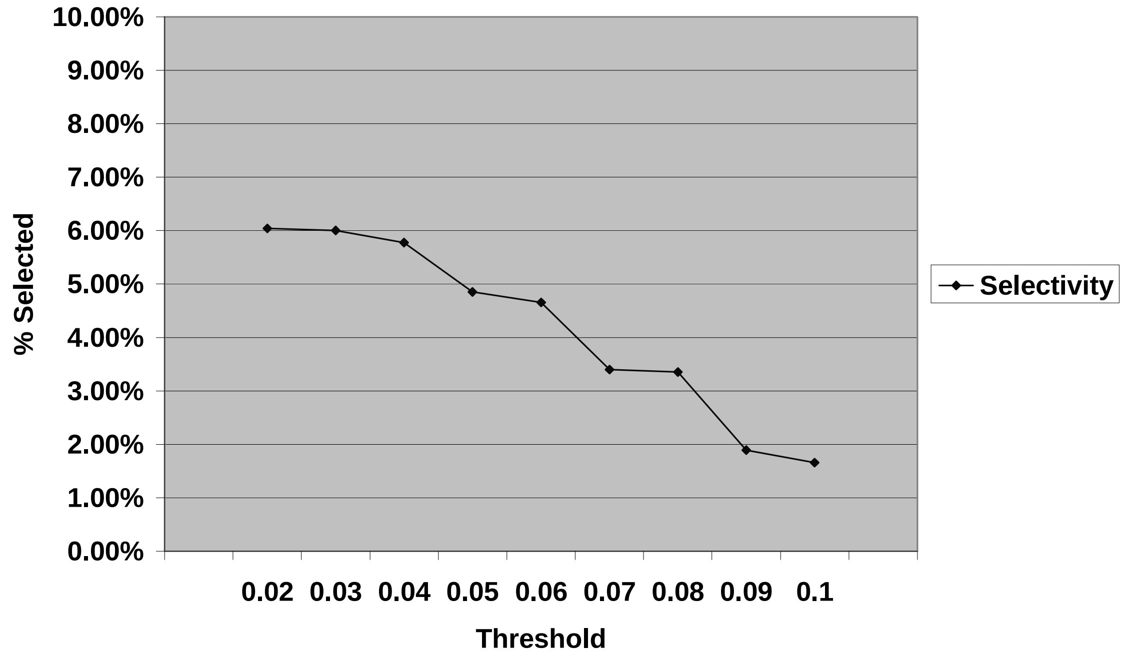

Figure G2. Selectivity for Naïve Satisfaction.

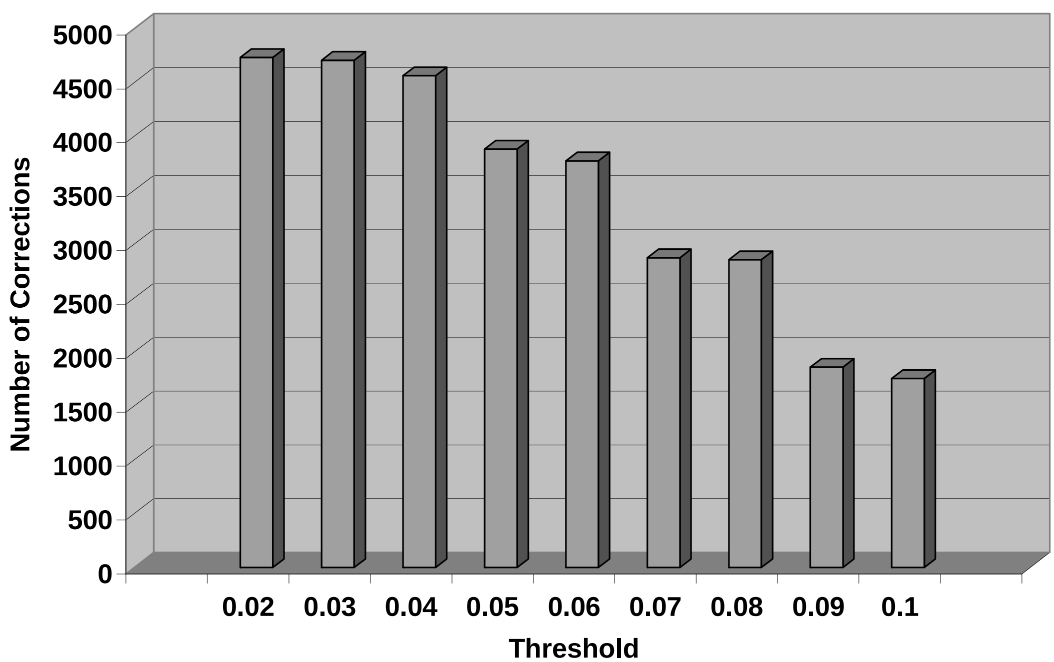

Figure G3. Number of Corrections for Naïve Satisfaction.

