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**DECISION SUPPORT SYSTEM FOR MALAYSIAN  
UNDERGRADUATE STUDENT'S STUDY LOANS**

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SEPTEMBER 2012**

DECISION SUPPORT SYSTEM FOR MALAYSIAN  
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by

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Final dissertation submitted in partial fulfillment of the requirements for  
the  
Bachelor of Technology (Hons)  
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**CERTIFICATION OF APPROVAL**  
**DECISION SUPPORT SYSTEM FOR MALAYSIAN**  
**UNDERGRADUATE STUDENT’S STUDY LOANS**

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YEN MUN S’NG

A project submitted in partial fulfillment to the  
Business Information System Programme  
Universiti Teknologi Petronas  
In partial fulfillment of the requirement for the

**BACHELOR OF TECHNOLOGY (Hons)**  
**(BUSINESS INFORMATION SYSTEM)**

Approved by

.....  
(DR. P.D.D Dominic)

**UNIVERSITI TEKNOLOGI PETRONAS**  
**SEPTEMBER 2012**

## **CERTIFICATION OF ORIGINALITY**

This is to certify that I am responsible for the work submitted in this project, that the original work is my own except as specified in the references and acknowledgements, and that the original work contained herein have not been undertaken or done by unspecified sources or persons.

.....  
**(YEN MUN S'NG)**

## **ABSTRACT**

Decision Support System (DSS) has been extremely studied in the both individual and group decision making. Until today, there is no DSS that assists individual in selecting suitable study loan. This report presents the research and techniques used in developing DSS that assists Malaysia undergraduate students in selecting study loan. The results of the feasibility study had revealed that DSS is applicable for individuals that are actively searching for study loan.

The objectives of this study is to develop a DSS that guides students in choosing the most equitable study loan as well as the shortest payback time for their study loan. The DSS was developed based on waterfall model with 4 phases which are (1) Requirement Definitions, (2) System and Software Design, (3) Implementation and Unit Testing, and (4) Integration and System Testing.

The system can provide its users updated information about the amount needed in a particular program offered by a college in order to make effective decision in choosing the amount of study loan. In addition, users will also know about the amount to be reimbursed to its loan provider upon their completion of study.

To my family members and especially my brother

**~Graham Mun Jee~**

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## **ABBREVIATIONS AND NOMENTCLATURES**

<b>DSS</b>	Decision Support System
<b>OLAP</b>	Online Analytical Processing
<b>STPM</b>	Sjiil Tinggi Persekolahan Malaysia
<b>SPM</b>	Sijil Pelajaran Malaysia

# CHAPTER 1

## INTRODUCTION

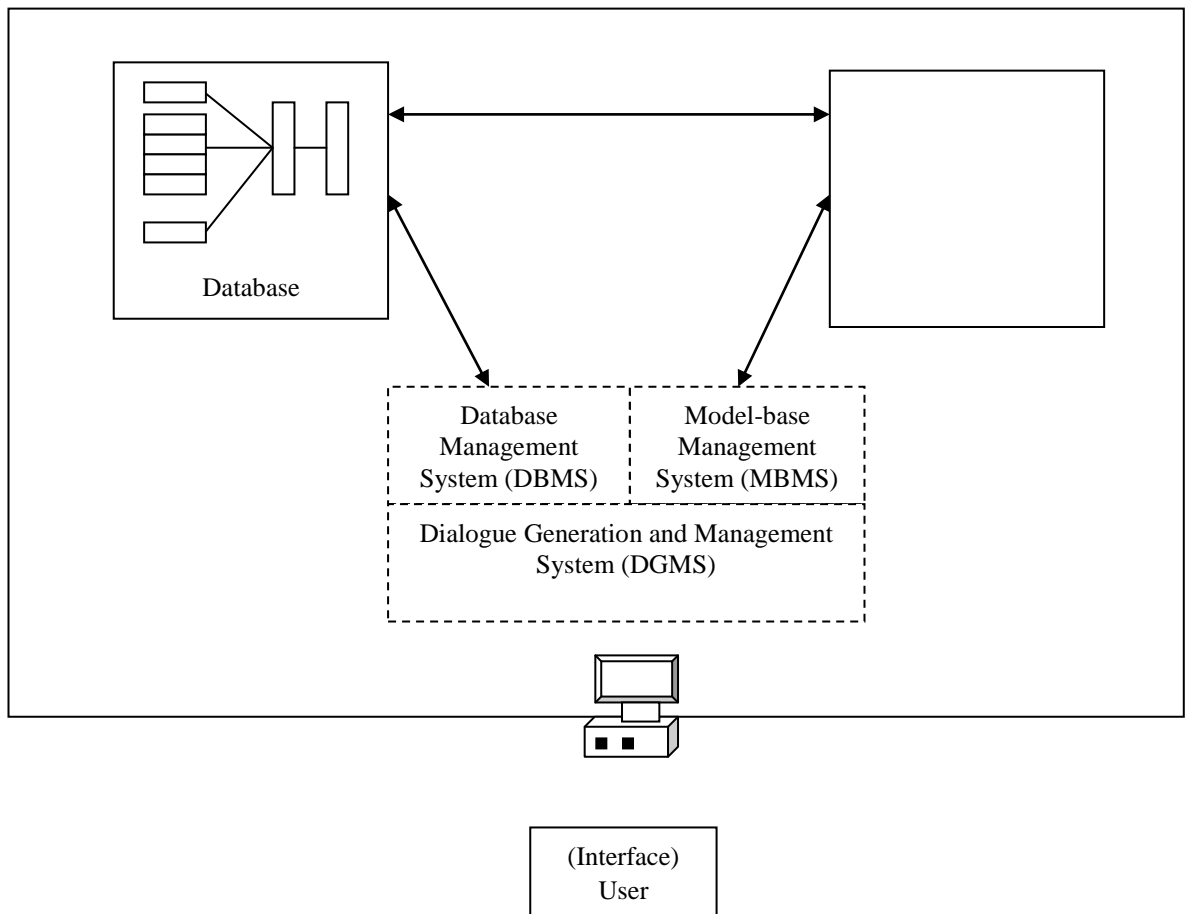
### 1.1 Background of study

#### 1.1.1 Decision Support System

For centuries, human had been using available knowledge to make important decision. The development of Management Information System in 1960s had increased the number of decision being ever made before as well as the complexity of the decision. Gradually, the Internet had given an additional opportunity to DSSs such as OLAP and other web-drive systems where decisions were made easily with the data stored in database and able to access easily. *Drew Hofler*, the Senior Manager of Financial Solutions for Ariba, Inc.<sup>[1]</sup> presents an article on transformation in procurement method – claiming that consumers are more connected to the business, where information are readily available and better quality of decisions can be make.

Figure 1.1 shows that DSS consists of two major sub-systems which are the users (decision maker) and the computer system. Users (decision maker) which is a part of DSS do not enter data to build a database, whereas using their own decision or insight throughout the decision making process. DBMS are a set of computer programs that control the access of data stored within DSS. MBMS is another set of computer program in DSS that allow users to create, edit, update or delete a model. In order to make specific decisions, models are created using the relevant database files. The created models and databases will be stored in the direct access storage device. For user, they can only access to the interface of the system

where choice of input and output, data and information presentation format etc. will be customize according to their preferences



**Figure 1.1: Component of DSS**

### 1.1.2 Current Study Loan

Study loan is one of the financial aids that can help individuals to fund their tuition fees, books and utilities fees, living expenses or other education related expenses in university. Unlike scholarship or sponsorship which is usually an award by an organization or an institution to support selected students financially for the education where normally does not require to pay back financially, a study loan is a financial aid that must be reimburse upon students completed their studies or started working and able to earn for their living.

In Malaysia, every year scholarship awards are too few to be awarded to all students that had performed well in the studies. Besides, the number of tertiary education institutions is increasing as Malaysia aim to be regional education center had resulted more learning opportunity to all individuals. Thus, the demand for study loan increases.

Choosing study loan is one of the major dilemmas for individual that had intention to further their studies. The expensive cost of tertiary education that significantly increasing with time raise the individual alertness in choosing study loan in order to avoid high interest rate. In the process of selecting a suitable loan for individual, advice and information about the loan from someone that has deep knowledge about the loan for instance i.e. the loan issuer or bank officer is vital.

However, in most cases, individual tend to follow the majority or buddies blindly without identifying the lowest interest rate and the shortest reimbursement duration of the loan. Besides, most individuals are not aware of the loan they had incurred prior to their completion of tertiary studies and finally realize that they are hugely in debt.

## **1.2 Problem Statement**

The main problem that Malaysia undergraduate student is that:-

- Decision support functionality or application that assist individual in choosing suitable study loan are not provide.
- Loan reimbursement need to be calculated manually using the formula provided.
- The formula provided is usually static and users normally do not understand the variable of the formula.

### **1.3 Relevancy of the Project**

The demand of study loan has increasing gradually because

- Malaysia is aiming to be the regional education hub.
  - Education opportunities increases
- Too many top scorers but too few scholarships.
  - Study loan is one of the alternatives for students that are interested to continue their studies.

### **1.4 Objectives and Scope of Study**

The main purposes of this study are:

- To develop a DSS that guides students in choosing the most equitable study loan.
- To recommend individuals the shortest payback time proposal for their study loan.

The scope of the study for this project is on the knowledge-based system which is the decision support system. In order to build this decision support system, knowledge on study loan will also be studied to facilitate in developing the inference engine (model base) of the decision support system.

In brief, the scopes of study are

- Knowledge-based system (decision support system)
  - Inference engine (rule-based reasoning)
- Study loan
  - Loan interest rate



## **CHAPTER 2**

### **LITERATURE REVIEW**

#### **2.1 Overview**

In this chapter, relevant literature on DSS will be scanned through in order to get a better understand about DSS such as the definition, framework as well as the characteristic of DSS from several studies conducted prior to this project.

#### **2.2 Related Theory/ Approaches**

##### **Definition of DSS**

Druzdzel and Flynn (1999) suggest that DSSs are interactive, computer-based systems that aid users in judgment and choice activities. Besides, DSS provide data storage and retrieval but enhance the traditional information access and retrieval functions with support for model building and model-based reasoning. DSS also support framing, modeling, and problem solving.<sup>[2]</sup>

Vyas and Sharma (2007) describe DSS as an integrated entity that provide management with tools and timely plus accurate information to assist in decision making.

DSS can be defined as computer based systems that help decision makers to confront ill structured problems through direct interaction with data and analysis models.<sup>[3]</sup>

In addition, Tripathi (2011) have the same opinion with Druzdzel and Flynn where a DSS is an interactive computer based information system with an organized collection of models, people, procedures, software, databases, telecommunication, and devices, which helps decision makers to solve unstructured or semi-structured

business problems. Moreover, DSS is also a computer-based information systems designed in such a way that help managers to select one of the many alternative solutions to a problem.<sup>[4]</sup>

### Framework of DSS

Hayen (2006) examined the framework of DSS developed by Gorry and Scott Morton and suggested that the framework is useful to assist in gaining perspective on the field of DSS and providing focus on their characteristic as well as improving the effectiveness of the system.<sup>[5]</sup>

<b>Characteristics of Information</b>	<b>Operational Control</b>	<b>Strategic Planning</b>
Source	Largely internal	External
Scope	Well defined, narrow	Very wide
Level of Aggregation	Detailed	Aggregate
Time Horizon	Historical	Future
Currency	Highly current	Quite old
Required Accuracy	High	Low
Frequency of Use	Very frequent	Infrequent

**Source:** Gorry, G. A., & Scott Morton, M. S. (1989). A framework of management information systems. *Sloan Management Review*, 13(1), 51.