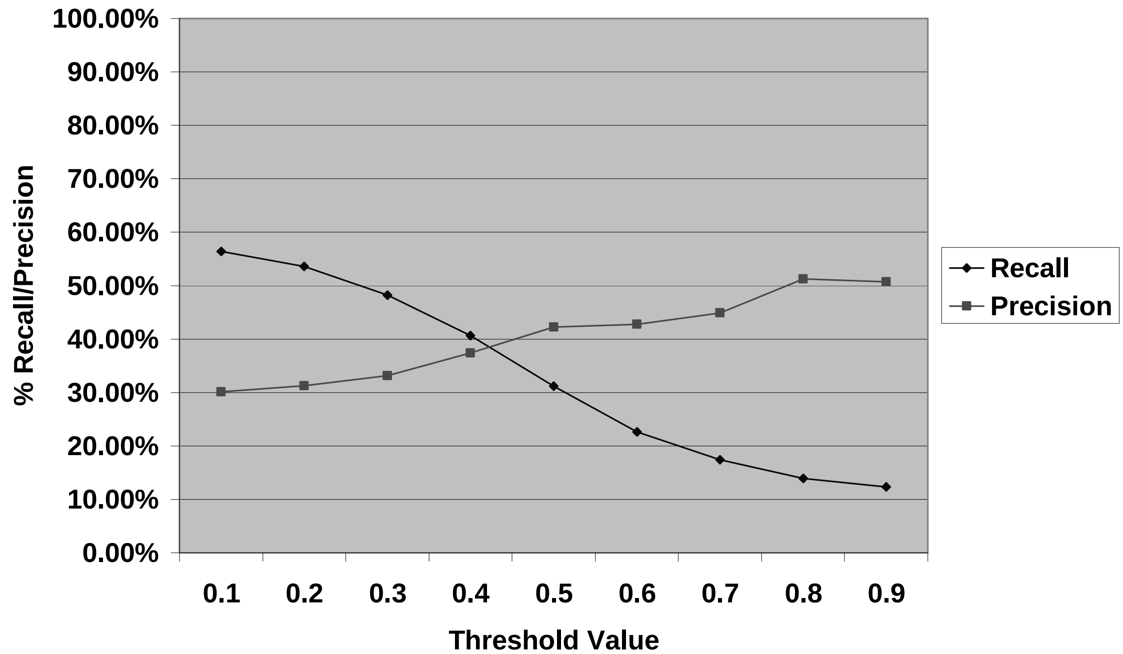

Figure G4. Recall and Precision for TF-IDF Satisfaction.

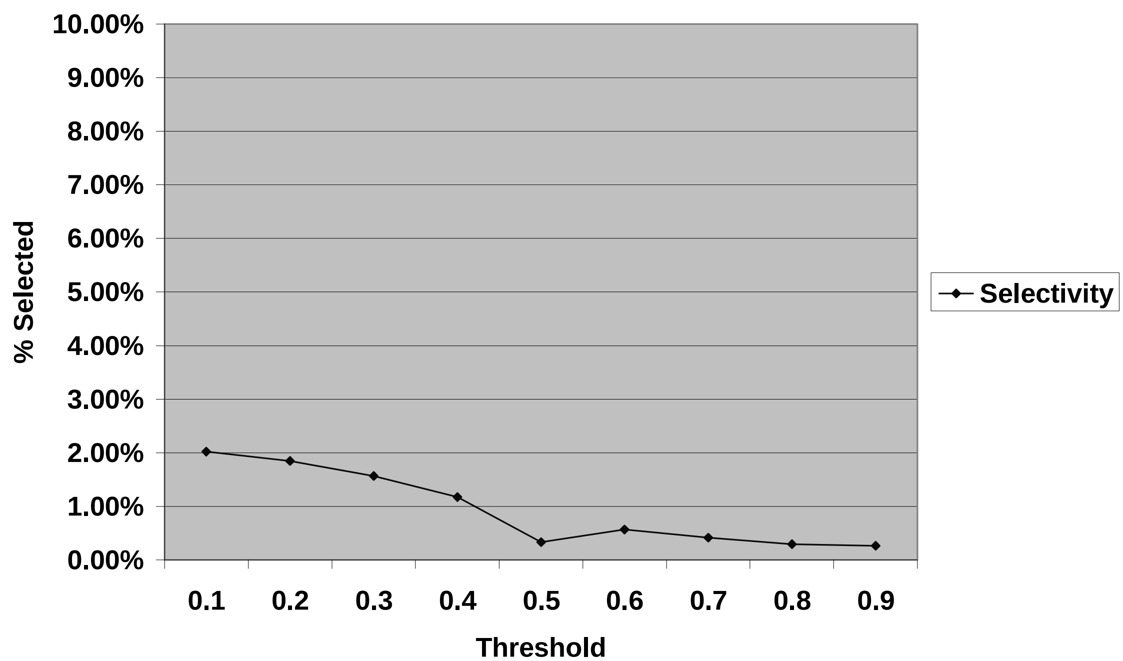

Figure G5. Selectivity for TF-IDF Satisfaction.

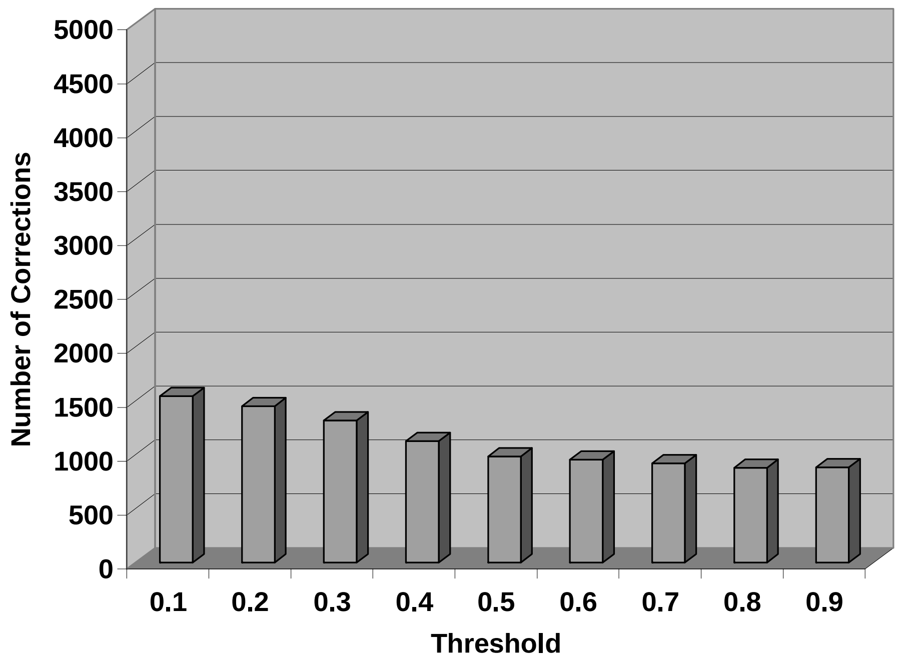

Figure G6. Number of Corrections for TF-IDF Satisfaction.

Appendix H: Data for Gantt and CM-1 Analysis

Table H1. Recall, Precision, Number of Corrections, and Selectivity for CM-1 Subset 1 Naïve Satisfaction Assessment.

Threshold	Recall	Precision	Number of Corrections	Selectivity	Normalized Number of Corrections	Normalized Selectivity
0.02	62.94%	11.23%	4733	6.04%	5.348022599	0.0068%
0.03	62.49%	11.22%	4707	6.00%	5.318644068	0.0068%
0.04	60.23%	11.23%	4564	5.78%	5.157062147	0.0065%
0.05	55.59%	12.35%	3884	4.85%	4.388700565	0.0055%
0.06	52.77%	12.22%	3773	4.65%	4.263276836	0.0053%
0.07	45.42%	14.39%	2874	3.40%	3.247457627	0.0038%
0.08	44.29%	14.22%	2857	3.36%	3.228248588	0.0038%
0.09	32.77%	18.69%	1857	1.89%	2.098305085	0.0021%
0.1	27.80%	18.07%	1754	1.66%	1.981920904	0.0019%

Table H2. Recall, Precision, Number of Corrections, and Selectivity for Gantt Naïve Satisfaction Assessment.

Threshold	Recall	Precision	Number of Corrections	Selectivity	Normalized Number of Corrections	Normalized Selectivity
0.01	67.75%	29.38%	599	0.54%	1.111317254	0.0010%
0.02	67.75%	29.38%	599	0.54%	1.111317254	0.0010%
0.03	67.75%	29.50%	596	0.54%	1.105751391	0.0010%
0.04	67.43%	29.87%	586	0.53%	1.087198516	0.0010%
0.05	64.50%	31.18%	546	0.49%	1.012987013	0.0009%
0.06	63.52%	31.15%	543	0.48%	1.00742115	0.0009%
0.07	55.70%	32.51%	491	0.40%	0.910946197	0.0007%
0.08	55.37%	32.50%	490	0.40%	0.909090909	0.0007%
0.09	46.25%	36.04%	417	0.30%	0.773654917	0.0006%
0.1	43.32%	36.34%	407	0.28%	0.755102041	0.0005%
0.2	7.82%	32.00%	334	0.06%	0.619666048	0.0001%
0.3	0.00%	0.00%	307	0.00%	0.569573284	0.0000%

Table H3. Recall, Precision, Number of Corrections, and Selectivity for CM-1 Naïve Satisfaction Assessment.

Threshold	Recall	Precision	Number of Corrections	Selectivity	Normalized Number of Corrections	Normalized Selectivity
0.01	0.713607	0.288702	3441	0.00013	2.044563	0.0000%
0.02	0.713607	0.288702	3441	0.00013	2.044563	0.0000%
0.03	0.713607	0.289049	3436	0.00013	2.041592	0.0000%
0.04	0.710636	0.290362	3410	0.000129	2.026144	0.0000%
0.05	0.697564	0.296689	3292	0.000123	1.956031	0.0000%
0.06	0.691028	0.298741	3250	0.000121	1.931075	0.0000%
0.07	0.632799	0.302128	3078	0.00011	1.828877	0.0000%
0.08	0.628045	0.302432	3064	0.000109	1.820559	0.0000%
0.09	0.574569	0.333448	2649	9.05E-05	1.573975	0.0000%
0.1	0.54486	0.341654	2533	8.37E-05	1.505051	0.0000%
0.2	0.228758	0.443038	1782	2.71E-05	1.058824	0.0000%
0.3	0	NaN	1683	0	1	0.0000%

Table H4. F-Measure and F-2 Measure for CM-1 Subset 1 Naïve Satisfaction Assessment.

Threshold	F-Measure	F-2 Measure
0.1	0.1905936	0.327654459
0.2	0.1902422	0.326505448
0.3	0.1893039	0.321627627
0.4	0.2021008	0.326953281
0.5	0.1984457	0.317191048
0.6	0.2185567	0.317340163
0.7	0.2152807	0.311260156
0.8	0.2380378	0.284790896
0.9	0.2190303	0.250972222

Table H5. F-Measure and F-2 Measure for Gantt Naïve Satisfaction Assessment.

Threshold	F-Measure	F-2 Measure
0.01	0.409852217	0.537190083
0.02	0.409852217	0.537190083
0.03	0.411067194	0.538023797
0.04	0.414	0.538781884
0.05	0.420382166	0.531400966
0.06	0.418006431	0.525889968
0.07	0.410564226	0.487457241
0.08	0.409638554	0.485436893
0.09	0.405135521	0.437731196
0.1	0.395245171	0.41718946
0.2	0.12565445	0.092095165
0.3	0	0

Table H6. F-Measure and F-2 Measure for CM-1 Naïve Satisfaction Assessment.