**Figure 2.1: Gorry and Scott Morton DSS Framework**

Asemi et al (2011) also examined Gorry and Scott Morton DSS Framework and found out that the framework can be classified by its structure into three levels; structured decision, unstructured decision and semi structured decision.<sup>[6]</sup>

		Management levels		
		Operation control	Management Control	Strategic planning
Degree Of Decision Structured	Structured	Accounting receivable Order entry Inventory Control	Budget analysis Engineered cost Short term Forecasting	Tanker fleets mix Warehouse and factory location
	Semi structured	Production scheduling Cash management	Variance analysis overall budget Budget preparation	Mergers and acquisition New product planning
	Unstructured	PERT/ Cost System	Sale and production	R.&D planning

**Figure 2.2: The Gory and Morton grid**

### Characteristic of DSS

Asemi et al (2011) had identified that there are 9 characteristic of DSS from various researchers which are [\[6\]](#):-

- 1) **DSS provide support for decision maker mainly in semi structured and unstructured situations** by bringing together human judgment and computerized information. Such problem cannot be solved (cannot be solved conveniently) by other computerized systems, such as MIS.
- 2) **DSS attempts to improve the effectiveness of decision-making** (accuracy, timeliness, quality) rather than its efficiency (cost of making the decision, including the charges for computer time) (Davis & Olson, 1985).
- 3) **DSS provides support to individuals as well as to groups.** Many organizational problems involve group decision-making. The less structured problem frequently requires the involvement of several individuals from different departments and organizational levels.
- 4) **Advanced DSS are equipped by a knowledge component**, which enables the efficient and effective solution of very difficult problems (Turban & Aronson, 1998).
- 5) **A DSS can handle large amount of data** for instance advanced database management package have allowed decision makers, to search database for

information. A DSS can also solve problems where a small amount of data is required.

- 6) **A DSS can be developed using a modular approach.** With this approach, separate functions of the DSS are placed in separate modules - program or subroutines-allowing efficient testing and implement of systems. It also allows various modules to be used for multiple purposes in different systems.
- 7) **A DSS has a graphical orientation.** It has often been said that a picture is worth a thousand words. Today's DSSs can help managers make attractive, informative graphical presentations on computer screens and on printed documents. Many of today's software packages can produce line drawing, pie chart, trend line and more. This graphical orientation can help decision makers a better understanding of the true situation in a given market place.
- 8) **A DSS support optimization and heuristic approach.** For smaller problems, DSS has the ability to find the best (optimal) situation. For more complex problems, heuristics are used. With heuristic, the computer system can determine a very good-but not necessarily the best- solution. This approach gives the decision maker a great deal of flexibility in getting computer support for decision making activities.
- 9) **A DSS can perform "what – if" and goal – seeking analysis.** "What – if" analysis is the process of making hypothetical change to problem data and observing impact of the results. In with" what – if "analysis, a manager can make changes to problem data (the number of automobiles for next month) and immediately see the impact on the requirement for subassemblies (engines, windows, etc.) (Stair, 1992).

## **CHAPTER 3**

### **METHODOLOGY**

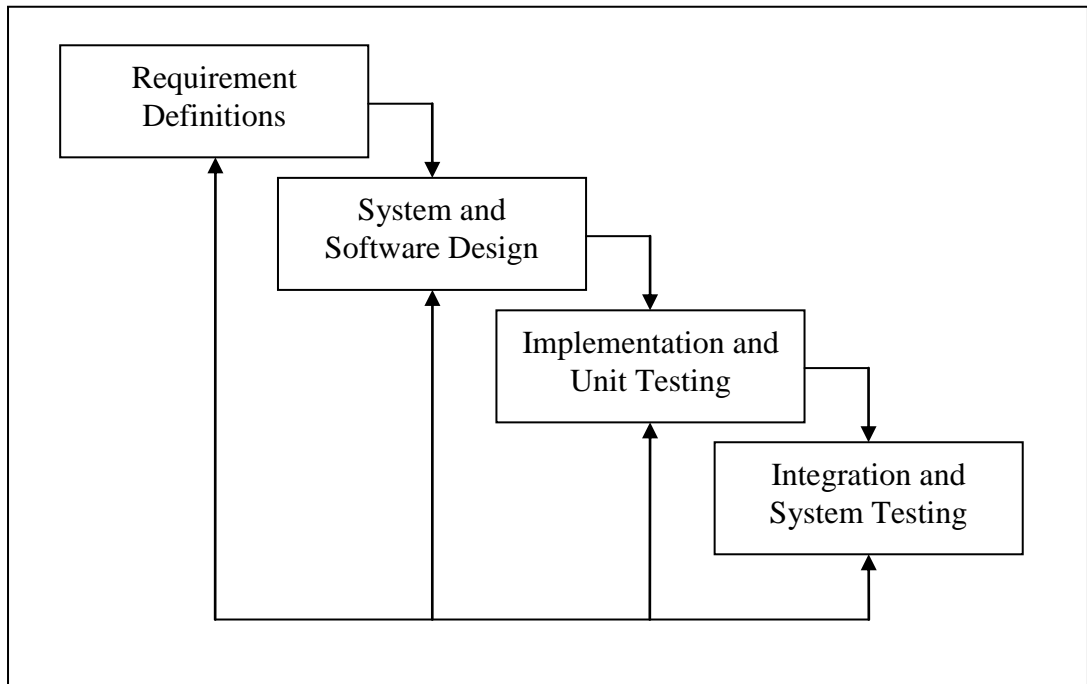
#### **3.1 Overview**

This chapter will be focusing on the techniques and methodology used to develop the DSS for Students' Study Loan. The methodology use to develop the DSS for Students' Study Loan is based on the waterfall model. Apart from that, the hardware, software, tools as well as the procedures that is required in developing the DSS were identified in this chapter.

#### **3.2 Research Methodology**

This development of the DSS that can assist individuals in choosing their study loan is based on the waterfall model. The waterfall model is a linear and sequential where the development process of the DSS is based on the downward flowing stages as shown in the **Figure 3.1**.

One of the reasons waterfall model chosen for the development of this project is because the documentation of the system development is well defined and promotes discipline in documentation (Vennapoosa, 2012)<sup>[7]</sup>. In addition, each step can be easily monitor and control since it is in a sequential order as shown in Figure 3.1.



**Figure 3.1: Waterfall Model**

### **3.2.1 Requirement Definitions**

The first phase of the waterfall model is analysis phases where analytical skills are essential. In this phase, the problem statement was analyzed to obtain a better understanding. Next, the objectives and the scope of the study were also identified based on the problem statement.

### **3.2.2 System and Software Design**

In this phase, the design of workflow of the system was done. Expert knowledge and experience (heuristic) are needed to outline the needs of user of the system. Besides, the system architecture and the necessary formula of system were identified and described in this phase.

### **3.2.3 Implementation and Unit Testing**

At this phase, the system architecture was converted to a working system using the necessary tools. In other words, the development of the system begins here.

### **3.2.4 Integration and System Testing**

The final phase is the system testing where the working system will be test by users to determine whether the output generated by the system is able to solve the users' problem.

## **3.3 Method used**

### **3.3.1 Questionnaire (quantitative data)**

To come out with the problem statement, a quantitative survey using questionnaire was conducted. Data obtained from survey were selected using sampling method. Quantitative data had provided valuable information on how individual choose their study loan as well as the feasibility of the application if DSS in the process of choosing a study loan. The results of the quantitative survey tabulated in Chapter 4 portray the feasibility of the DSS in the process of study loan selection.

### **3.3.2 Literature review**

Reviewing the existing literature done by researcher prior to this project is vital because it can provide more information about a particular field i.e. DSS. Thus, based on the existing theories developed by the previous researchers, appropriate methods were selected to solve the problem statement of this project. The relevant literatures that had been reviewed were documented in Chapter 2. In addition, list of Malaysian loan providers with application terms and conditions were identified and documented in Chapter 4.

### **3.3.3 System design and unit testing**

It started with the development of interface, followed by the creation of databases and last but not least encoding the system. The source code of the program was written based on the system architecture. After complete encoding the system, a series of testing was conducted to check the functionality of the program is similar to the system architecture. Also, the testing is to check for errors of the system i.e. the completeness and accuracy of the information generated were conducted in the phase.

### **3.3.4 User acceptance and usability testing**

In this phase, users will registered themselves as new user and login to the system to test the functionality of the system. The system will continuous improvise based on the user comments obtained will be tested by the user's comments to ensure that the system perform as desired.



### 3.4 Tools Required

#### 3.4.1 Software

Software used in developing the decision support system as shown in table below.

<b>Elements</b>	<b>Software used</b>
Development tool	Adobe Dreamweaver
Programming language	PHP, HTML, Javascript
Database	MySQL
Web Server	WAMP SERVER

**Table 3.1: Software used**

#### 3.4.2 Hardware

The following are hardware used in developing the decision support system:-

<b>Hardware</b>	
CPU	Intel(R) Core(TM) i5-2450M 2.4 GHz
Memory	6 GB
Hard disk space	250 GB
Others	Other computer hardware accessories (i.e mouse, keyboard, screen, etc)

**Table 3.2: Hardware used**

### 3.5 Progress in Gantt chart

Activities	Date	Duration (weeks)	1	2	3	4	5	6	7	8	9	10	11	1	2	3	4	5	6	7	8	9	10	11	12	13	14	
<b>SEMESTER</b>			<b>Final Year Project 1</b>											<b>Final Year Project 2</b>														
<b>PLANING</b>																												
1-Identify Problem and Objectives		2	■	■																								
2-Feasibility Analysis		2		■	■																							
<b>Title selection and proposal</b>					■																							
<b>ANALYSIS</b>																												
1-Review Literature		1				■																						
2-Feasibility Analysis		2				■	■																					
3-Methodology Design		2							■	■																		
<b>Extended Proposal</b>									■																			
<b>DESIGN</b>																												
1-Documentation design		2								■	■																	
2-Database design		3									■	■	■															
3-Data collection		3										■	■	■														
<b>Interim report</b>													■															
<b>IMPLEMENTATION</b>																												
1-Data collection		8												■	■	■	■	■	■	■								
2-Interface design		8												■	■	■	■	■	■	■								
3-Model implementation		8													■	■	■	■	■	■								
4-Implementation		8														■	■	■	■	■	■							
<b>Progress report</b>																■												
<b>TESTING</b>																												
1-Debugging		7																			■	■	■	■	■	■		
<b>PRE-EDX</b>																						■						
<b>Dissertation</b>																							■					
<b>Viva</b>																								■				
<b>Final Dissertation</b>																										■		

## **CHAPTER 4**

### **RESULTS AND DISCUSSION**

#### **4.1 Overview**

In this chapter, results and findings gathered throughout the development of DSS will be documented. Result from research methodology which covers the qualitative and quantitative survey as well as the quantitative findings from the system usability scale survey will be discussed.

#### **4.2 Questionnaire or Quantitative survey**

A quantitative survey had been conducted to find out the feasibility of DSS in the study loan selection process and how students choose their study loan currently. The surveys were conducted using Google Document online form so that it is widely reachable for students from different college/university as an additional control measure in case different demographic background has different understanding. A total of 43 respondents were surveyed.

##### **4.2.1 Questionnaire or Quantitative survey (Results)**

The questionnaires comprised of 8 closed-ended questions. Questions included the demography, users' knowledge on study loan interest rate, how difficult user face while selecting a study loan, ways used to choose study loan and user willingness to use DSS in choosing study loan.

## Demography questions:

### Question 1: Respondent's age range

Age Range	No. of respondents
Less than 18 years old	5
19 years old – 21 years old	9
22 years old - 24 years old	28
25 years old and above	1

**Table 4.1: Respondent's age range**

According to the survey results, 28 respondents are in the age range of 22-24 years old, 9 respondents 19-21 years old, 5 of the respondents are 18 years old and below and only 1 respondent is aged more than 25.