Threshold	F-Measure	F-2 Measure
0.01	0.411090193	0.551322071
0.02	0.411090193	0.551322071
0.03	0.411442275	0.551575273
0.04	0.41227163	0.551101281
0.05	0.416312057	0.549162691
0.06	0.417144907	0.547294118
0.07	0.408986175	0.519157648
0.08	0.40826574	0.516769336
0.09	0.421994327	0.501972591
0.1	0.419967941	0.486937128
0.2	0.301724138	0.253256151
0.3	NaN	NaN

Table H7. Raw Data for CM-1 Subset 1 Naïve Satisfaction Assessment.

Threshold	# Candidate Matches	# Correct Matches	# Answer Set Matches	Possible # Matches
0.02	4962	557	885	82138
0.03	4928	553	885	82138
0.04	4745	533	885	82138
0.05	3983	492	885	82138
0.06	3822	467	885	82138
0.07	2793	402	885	82138
0.08	2756	392	885	82138
0.09	1552	290	885	82138
0.1	1361	246	885	82138

Table H8. Raw Data for Gantt Naïve Satisfaction Assessment.

Threshold	# Candidate Matches	# Correct Matches	# Answer Set Matches	Possible # Matches
0.01	708	208	539	130480
0.02	708	208	539	130480
0.03	705	208	539	130480
0.04	693	207	539	130480
0.05	635	198	539	130480
0.06	626	195	539	130480
0.07	526	171	539	130480
0.08	523	170	539	130480
0.09	394	142	539	130480
0.1	366	133	539	130480
0.2	75	24	539	130480
0.3	0	0	539	130480

Table H9. Raw Data for CM-1 Naïve Satisfaction Assessment.

Threshold	# Candidate Matches	# Correct Matches	# Answer Set Matches	Possible # Matches
0.01	4160	1201	1683	29162200
0.02	4160	1201	1683	29162200
0.03	4155	1201	1683	29162200
0.04	4119	1196	1683	29162200
0.05	3957	1174	1683	29162200
0.06	3893	1163	1683	29162200
0.07	3525	1065	1683	29162200
0.08	3495	1057	1683	29162200
0.09	2900	967	1683	29162200
0.1	2684	917	1683	29162200
0.2	869	385	1683	29162200
0.3	0	0	1683	29162200

Table H10. Recall, Precision, Number of Corrections, and Selectivity for CM-1 Subset 1 TF-IDF Satisfaction Assessment.

Threshold	Recall	Precision	Number of Corrections	Selectivity	Normalized Number of Corrections	Normalized Selectivity
0.1	56.38%	30.10%	1545	2.02%	1.745762712	0.0023%
0.2	53.56%	31.29%	1452	1.84%	1.640677966	0.0021%
0.3	48.25%	33.18%	1318	1.57%	1.489265537	0.0018%
0.4	40.68%	37.42%	1127	1.17%	1.273446328	0.0013%
0.5	31.19%	42.27%	986	0.34%	1.114124294	0.0004%
0.6	22.60%	42.74%	953	0.57%	1.076836158	0.0006%
0.7	17.40%	44.90%	920	0.42%	1.039548023	0.0005%
0.8	13.90%	51.25%	879	0.29%	0.993220339	0.0003%
0.9	12.32%	50.70%	882	0.26%	0.996610169	0.0003%

Table H11. Recall, Precision, Number of Corrections, and Selectivity for Gantt TF-IDF Satisfaction Assessment.

Threshold	Recall	Precision	Number of Corrections	Selectivity	Normalized Number of Corrections	Normalized Selectivity
0.01	66.73%	56.83%	419	0.45%	0.777365492	0.0008%
0.02	66.73%	56.83%	419	0.45%	0.777365492	0.0008%
0.03	66.73%	56.83%	419	0.45%	0.777365492	0.0008%
0.04	66.73%	56.83%	419	0.45%	0.777365492	0.0008%
0.05	66.73%	56.83%	419	0.45%	0.777365492	0.0008%
0.06	66.73%	56.83%	419	0.45%	0.777365492	0.0008%
0.07	66.73%	56.83%	419	0.45%	0.777365492	0.0008%
0.08	66.73%	56.92%	418	0.45%	0.775510204	0.0008%
0.09	66.53%	56.85%	419	0.45%	0.777365492	0.0008%
0.1	66.53%	56.85%	419	0.45%	0.777365492	0.0008%
0.2	60.12%	57.69%	419	0.40%	0.777365492	0.0007%
0.3	58.52%	61.09%	393	0.37%	0.729128015	0.0007%
0.4	51.30%	62.14%	399	0.32%	0.74025974	0.0006%
0.5	44.09%	64.71%	399	0.26%	0.74025974	0.0005%
0.6	39.68%	69.23%	389	0.22%	0.721706865	0.0004%
0.7	35.87%	77.49%	372	0.18%	0.690166976	0.0003%
0.8	34.87%	80.93%	366	0.16%	0.67903525	0.0003%
0.9	32.67%	88.59%	357	0.14%	0.662337662	0.0003%

Table H12. Recall, Precision, Number of Corrections, and Selectivity for CM-1 TF-IDF Satisfaction Assessment.