### Question 2: Respondent's level of education

Highest level of education	No. of respondents
SPM	7
STPM/ equivalent to Diploma	9
Foundation Studies	25
Matriculation	2

**Table 4.2: Respondent's level of education**

Based on the data collected, 25 of respondents had studied Foundation Studies programs before proceed to Undergraduate Studies. 9 of them had completed their Sjiil Tinggi Persekolahan Malaysia (STPM) or equivalent to Diploma Studies, 7 had completed Sijil Pelajaran Malaysia (SPM) and 2 studied in Matriculation.

### Question 3: Respondent's monthly household income

Household monthly income (RM)	No. of respondents
3,000- 4,000	24
4,001-5,000	12
5,001-6,000	5
More than 6,001	2

**Table 4.3: Respondent's monthly household**

The survey shown that 24 respondents' household monthly income are between RM3, 000 to RM 4,000. 12 respondents have household monthly income of RM4, 001 to RM5, 000. 5 of them have monthly income between RM5, 001 and RM 6,000 and 2 respondents have monthly income of RM6, 001 and above.

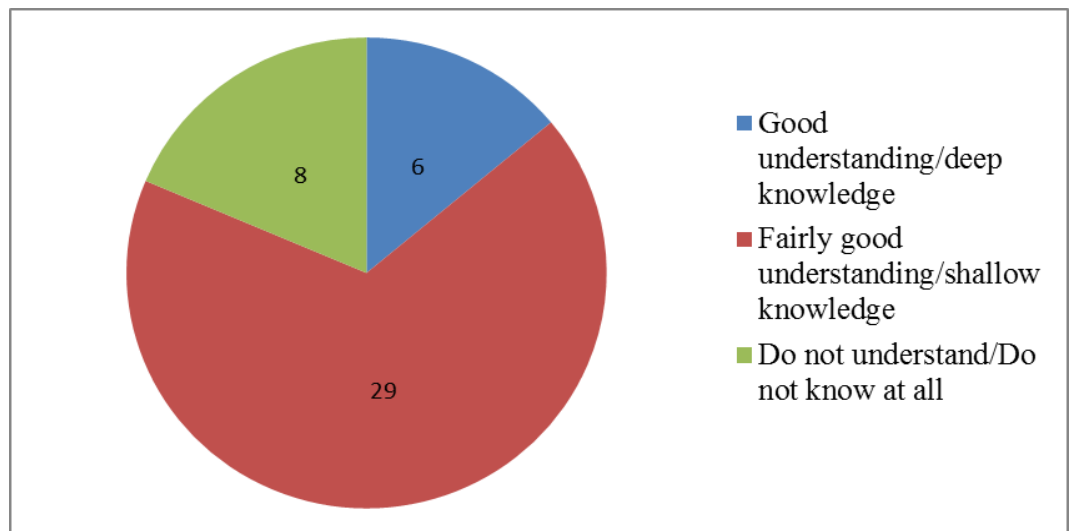
### Question 4: Respondent's family size

Family size (person in family)	No. of respondents
1-3	14
4-6	24
7-9	5

**Table 4.4: Respondent's family size**

As per the data collected, 24 respondents has the family size of between four to five person, 14 respondents has a family size between six and eight people and only 5 respondents has less than or equal to three people in the family.

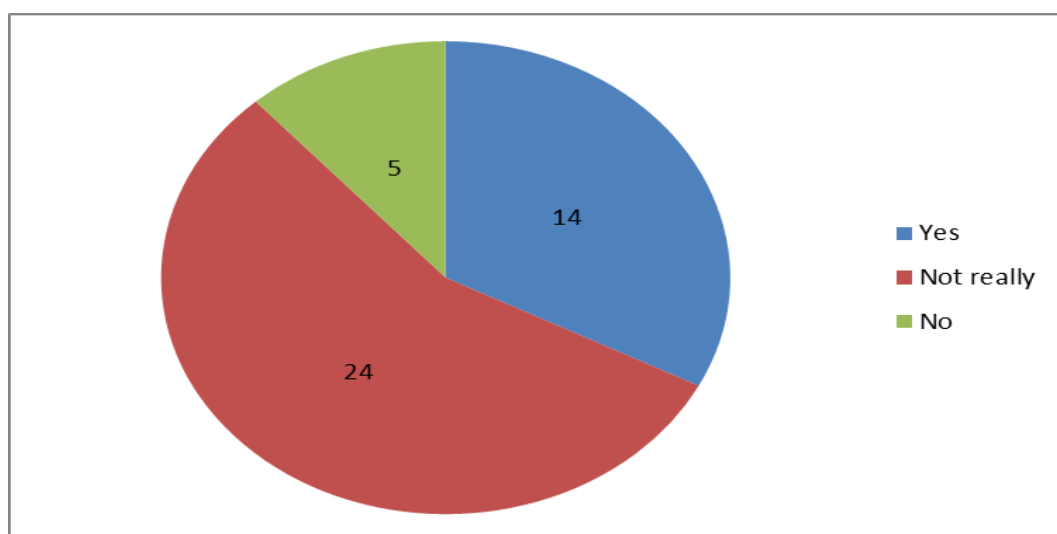
**Question 5: Respondents' understanding about the current study loan in Malaysia**



**Figure 4.1: Respondents' understanding about the current study loan in Malaysia**

In Question 5, respondents' knowledge about the current study loan interest rate was surveyed. Figure 4.1 portrays the result of the question. According to the result, 29 out of 43 respondents have a fairly good knowledge about the interest rate. 8 respondents do not know at all about the interest rate of the study loan. Only 6 respondents have a good understanding about the interest rate of study loan.

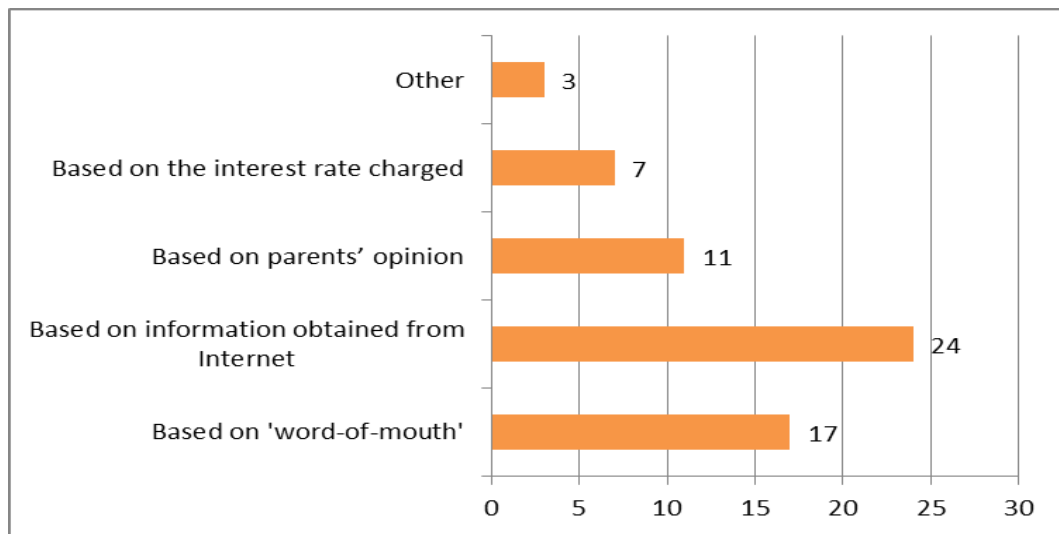
**Question 6: Level of difficulty face in selecting a study loan**



**Figure 4.2: Is it difficult to choose a study loan**

Question 6 inquired whether respondents found it difficult to choose a study loan that is suitable for them. Figure 4.2 show the result of the question. 24 respondents did not actually found any significant difficulty while selecting study loan.14 respondents stated that they found it difficult in selecting a study loan. However, 5 respondents do not face any problem while selecting their study loan.

**Question 7: Ways used to choose study loan**

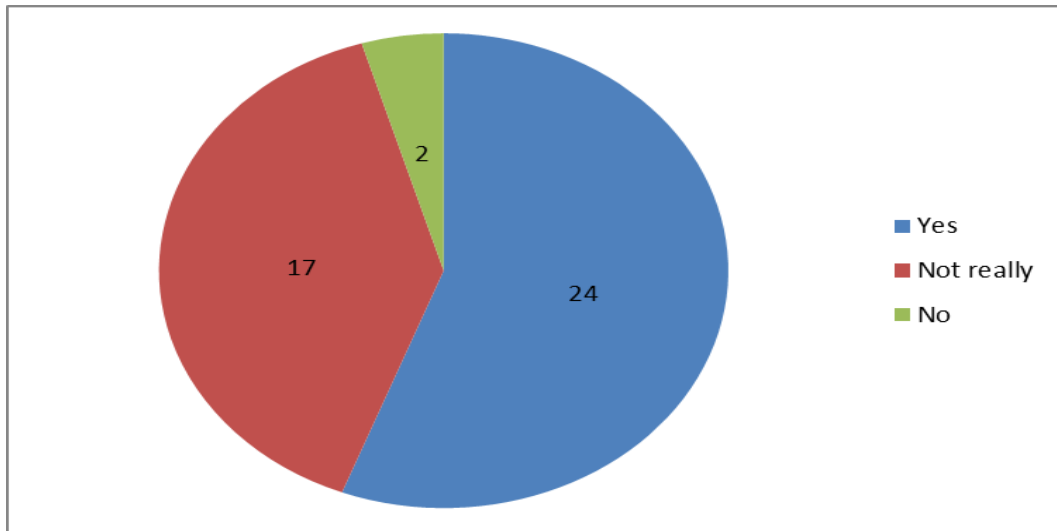


**Figure 4.3: Ways used to choose study loan**

For Question 7, respondents can choose more than one option on how they choose their study loan. Figure 4.3 shows the ways used by the respondents in choosing their study loan. 24 respondents choose their study loan based on the information obtained from Internet. 17 of them choose study loan based on the ‘word of mouth’, 11 based on their parents’ opinion, and only 7 respondents choose based on the interest rate of the loan. 3 respondents choose based on Other methods where the respondents answered:-

- 1)“**based on the term and condition they apply**”
- 2)“**i'm never make any study loan**”
- 3) “**I don't have to take a loan**”

**Question 8: User willingness to use DSS in choosing study loan**



**Figure 4.4: User willingness to use DSS in choosing study loan**

The last question, Question 8, enquired whether the respondents would use DSS in assisting them to select study loan. Figure 4.4 portrays the results. 24 of the respondents will use the system to assist them in choosing their study loan. 17 will hesitate whether to use they will use decision support system while choosing their study loan. Only 2 respondents stated that they will not use the system.



### **Questionnaire or Quantitative survey (Discussion)**

The feasibility study of the DSS for Undergraduate Students' Study Loan was conducted with students that had chosen their study loan as well as those who are actively looking for study loan.

The study had shown that only 6 out of 43 respondents understand the interest rate of their study loan. However, the remaining respondents barely know the interest rate and some even do not know about their study loan interest rate.

Besides the study also revealed that students in Malaysia choose their study loan based on the information obtained from Internet which is mainly from Internet forum, discussion threads and etc. Besides, most respondents stated that they choose their study loan based on the 'word-of-mouth' and their parents opinion. Through this study, it was found out that students in Malaysia hardly ever use DSS in choosing their study loan and most of them choose study loan 'blindly' without ascertaining their loan reimbursement period and amount.