Threshold	Recall	Precision	Number of Corrections	Selectivity	Normalized Number of Corrections	Normalized Selectivity
0.01	0.715389	0.28144	3553	0.000133	2.111111	0.0000%
0.02	0.715389	0.28144	3553	0.000133	2.111111	0.0000%
0.03	0.715389	0.28144	3553	0.000133	2.111111	0.0000%
0.04	0.715389	0.28144	3553	0.000133	2.111111	0.0000%
0.05	0.715389	0.28144	3553	0.000133	2.111111	0.0000%
0.06	0.715389	0.28144	3553	0.000133	2.111111	0.0000%
0.07	0.715389	0.28144	3553	0.000133	2.111111	0.0000%
0.08	0.715389	0.281506	3552	0.000133	2.110517	0.0000%
0.09	0.715389	0.281506	3552	0.000133	2.110517	0.0000%
0.1	0.715389	0.281572	3551	0.000133	2.109923	0.0000%
0.2	0.708853	0.294713	3345	0.000126	1.987522	0.0000%
0.3	0.654783	0.320442	2918	0.000107	1.733809	0.0000%
0.4	0.58645	0.35645	2478	8.64E-05	1.472371	0.0000%
0.5	0.524064	0.384985	2210	7.15E-05	1.313131	0.0000%
0.6	0.430184	0.397584	2056	5.68E-05	1.221628	0.0000%
0.7	0.34997	0.436296	1855	4.21E-05	1.102198	0.0000%
0.8	0.289364	0.453445	1783	3.35E-05	1.059418	0.0000%
0.9	0.242424	0.444444	1785	2.86E-05	1.060606	0.0000%

Table H13. F-Measure and F-2 Measure for CM-1 Subset 1 TF-IDF Satisfaction Assessment.

Threshold	F-Measure	F-2 Measure
0.1	0.3924695	0.479985858
0.2	0.3950247	0.468859781
0.3	0.3932052	0.44232055
0.4	0.3898196	0.399833368
0.5	0.358944	0.329155964
0.6	0.2956609	0.249515396
0.7	0.2508058	0.19828934
0.8	0.2186876	0.162716994
0.9	0.1982304	0.145180364

Table H14. F-Measure and F-2 Measure for Gantt TF-IDF Satisfaction Assessment.

Threshold	F-Measure	F-2 Measure
0.01	0.613824885	0.644848954
0.02	0.613824885	0.644848954
0.03	0.613824885	0.644848954
0.04	0.613824885	0.644848954
0.05	0.613824885	0.644848954
0.06	0.613824885	0.644848954
0.07	0.613824885	0.644848954
0.08	0.614391144	0.645098799
0.09	0.613111727	0.643410853
0.1	0.613111727	0.643410853
0.2	0.588812561	0.59618442
0.3	0.597748209	0.590137429
0.4	0.562019759	0.531561462
0.5	0.52443385	0.470890411
0.6	0.504458599	0.433829974
0.7	0.490410959	0.401885945
0.8	0.487394958	0.39348711
0.9	0.477306003	0.373853211

Table H15. F-Measure and F-2 Measure for CM-1 TF-IDF Satisfaction Assessment.

Threshold	F-Measure	F-2 Measure
0.01	0.403959067	0.546775658
0.02	0.403959067	0.546775658
0.03	0.403959067	0.546775658
0.04	0.403959067	0.546775658
0.05	0.403959067	0.546775658
0.06	0.403959067	0.546775658
0.07	0.403959067	0.546775658
0.08	0.404026846	0.546825325
0.09	0.404026846	0.546825325
0.1	0.404094647	0.546875
0.2	0.416332228	0.553339518
0.3	0.430300664	0.541736309
0.4	0.443396226	0.519419009
0.5	0.443885254	0.48875097
0.6	0.413242009	0.423243306
0.7	0.388394329	0.364390002
0.8	0.353282554	0.311939534
0.9	0.31372549	0.266666667

Table H16. Raw Data for CM-1 Subset 1 TF-IDF Satisfaction Assessment.

Threshold	# Candidate Matches	# Correct Matches	# Answer Set Matches	Possible # Matches
0.1	1658	499	885	82138
0.2	**1515**	**474**	**885**	**82138**
0.3	1287	427	885	82138
0.4	962	360	885	82138
0.5	276	653	885	82138
0.6	468	200	885	82138
0.7	343	154	885	82138
0.8	240	123	885	82138
0.9	215	109	885	82138

Table H17. Raw Data for Gantt TF-IDF Satisfaction Assessment.

Threshold	# Candidate Matches	# Correct Matches	# Answer Set Matches	Possible # Matches
0.01	586	333	499	130480
0.02	586	333	499	130480
0.03	586	333	499	130480
0.04	586	333	499	130480
0.05	586	333	499	130480
0.06	586	333	499	130480
0.07	586	333	499	130480
0.08	**585**	**333**	**499**	**130480**
0.09	584	332	499	130480
0.1	584	332	499	130480
0.2	520	300	499	130480
0.3	478	292	499	130480
0.4	412	256	499	130480
0.5	340	220	499	130480
0.6	286	198	499	130480
0.7	231	179	499	130480
0.8	215	174	499	130480
0.9	184	163	499	130480

Table H18. Raw Data for CM-1 TF-IDF Satisfaction Assessment.

Threshold	# Candidate Matches	# Correct Matches	# Answer Set Matches	Possible # Matches
0.01	4278	1204	1683	29162200
0.02	4278	1204	1683	29162200
0.03	4278	1204	1683	29162200
0.04	4278	1204	1683	29162200
0.05	4278	1204	1683	29162200
0.06	4278	1204	1683	29162200
0.07	4278	1204	1683	29162200
0.08	4277	1204	1683	29162200
0.09	4277	1204	1683	29162200
0.1	4276	1204	1683	29162200
0.2	4048	1193	1683	29162200
0.3	3439	1102	1683	29162200
0.4	**2769**	**987**	**1683**	**29162200**
0.5	2291	882	1683	29162200
0.6	1821	724	1683	29162200
0.7	1350	589	1683	29162200
0.8	1074	487	1683	29162200
0.9	918	408	1683	29162200

Table H19. Recall, Precision, and Number of Corrections for Gantt Rules-Based Approach to Satisfaction Assessment.

Rule Family	Rule	Recall	Precision	Number of Corrections	Selectivity
RF1	d_verbphrase	0.026052	0.135417	569	0.026052
RF1	r_nounphrase	0.436874	0.418426	584	0.436874
RF1	r_verbphrase	0.026052	0.135417	569	0.026052
RF1	d_nounphrase	0.436874	0.418426	584	0.436874
RF2	d_adjectivephrase	0.042084	0.304348	526	0.042084
RF2	d_adverbphrase	0.004008	0.5	499	0.004008
RF2	r_adjectivephrase	0.042084	0.304348	526	0.042084
RF2	r_adverbphrase	0.004008	0.5	499	0.004008
RF3	d_conjunction	0.138277	0.310811	583	0.138277
RF3	d_list	0	0	499	0
RF3	r_conjunction	0.138277	0.310811	583	0.138277
RF3	r_list	0	0	499	0
RF4	d_interjection	0	0	499	0
RF4	d_particle	0	0	499	0
RF4	d_preposition	0	0	555	0
RF4	r_interjection	0	0	499	0
RF4	r_particle	0	0	499	0
RF4	r_preposition	0	0	555	0

Table H20. Recall, Precision, Number of Corrections, and Selectivity for CM-1 Rules-Based Approach to Satisfaction Assessment.

Rule Family	Rule	Recall	Precision	Number of Corrections	Selectivity	Normalized Number of Corrections	Normalized Selectivity
RF1	d_verbphrase	0.029709	0.092081	2126	1.69E-05	1.26322	0.0000%
RF1	r_nounphrase	0.198455	0.162136	3075	6.43E-05	1.827094	0.0000%
RF1	r_verbphrase	0.029709	0.092081	2126	1.69E-05	1.26322	0.0000%
RF1	d_nounphrase	0.198455	0.162136	3075	6.43E-05	1.827094	0.0000%
RF2	d_adjectivephrase	0.034462	0.121593	2044	1.49E-05	1.214498	0.0000%
RF2	d_adverbphrase	0.001783	0.019108	1834	4.90E-06	1.089721	0.0000%
RF2	r_adjectivephrase	0.034462	0.121593	2044	1.49E-05	1.214498	0.0000%
RF2	r_adverbphrase	0.001783	0.019108	1834	4.90E-06	1.089721	0.0000%
RF3	d_conjunction	0.064765	0.074251	2933	4.58E-05	1.742721	0.0000%
RF3	d_list	0	0	1683	0	1	0.0000%
RF3	r_conjunction	0.064765	0.074251	2933	4.58E-05	1.742721	0.0000%
RF3	r_list	0	0	1683	0	1	0.0000%
RF4	d_interjection	0	0	1683	0	1	0.0000%
RF4	d_particle	0	0	1683	0	1	0.0000%
RF4	d_preposition	0.001188	0.001654	2888	3.77E-05	1.715983	0.0000%
RF4	r_interjection	0	0	1683	0	1	0.0000%
RF4	r_particle	0	0	1683	0	1	0.0000%
RF4	r_preposition	0.001188	0.001654	2888	3.77E-05	1.715983	0.0000%

Table H21. F-Measure and F-2 Measure for Gantt Rules-Based Approach to Satisfaction Assessment.

Rule Family	Rule	F-Measure	F-2 Measure
RF1	d_verbphrase	0.043697	0.031071
RF1	r_nounphrase	0.427451	0.433055
RF1	r_verbphrase	0.043697	0.031071
RF1	d_nounphrase	0.427451	0.433055
RF2	d_adjectivephrase	0.073944	0.050847
RF2	d_adverbphrase	0.007952	0.005
RF2	r_adjectivephrase	0.073944	0.050847
RF2	r_adverbphrase	0.007952	0.005
RF3	d_conjunction	0.191401	0.155546
RF3	d_list	0	0
RF3	r_conjunction	0.191401	0.155546
RF3	r_list	0	0
RF4	d_interjection	0	0
RF4	d_particle	0	0
RF4	d_preposition	0	0
RF4	r_interjection	0	0
RF4	r_particle	0	0
RF4	r_preposition	0	0

Table H22. F-Measure and F-2 Measure for CM-1 Rules-Based Approach to Satisfaction Assessment.

Rule Family	Rule	F-Measure	F-2 Measure
RF1	d_verbphrase	0.044924	0.034364
RF1	r_nounphrase	0.178466	0.189945
RF1	r_verbphrase	0.044924	0.034364
RF1	d_nounphrase	0.178466	0.189945
RF2	d_adjectivephrase	0.053704	0.040227
RF2	d_adverbphrase	0.003261	0.002177
RF2	r_adjectivephrase	0.053704	0.040227
RF2	r_adverbphrase	0.003261	0.002177
RF3	d_conjunction	0.069184	0.066463
RF3	d_list	0	0
RF3	r_conjunction	0.069184	0.066463
RF3	r_list	0	0
RF4	d_interjection	0	0
RF4	d_particle	0	0
RF4	d_preposition	0.001383	0.001259
RF4	r_interjection	0	0
RF4	r_particle	0	0
RF4	r_preposition	0.001383	0.001259

Table H23. Raw Data for Gantt Rules-Based Approach to Satisfaction Assessment.