Nonetheless, the final question which is "the willingness of the respondents to let DSS in assisting them in choosing study loan" portrays whether the DSS is applicable for Undergraduate students in study loan. The result shows that the DSS is applicable for the students that are interested to select study loan. Only 2 responds stated that they will not use the system because one of the respondents is no longer studying and the other was financially supported by his parents. Thus the DSS is not applicable for them.

### 4.3 Qualitative Survey (Interview)

An interview session was conducted with a Customer Service officer at PTPTN One Stop Center to get a better understanding on the study loan provider.

Summary of the interview:

- 1) Can you briefly explain on the basic requirement to apply PTPTN loan?
  - Borrower must be a Malaysian citizen and is not be blacklisted by PTPTN not older than 45 years old.
  - Borrower must open an account at Bank Simpanan Nasional.
  - Borrower must not be bonded by other organization or loan provider
  
- 2) Is there any decision support functionality in PTPTN official/corporate Website?
  - No
  
- 3) What is the interest rate of the loan currently?
  - 1% (Starting from Jun 2008)
  - Student that is still reimbursing can apply to lower the interest rate.
  
- 4) How long would you suggest the loan repayment of a particular loan amount?
  - Based on the study loan amount borrowed

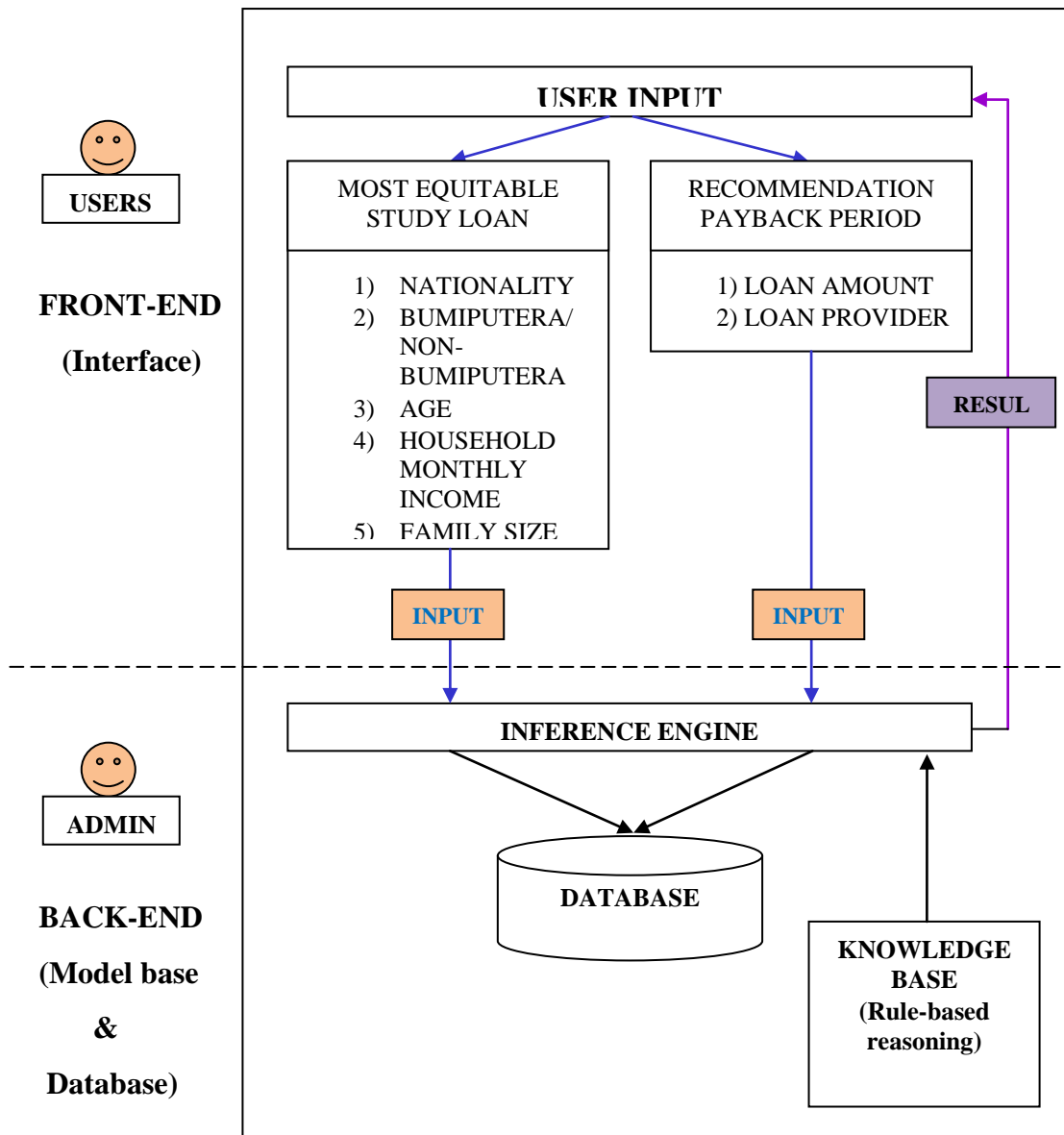
#### 4.4 List of Malaysia Study Loan Provider with terms and conditions

Loan Name	Requirements
PTPTN	Malaysian citizens
MARA	Malaysian citizens only for Bumiputera
MIED	Malaysian citizens
KOJADI	Malaysian citizens KOJADI Member(RM100)
Bank Rakyat Loan (Al-Falah)	Malaysian citizens
RHB Bank (Study Loan)	Registered student of any college or universities

**Table 4.5: List of Malaysia Study Loan Provider**

**Table 4.5** depicted Malaysian undergraduate study loan provider. Based on the data gathered, most of the study loan providers require borrowers to be a Malaysian citizens, only one study loan provider that accept foreign citizenship borrowers which is the RHB Bank Study Loan.

#### 4.5 Process flow diagram



**Figure 4.5: Process flow diagram**

**Figure 4.5** illustrates the process flow of data (input) in Decision Support System for Malaysian Undergraduate Student's Study Loans. Based on the process flow diagram shown in Figure 4.5, users can interact with the system by entering necessary information. There are 2 options of users:-

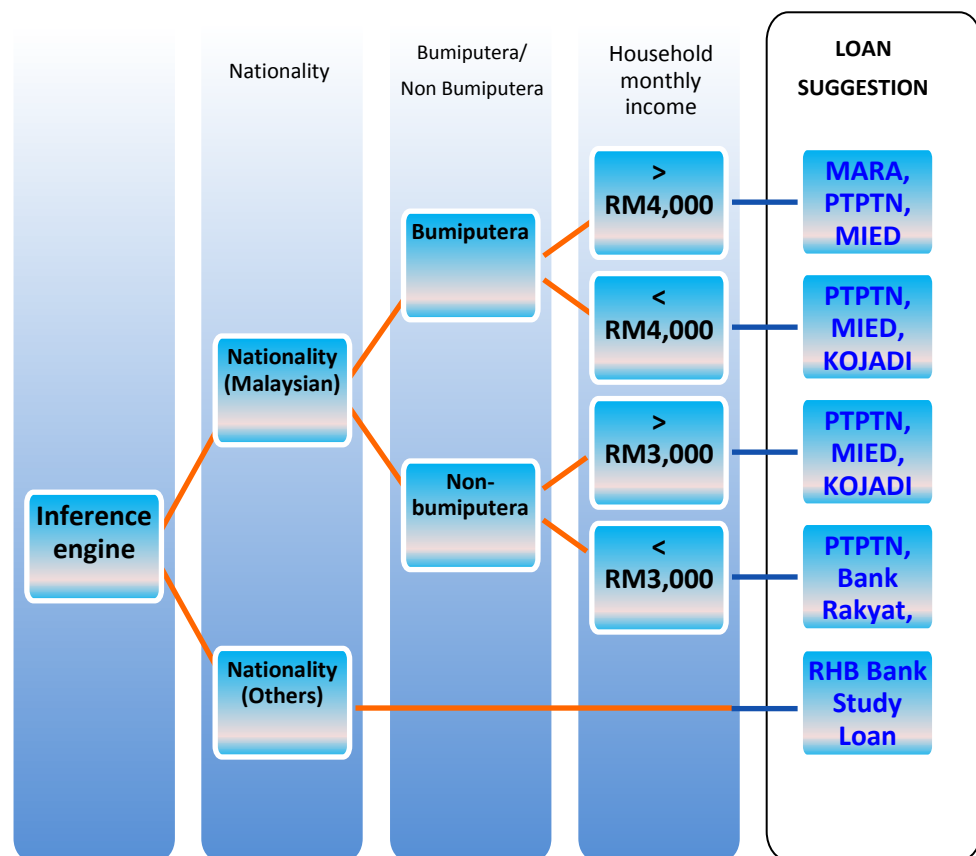
**Option 1:**

**This option is for students who are actively seeking for study loan.**

Input → Nationality, Bumiputera/ Non- Bumiputera, Age, Household monthly income, and Family size

Output → Most equitable study loan

Using input obtained from user, the inference engine will tries to derive answer (list of suitable loan provider) from the knowledge base. Rule-based reasoning or IF-THEN rules were used in the knowledge base. The rule base reasoning is portray as shown in **Figure 4.6**



**Figure 4.6: Inference engine**

**Option 2:**

**This option is for students who are studying and wanted to plan ahead on how to reimburse their loan.**

Input → Loan amount, Loan provider

Output → Suggested reimbursement period and reimbursement amount in monthly basis

Similarly, using loan amount and loan provider obtained from user, the inference engine will tries to derive answer (best repayment loan period and reimbursement amount in monthly basis) from the knowledge base.

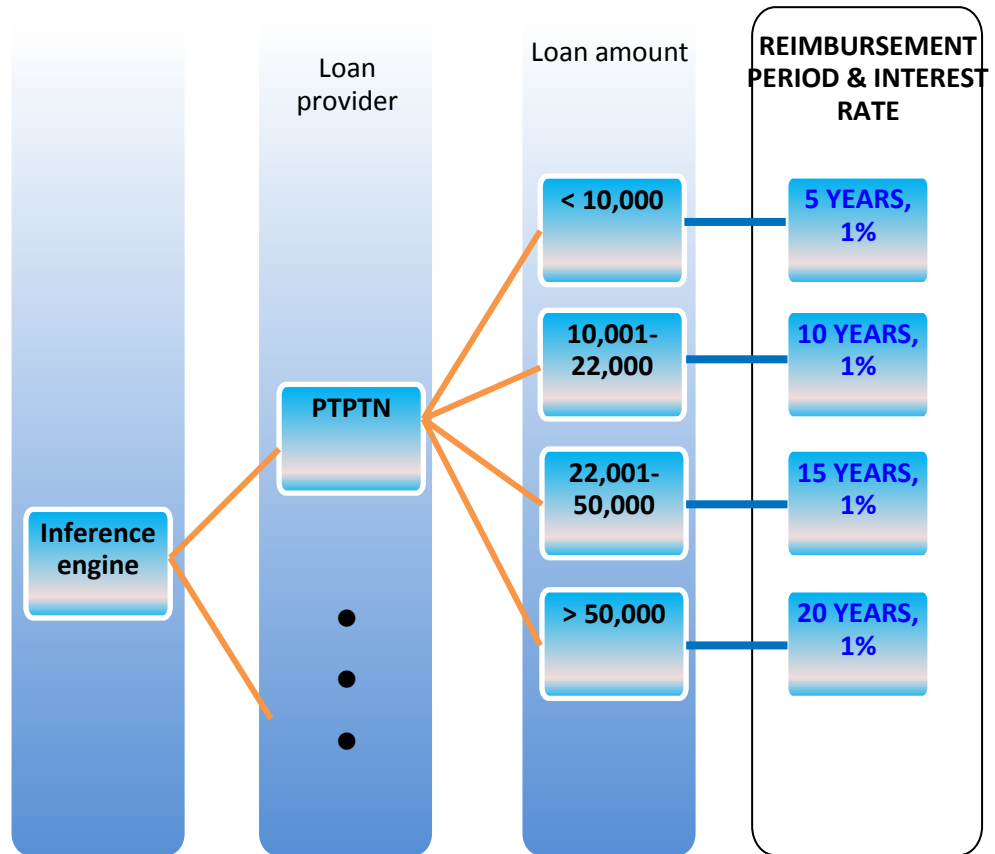


Figure 4.7: Inference engine

## **4.6 Unified Modeling Language (UML)**

During the system development 3 different modeling language to enhance the understanding of a system had been developed which are