Rule Family	Rule	# Candidate Matches	# Correct Matches	# Answer Set Matches	Possible # Matches
RF1	d_verbphrase	96	96	499	130480
RF1	r_nounphrase	521	521	499	130480
RF1	r_verbphrase	96	96	499	130480
RF1	d_nounphrase	521	521	499	130480
RF2	d_adjectivephrase	69	69	499	130480
RF2	d_adverbphrase	4	4	499	130480
RF2	r_adjectivephrase	69	69	499	130480
RF2	r_adverbphrase	4	4	499	130480
RF3	d_conjunction	222	222	499	130480
RF3	d_list	0	0	499	130480
RF3	r_conjunction	222	222	499	130480
RF3	r_list	0	0	499	130480
RF4	d_interjection	0	0	499	130480
RF4	d_particle	0	0	499	130480
RF4	d_preposition	56	56	499	130480
RF4	r_interjection	0	0	499	130480
RF4	r_particle	0	0	499	130480
RF4	r_preposition	56	56	499	130480

Table H24. Raw Data for CM-1 Rules-Based Approach to Satisfaction Assessment.

Rule Family	Rule	# Candidate Matches	# Correct Matches	# Answer Set Matches	Possible # Matches
RF1	d_verbphrase	543	50	1683	29162200
RF1	r_nounphrase	2060	334	1683	29162200
RF1	r_verbphrase	543	50	1683	29162200
RF1	d_nounphrase	2060	334	1683	29162200
RF2	d_adjectivephrase	477	58	1683	29162200
RF2	d_adverbphrase	157	3	1683	29162200
RF2	r_adjectivephrase	477	58	1683	29162200
RF2	r_adverbphrase	157	3	1683	29162200
RF3	d_conjunction	1468	109	1683	29162200
RF3	d_list	0	0	1683	29162200
RF3	r_conjunction	1468	109	1683	29162200
RF3	r_list	0	0	1683	29162200
RF4	d_interjection	0	0	1683	29162200
RF4	d_particle	0	0	1683	29162200
RF4	d_preposition	1209	2	1683	29162200
RF4	r_interjection	0	0	1683	29162200
RF4	r_particle	0	0	1683	29162200
RF4	r_preposition	1209	2	1683	29162200

Table H25. Recall, Precision, Number of Corrections, and Selectivity for Gantt Combination Approach to Satisfaction Assessment (TFThresh = 0.08, RThresh = 0.5).

Method	Ruleset	Recall	Precision	Number of Corrections	Selectivity	Normalized Number of Corrections	Normalized Selectivity
TF-IDF	(none)	66.73%	56.92%	418	0.45%	0.77551	0.0008%
RF1	d_verbphrase	0.673347	0.535885	466	0.48%	0.864564	0.0009%
RF1	r_nounphrase	0.667335	0.567291	528	0.45%	0.979592	0.0008%
RF1	r_verbphrase	0.691383	0.477839	652	0.55%	1.209647	0.0010%
RF1	d_nounphrase	0.667335	0.569231	583	0.45%	1.081633	0.0008%
RF2	d_adjectivephrase	0.667335	0.569231	499	0.45%	0.925788	0.0008%
RF2	d_adverbphrase	0.729459	0.49863	802	0.56%	1.487941	0.0010%
RF2	r_adjectivephrase	0.667335	0.569231	584	0.45%	1.083488	0.0008%
RF2	r_adverbphrase	0.667335	0.519501	555	0.49%	1.029685	0.0009%
RF3	d_conjunction	0.673347	0.508321	638	0.51%	1.183673	0.0009%
RF3	d_list	0.673347	0.535885	617	0.48%	1.144712	0.0009%
RF3	r_conjunction	0.667335	0.567291	528	0.45%	0.979592	0.0008%
RF3	r_list	0.691383	0.477839	652	0.55%	1.209647	0.0010%
RF4	d_interjection	0.667335	0.569231	583	0.45%	1.081633	0.0008%
RF4	d_particle	0.667335	0.569231	499	0.45%	0.925788	0.0008%
RF4	d_preposition	0.729459	0.49863	802	0.56%	1.487941	0.0010%
RF4	r_interjection	0.667335	0.569231	584	0.45%	1.083488	0.0008%
RF4	r_particle	0.667335	0.519501	555	0.49%	1.029685	0.0009%
RF4	r_preposition	0.673347	0.508321	638	0.51%	1.183673	0.0009%

Table H26. Recall, Precision, Number of Corrections, and Selectivity for CM-1 Combination Approach to Satisfaction Assessment (TFThresh = 0.4, RThresh = 0.5).

Method	Ruleset	Recall	Precision	Number of Corrections	Selectivity	Normalized Number of Corrections	Normalized Selectivity
TF-IDF	**(none)**	0.586453	0.356446	2478	0.021222	4.597403	0.0039%
RF1	d_verbphrase	0.59893	0.310536	2897	0.024877	5.374768	0.0046%
RF1	r_nounphrase	0.586453	0.337321	2198	0.022425	4.077922	0.0042%
RF1	r_verbphrase	0.613785	0.243805	3193	0.032472	5.923933	0.0060%
RF1	d_nounphrase	0.586453	0.356446	2933	0.021222	5.441558	0.0039%
RF2	d_adjectivephrase	0.586453	0.356446	1683	0.021222	3.122449	0.0039%
RF2	d_adverbphrase	0.622103	0.216815	3409	0.03701	6.324675	0.0069%
RF2	r_adjectivephrase	0.586453	0.356446	3075	0.021222	5.705009	0.0039%
RF2	r_adverbphrase	0.587047	0.248366	2890	0.030487	5.361781	0.0057%
RF3	d_conjunction	0.588235	0.298913	3381	0.025383	6.272727	0.0047%
RF3	d_list	0.59893	0.310536	2545	0.024877	4.721707	0.0046%
RF3	r_conjunction	0.586453	0.337321	2198	0.022425	4.077922	0.0042%
RF3	r_list	0.613785	0.243805	3193	0.032472	5.923933	0.0060%
RF4	d_interjection	0.586453	0.356446	2933	0.021222	5.441558	0.0039%
RF4	d_particle	0.586453	0.356446	1683	0.021222	3.122449	0.0039%
RF4	d_preposition	0.622103	0.216815	3409	0.03701	6.324675	0.0069%
RF4	r_interjection	0.586453	0.356446	3075	0.021222	5.705009	0.0039%
RF4	r_particle	0.587047	0.248366	2890	0.030487	5.361781	0.0057%
RF4	r_preposition	0.588235	0.298913	3381	0.025383	6.272727	0.0047%

Table H27. F-Measure and F-2 Measure for Gantt Combination Approach to Satisfaction Assessment (TFThresh = 0.08, RThresh = 0.5).