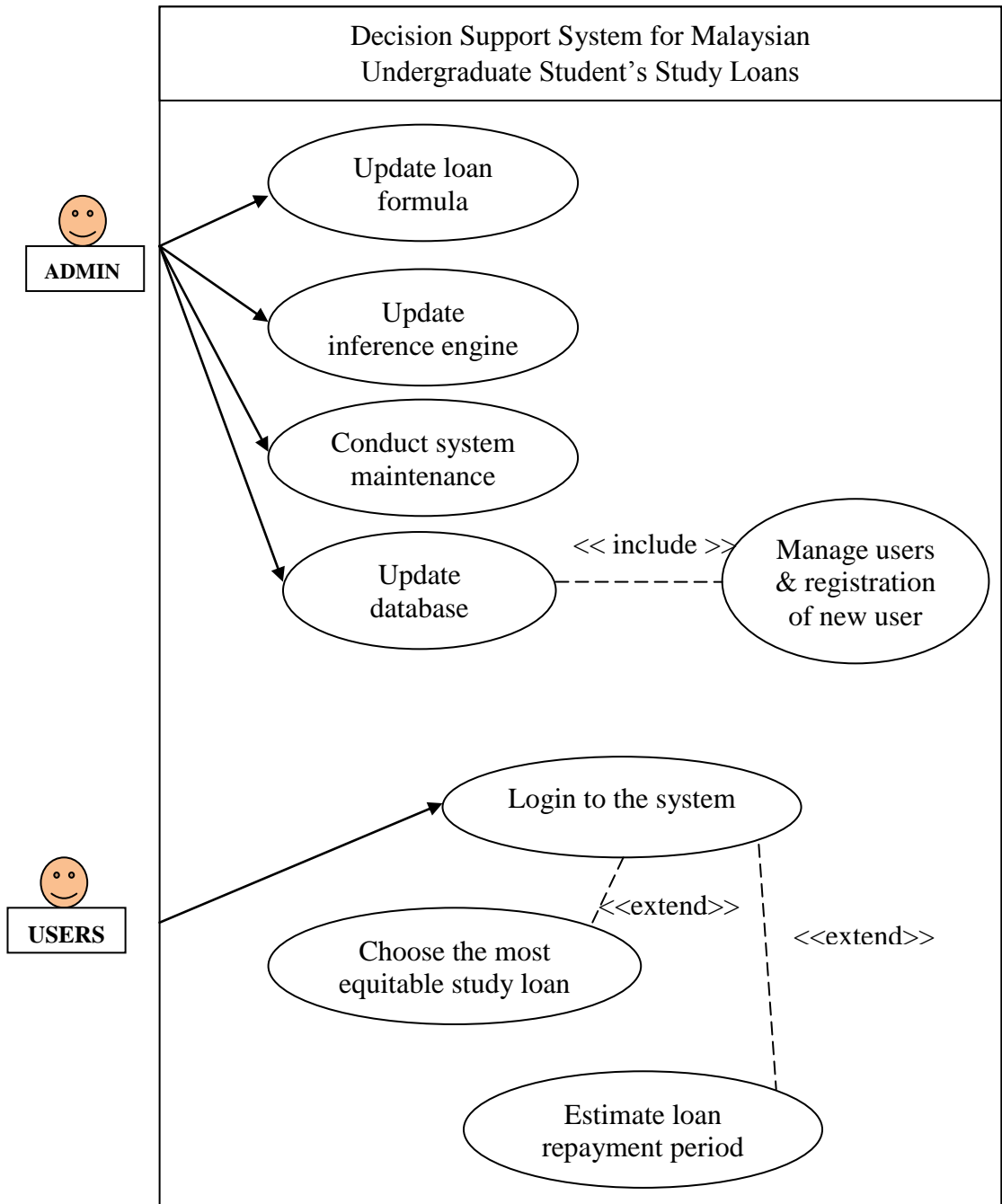
4.5.1 Use case diagrams

4.5.2 Sequence diagrams

Each diagram serves different purposes and enhances the understanding of a system development process

### **4.6.1 Use Case Diagram**

The UML diagram with use case diagram describes the functionality of the system from the actor's point of view which is user and admin as depicted in Figure 4.8. From the diagram it shows that the user can only access to the system front-end while admin can both access to the front-end and back-end of the system. In other words, admin is the super user of the system where he can change, update and alter the database, model base and the interface of the system.



**Figure 4.8: Use Case Diagram**



#### 4.6.2 Use Case Description

Use case description describes the functionality of each use case by its actor, trigger and relationships.

##### Use Case Description for System Admin

<b>Use case name:</b> Update loan formula	<b>ID:</b> 1	<b>Importance level:</b> High
<b>Primary Actor:</b> Admin	<b>Use Case Type:</b> Detail, essential	
<b>Stakeholders and interest:</b> Admin – change, alter or update loan formula		
<b>Brief Description:</b> This use case portrays how admin change, alter or update the formula of a study loan		
<b>Trigger:</b> When there is change of interest rate of study loan. <b>Type:</b> External		
<b>Relationships</b> <b>Association:</b> No <b>Include:</b> No <b>Extend:</b> No		

**Table 4.6: System Admin Use Case Diagram 1**

As shown in Table 4.6 the actor of update loan formula is system admin. This functionality will be trigger if there is change of interest rate of study loan.

<b>Use case name:</b> Update loan provider requirements	<b>ID:</b> 2	<b>Importance level:</b> High
<b>Primary Actor:</b> Admin	<b>Use Case Type:</b> Detail, essential	
<b>Stakeholders and interest:</b> Admin – change, alter or update loan provider requirement		
<b>Brief Description:</b> This use case describes how admin change, alter or update the loan provider requirements		
<b>Trigger:</b> When there is change of the study loan terms and conditions <b>Type:</b> External		
<b>Relationships</b> <b>Association:</b> No <b>Include:</b> No <b>Extend:</b> No		

**Table 4.7: System Admin Use Case Diagram 2**

In Table 4.7, the actor of update loan provider requirements is system admin. This functionality will be trigger when there is change of the study loan terms and conditions.

<b>Use case name:</b> Conduct system maintenance	<b>ID:</b> 3	<b>Importance level:</b> Moderate
<b>Primary Actor:</b> Admin	<b>Use Case Type:</b> Detail, essential	
<b>Stakeholders and interest:</b> Admin – wants to maintain the usability of the system		
<b>Brief Description:</b> This use case displays how admin maintain the Web system functionality		
<b>Trigger:</b> Periodically maintenance of the interface <b>Type:</b> External		
<b>Relationships</b> <b>Association:</b> No <b>Include:</b> No <b>Extend:</b> No		

**Table 4.8: System Admin Use Case Diagram 3**

Table 4.8 shows that system maintenance is conducted by system admin. This functionality will be trigger when there need to update the functionality of the system such as updating the interface and so on.

<b>Use case name:</b> Update database	<b>ID:</b> 4	<b>Importance level:</b> Moderate
<b>Primary Actor:</b> Admin	<b>Use Case Type:</b> Detail, essential	
<b>Stakeholders and interest:</b> Admin – wants to maintain the data stored in database		
<b>Brief Description:</b> This use case shows how admin maintain users’ data stored in the database		
<b>Trigger:</b> Periodically maintenance of the database <b>Type:</b> External		
<b>Relationships</b> <b>Association:</b> No <b>Include:</b> Manage users’ registration <b>Extend:</b> No		

**Table 4.9: System Admin Use Case Diagram 4**

Table 4.9 depicts database update was done by system admin. Database will be update in a periodically period. The update database functionality includes managing users’ registration.

#### **Use Case Description for System User**

<b>Use case name:</b> Login to the system	<b>ID:</b> 4	<b>Importance level:</b> High
<b>Primary Actor:</b> User	<b>Use Case Type:</b> Detail, essential	
<b>Stakeholders and interest:</b> User – Register and login to the system		
<b>Brief Description:</b> This use case shows the user register and log in to the system		
<b>Trigger:</b> Correct username and password obtained <b>Type:</b> External		
<b>Relationships</b> <b>Association:</b> No <b>Include:</b> No <b>Extend:</b> Choose the most equitable study loan & : Estimate loan repayment period		

**Table 4.10: System User Use Case Diagram 1**

Table 4.10 use case description portrays how a system user login in or register to the system. User successfully logged in when username and password obtained from user are matched. This use case is extended to two other use case which are 1) Choose the most equitable study loan  
2) Estimate loan repayment period

<b>Use case name:</b> Choose the most equitable study loan	<b>ID:</b> 5	<b>Importance level:</b> High
<b>Primary Actor:</b> User	<b>Use Case Type:</b> Detail, essential	
<b>Stakeholders and interest:</b> User – Choosing the most equitable loan		
<b>Brief Description:</b> This use case depicts how user estimate the most equitable study loan		
<b>Trigger:</b> When user input necessary information and click on “Estimate” <b>Type:</b> External		
<b>Relationships</b> <b>Association:</b> Login to the system <b>Include:</b> No <b>Extend:</b> No		

**Table 4.11: System User Use Case Diagram 2**

Table 4.11 shows how a system user chooses the most equitable study loan using this system. This use case is extended from the Login use case. In other words, user must login before he can reach this functionality. To estimate which study loan is the most equitable, user has to input necessary information and click on “Estimate” button.

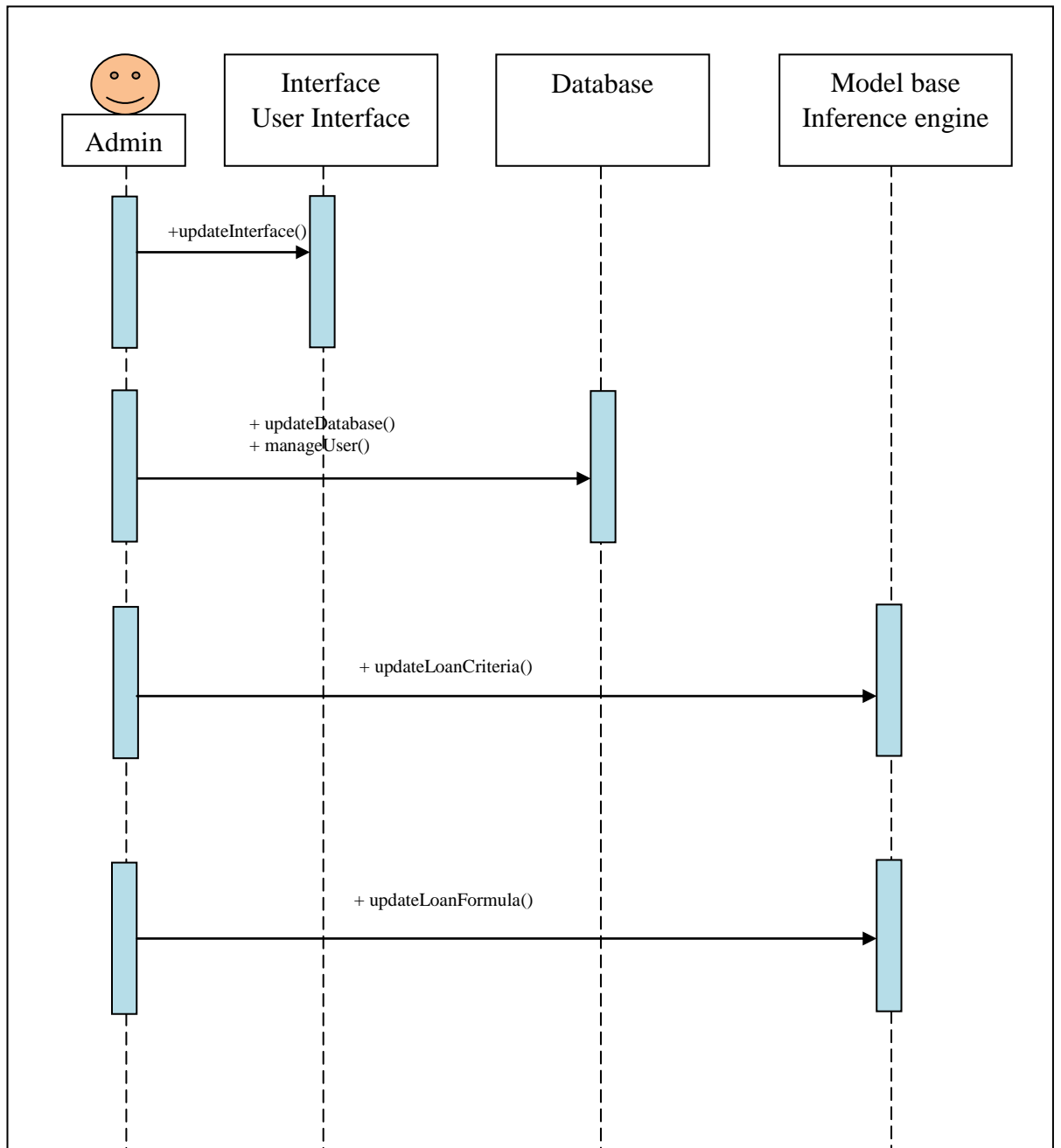
<b>Use case name:</b> Estimate loan repayment period	<b>ID:</b> 5	<b>Importance level:</b> High
<b>Primary Actor:</b> User	<b>Use Case Type:</b> Detail, essential	
<b>Stakeholders and interest:</b> User – estimate the best loan repayment period		
<b>Brief Description:</b> This use case portrays how a user estimate the best loan repayment period		
<b>Trigger:</b> When user input loan amount and loan provider and click on “Estimate” <b>Type:</b> External		
<b>Relationships</b> <b>Association:</b> Login to the system <b>Include:</b> No <b>Extend:</b> No		

**Table 4.12: System User Use Case Diagram 3**

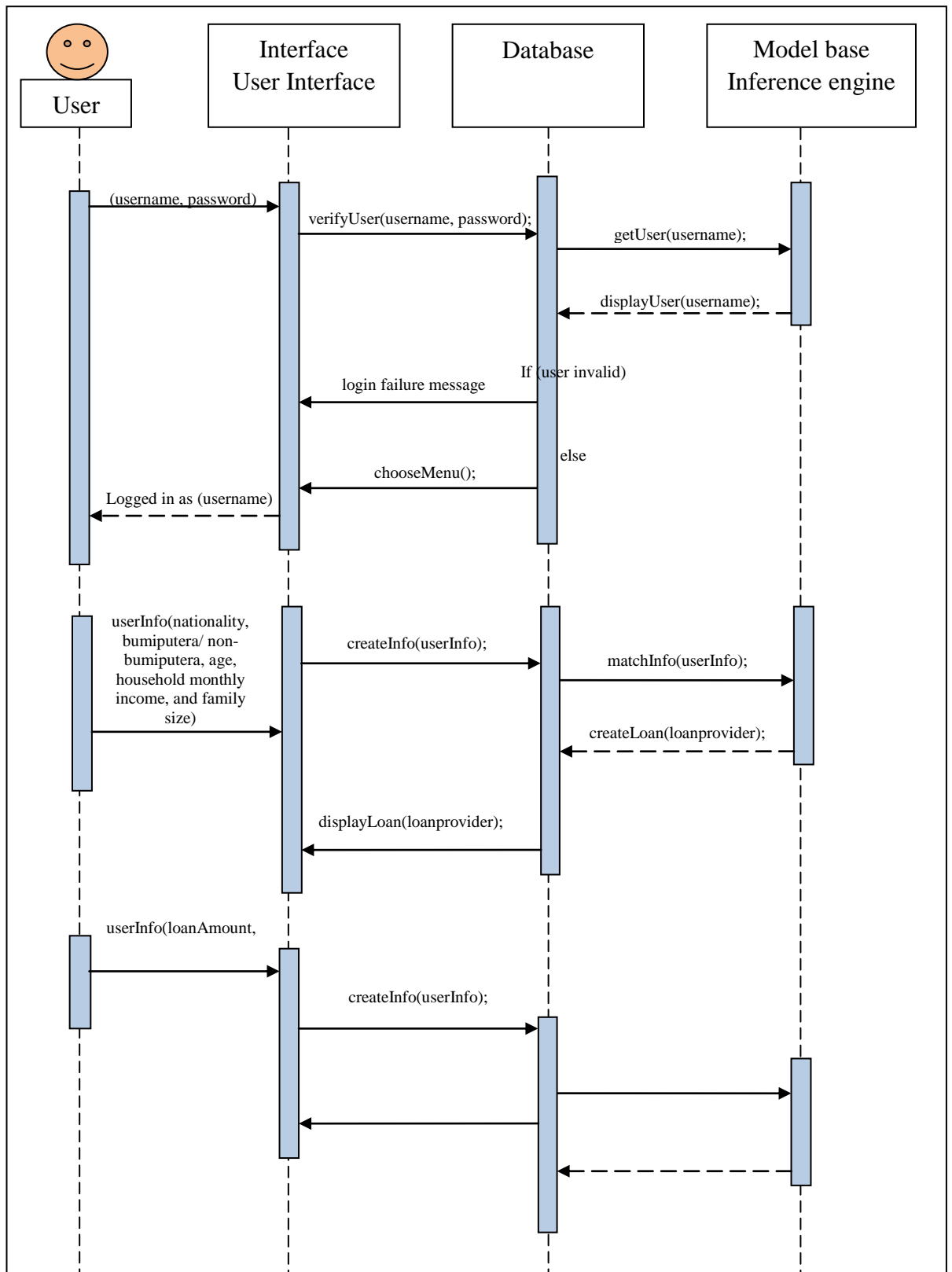
Table 4.12 is another use case that is extended from the Login use case. This use case shows how a system user estimate loan repayment period. Similarly, user must login before he can reach this functionality. To estimate loan repayment period, user has to input loan amount and loan provider and click on “Estimate” button.

#### **4.6.3 Interaction diagram: Sequence diagram**

Sequence diagram shows the order of processes operates in a particular system. It depicts the explicit sequence of messages that are passed between object in a defined interaction. **Figure 4.9** and **Figure 4.10** show the sequence of Decision Support System for Malaysian Undergraduate Student’s Study Loans for both admin and user. **Figure 4.9** shows that admin can directly access to the interface, database and model base of the system and perform change, update and manage processes. As depicted in **Figure 4.10**, user can perform 3 main processes which are login, estimate loan provider and estimate loan repayment period. Based on **Figure 4.10**, user only able to interact or perform processes with the interface.

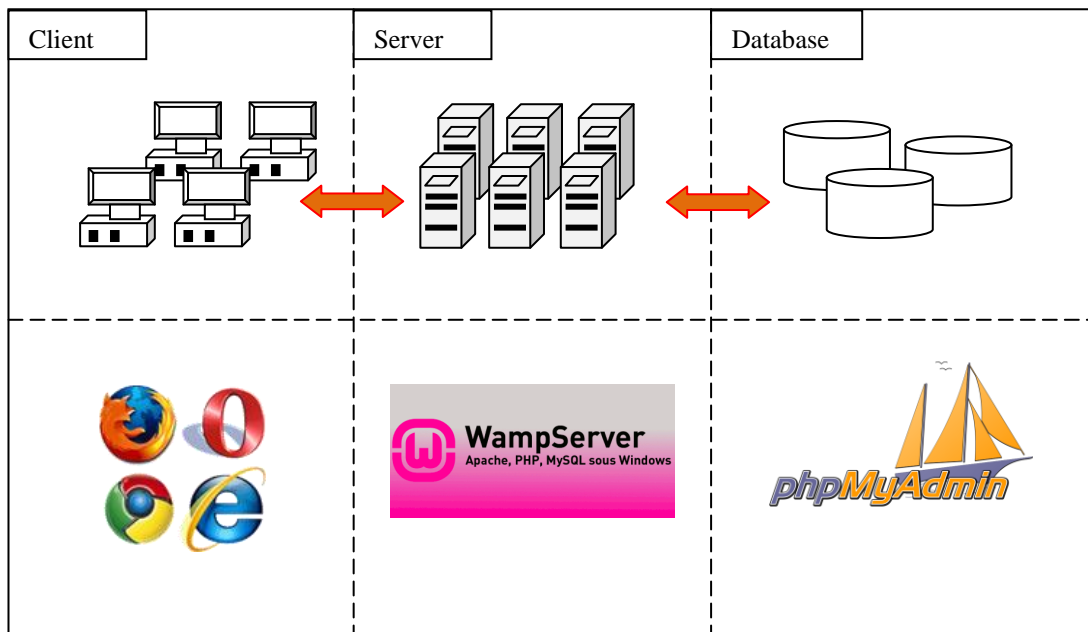


**Figure 4.9: Admin System Sequence Diagram**



**Figure 4.10: User System Sequence Diagram**

## 4.7 System Architecture



**Figure 4.11: System Architecture**

Figure 4.11 shows the system architecture of Decision Support System for Malaysian Undergraduate Student's Study Loans. Users can interact with the decision support system using any Web browser. WampServer was used as a web development platform while phpMyadmin database was used to store users' data.