Method	Ruleset	F-Measure	F-2 Measure
TF-IDF	**(none)**	**0.614391144**	**0.645098799**
RF1	d_verbphrase	0.596802842	0.640487991
RF1	r_nounphrase	0.613259669	0.644599303
RF1	r_verbphrase	0.565110565	0.634657837
RF1	d_nounphrase	0.614391144	0.645098799
RF2	d_adjectivephrase	0.614391144	0.645098799
RF2	d_adverbphrase	0.592351505	0.667644901
RF2	r_adjectivephrase	0.614391144	0.645098799
RF2	r_adverbphrase	0.584210526	0.631399317
RF3	d_conjunction	0.579310345	0.632292059
RF3	d_list	0.596802842	0.640487991
RF3	r_conjunction	0.613259669	0.644599303
RF3	r_list	0.565110565	0.634657837
RF4	d_interjection	0.614391144	0.645098799
RF4	d_particle	0.614391144	0.645098799
RF4	d_preposition	0.592351505	0.667644901
RF4	r_interjection	0.614391144	0.645098799
RF4	r_particle	0.584210526	0.631399317
RF4	r_preposition	0.579310345	0.632292059

Table H28. F-Measure and F-2 Measure for CM-1 Combination Approach to Satisfaction Assessment (TFThresh = 0.4, RThresh = 0.5).

Method	Ruleset	F-Measure	F-2 Measure
TF-IDF	**(none)**	0.443396226	0.01879593
RF1	d_verbphrase	0.409007912	0.020980469
RF1	r_nounphrase	0.428292471	0.019538773
RF1	r_verbphrase	0.348986486	0.024911599
RF1	d_nounphrase	0.443396226	0.01879593
RF2	d_adjectivephrase	0.443396226	0.01879593
RF2	d_adverbphrase	0.321560197	0.026938411
RF2	r_adjectivephrase	0.443396226	0.01879593
RF2	r_adverbphrase	0.349054937	0.02395441
RF3	d_conjunction	0.396396396	0.021266391
RF3	d_list	0.409007912	0.020980469
RF3	r_conjunction	0.428292471	0.019538773
RF3	r_list	0.348986486	0.024911599
RF4	d_interjection	0.443396226	0.01879593
RF4	d_particle	0.443396226	0.01879593
RF4	d_preposition	0.321560197	0.026938411
RF4	r_interjection	0.443396226	0.01879593
RF4	r_particle	0.349054937	0.02395441
RF4	r_preposition	0.396396396	0.021266391

Table H29. Raw Data for Gantt Combination Approach to Satisfaction Assessment (TFThresh = 0.08, RThresh = 0.5).

Method	Ruleset	# Candidate Matches	# Correct Matches	# Answer Set Matches	Possible # Matches
TF-IDF	(none)	585	333	499	130480
RF1	d_verbphrase	627	336	499	130480
RF1	r_nounphrase	587	333	499	130480
RF1	r_verbphrase	722	345	499	130480
RF1	d_nounphrase	585	333	499	130480
RF2	d_adjectivephrase	585	333	499	130480
RF2	d_adverbphrase	730	364	499	130480
RF2	r_adjectivephrase	585	333	499	130480
RF2	r_adverbphrase	641	333	499	130480
RF3	d_conjunction	661	336	499	130480
RF3	d_list	627	336	499	130480
RF3	r_conjunction	587	333	499	130480
RF3	r_list	722	345	499	130480
RF4	d_interjection	585	333	499	130480
RF4	d_particle	585	333	499	130480
RF4	d_preposition	730	364	499	130480
RF4	r_interjection	585	333	499	130480
RF4	r_particle	641	333	499	130480
RF4	r_preposition	661	336	499	130480

Table H30. Raw Data for CM-1 Combination Approach to Satisfaction Assessment (TFThresh = 0.4, RThresh = 0.5).

Method	Ruleset	# Candidate Matches	# Correct Matches	# Answer Set Matches	Possible # Matches
TF-IDF	(none)	2769	987	1683	29162200
RF1	d_verbphrase	3246	1008	1683	29162200
RF1	r_nounphrase	2926	987	1683	29162200
RF1	r_verbphrase	4237	1033	1683	29162200
RF1	d_nounphrase	2769	987	1683	29162200
RF2	d_adjectivephrase	2769	987	1683	29162200
RF2	d_adverbphrase	4829	1047	1683	29162200
RF2	r_adjectivephrase	2769	987	1683	29162200
RF2	r_adverbphrase	3978	988	1683	29162200
RF3	d_conjunction	3312	990	1683	29162200
RF3	d_list	3246	1008	1683	29162200
RF3	r_conjunction	2926	987	1683	29162200
RF3	r_list	4237	1033	1683	29162200
RF4	d_interjection	2769	987	1683	29162200
RF4	d_particle	2769	987	1683	29162200
RF4	d_preposition	4829	1047	1683	29162200
RF4	r_interjection	2769	987	1683	29162200
RF4	r_particle	3978	988	1683	29162200
RF4	r_preposition	3312	990	1683	29162200

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