## 4.8 Project Deliverables

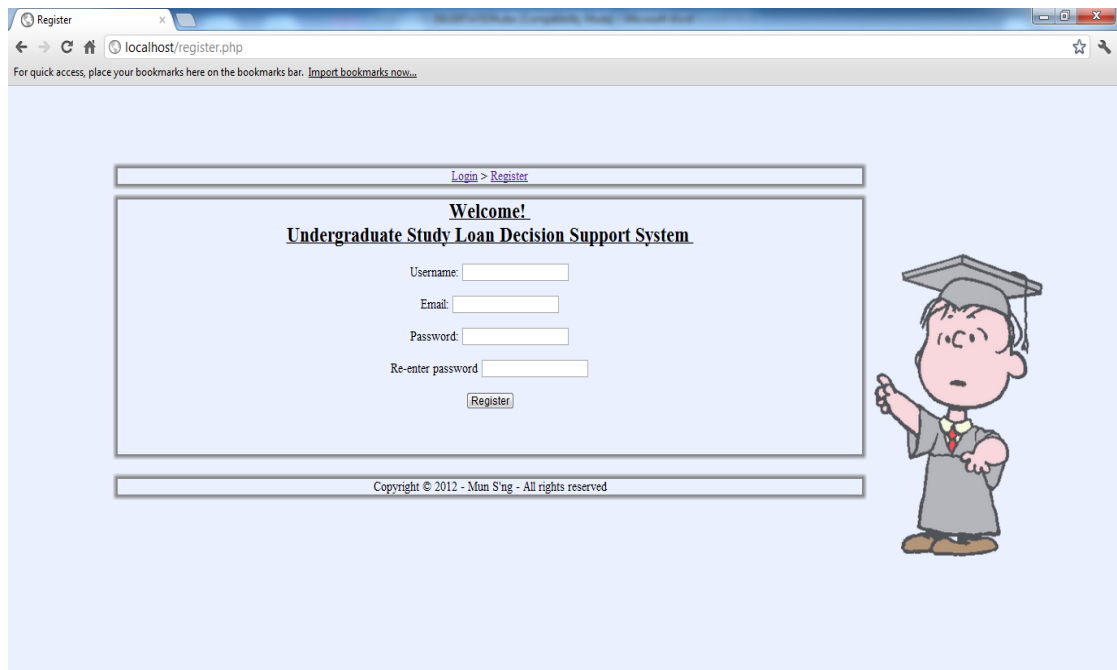


Figure 4.12: Registration Page

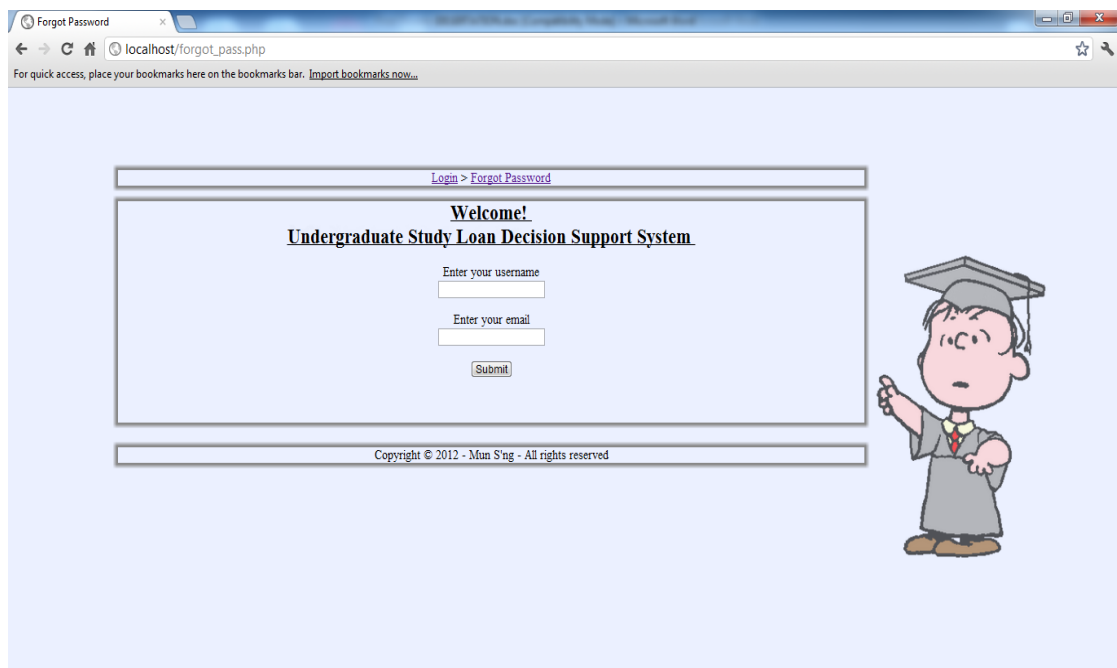


Figure 4.13: Forgot Password/ Password reset

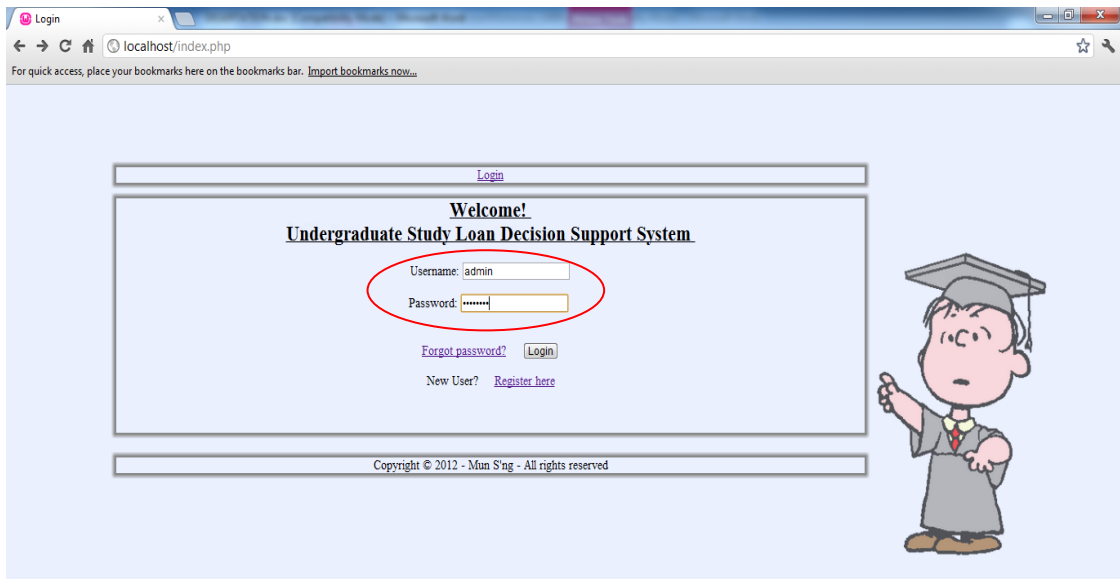


Figure 4.14: Login Page (logging in as admin)

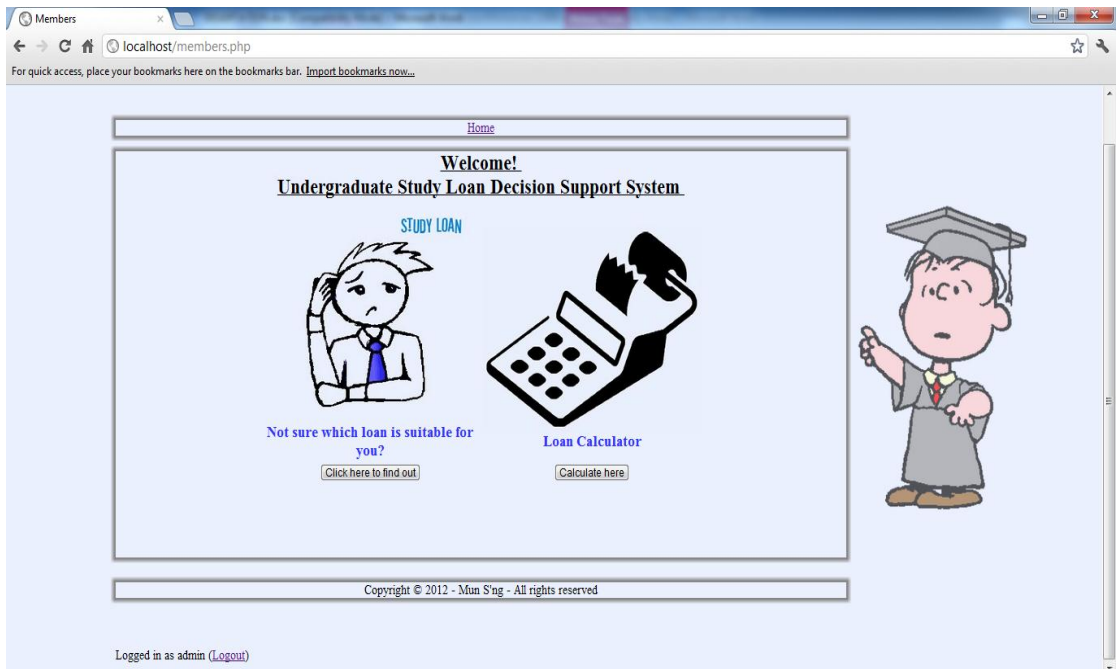


Figure 4.15: Home Page

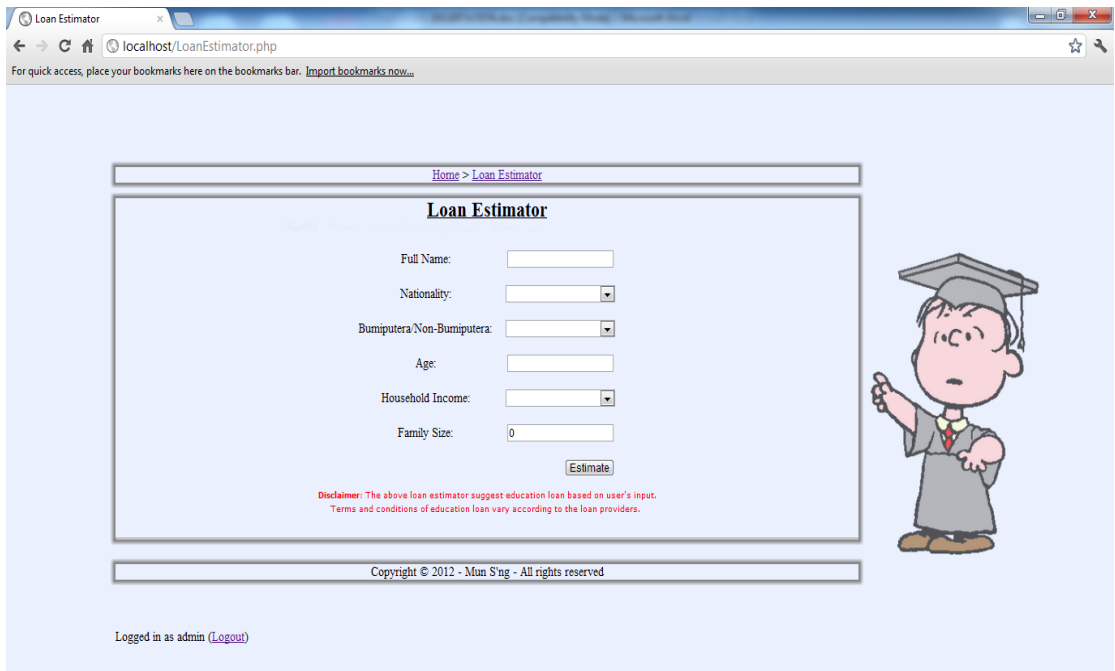


Figure 4.16: Loan Estimator



Figure 4.17: Loan Calculator

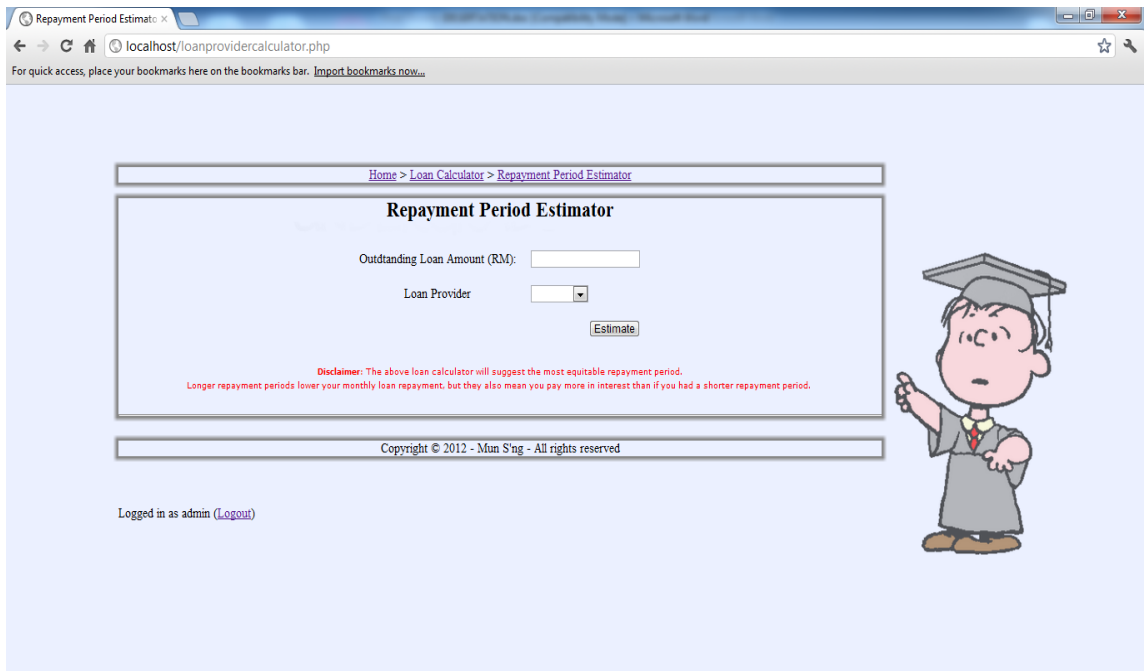


Figure 4.18: Loan Calculator (estimate loan repayment period)

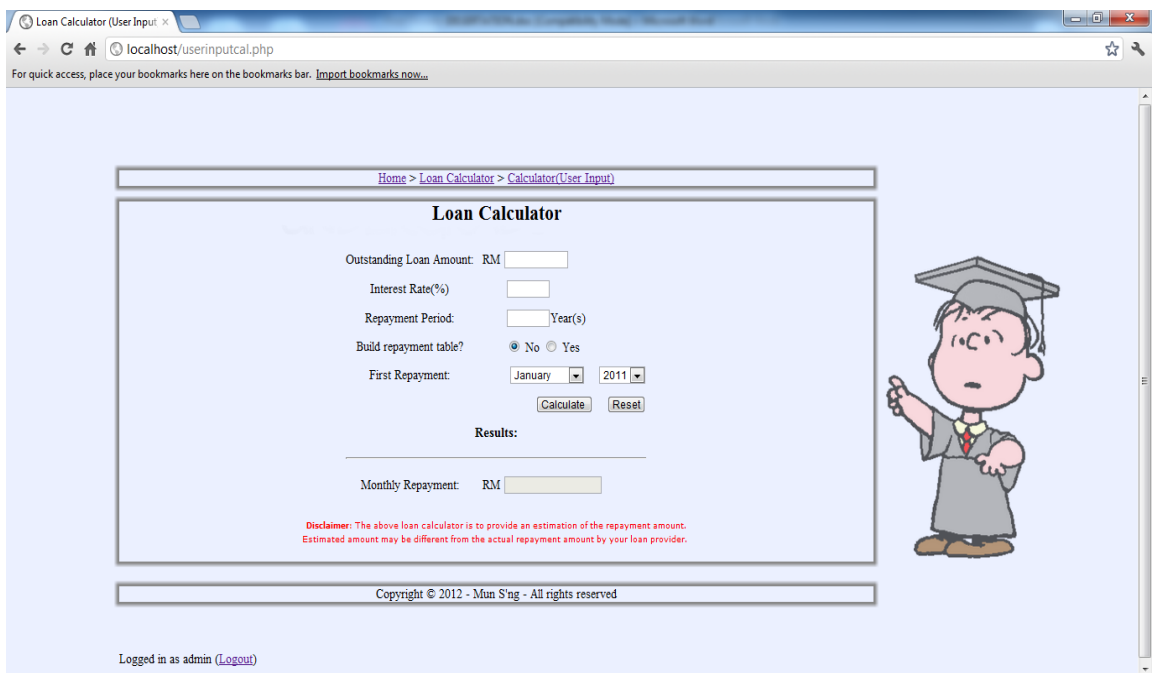
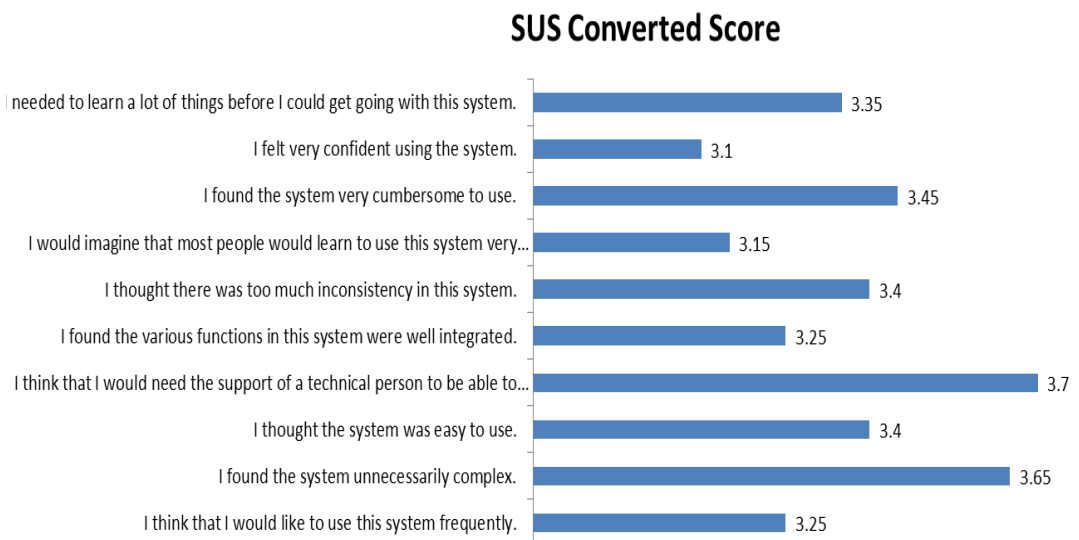


Figure 4.19: Loan Calculator (based on user input)

## 4.9 System Usability Scale (SUS)

### 4.9.1 System Usability Scale (Results)

System usability scale (SUS) is a survey to assess the usability level of a system by John Brooke. A total of 20 respondents were approached. Before answering the 10 closed-ended questions questionnaires, respondents were given chance to navigate through the Decision Support System for Malaysian Undergraduate Student's Study Loans. The questionnaires are based on a Likert scale ranging from 1 to 5 to find out users' perception towards the Web system. (Appendix 2)



**Figure 4.20: System Usability Scale**

<b>Questions</b>	<b>Rating Average (minus 1 or 5 minus the rating average)</b>
1. I think that I would like to use this system frequently	$4.25 - 1 = 3.25$
2. I found the system to be unnecessarily complex	$5 - 1.35 = 3.65$
3. I thought the system was easy to use	$4.4 - 1 = 3.4$
4. I think that I would need the support of a technical person to be able to use this system	$5 - 1.3 = 3.7$
5. I found the various functions in this system were well integrated	$4.25 - 1 = 3.25$
6. I thought there was too much inconsistency in this system	$5 - 1.6 = 3.4$
7. I would imagine that most people would learn to use this module very quickly	$4.15 - 1 = 3.15$
8. I found the module is very cumbersome to use	$5 - 1.55 = 3.45$
9. I felt very confident in using this module	$4.1 - 1 = 3.1$
10. I needed to learn a lot of things before I could get going using the module	$5 - 1.65 = 3.35$
<b>Total</b>	<b>33.7</b>

**Table 4.13: System Usability Scale**

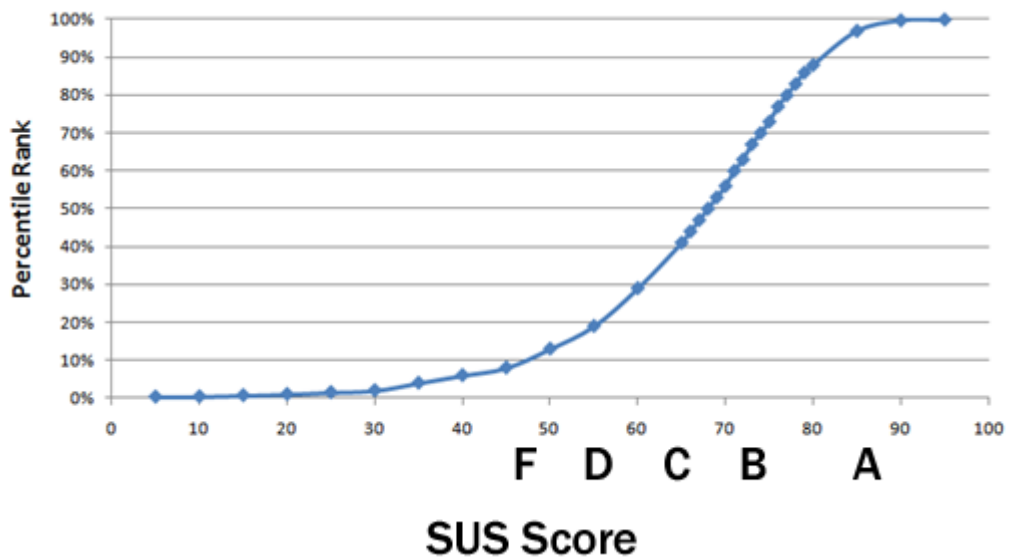
Table 4.13 shows the method of calculating the system usability scale based on the result obtained from 20 respondents. To calculate the score, first, mean for each questions must be obtained. Next, the mean scores for odd numbered questions (1, 3, 5, 7, and 9) will be minus 1. For the even numbered questions (2, 4, 6, 8 and 10) 5 is use to minus the mean scores. Then sum up all the scores obtained and multiply it by 2.5 to get the value of SUS.

For this project the sum score is 33.7. Thus the value of SUS will be 84.25

$$33.7 \times 2.5 = 84.25$$

#### 4.9.2 System Usability Scale (Discussion)

The score of the SUS obtained is 84.25



**Figure 4.21: SUS Score**

Figure 4.21 shows the percentile rank of a good SUS score obtained from the Measuring Usability with the System Usability Scale (SUS) website [\[8\]](#). Based on the percentile rank, the Decision Support System for Malaysian Undergraduate Student’s Study Loans has a higher perceive usability. The SUS score is a measure perceived ease-of-use and does not diagnose the usability problem. (Sauro.J, 2011)

#### 4.10 User Acceptance Testing

The User Acceptance Testing (UAT) was conducted simultaneously with the System Usability Scale (SUS). Thus, the respondents in both surveys had used the system before taking part in the survey. The questionnaires comprised of 7 closed-ended questions with 2 demographics questions. Other questions include ascertaining whether the DSS for Malaysian Undergraduate Student's Study Loans is accepted by the user, user-friendliness of the system and if the system is performing the functionality as expected by the users. The results of the survey had been documented and discussed.

##### 4.10.1 User Acceptance Testing (Results)

###### Demography questions:

###### Question 1: Respondent's age range

*Significance of this question: To ascertain the age group of respondents of the survey*

Age Range	No. of respondents
Less than 18 years old	0
19 years old – 21 years old	5
22 years old - 24 years old	7
25 years old and above	8

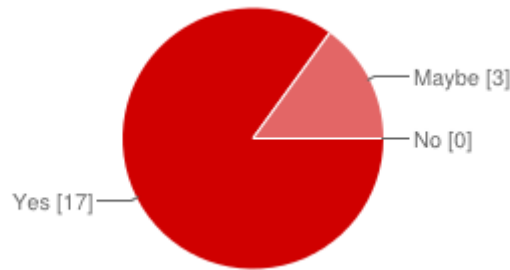
**Table 4.14: Respondent's age range**

As depicted in **Table 4.14**, 8 respondents are more than 24, 7 respondents are in the age range of 22-24 years old, 5 respondents 19-21 years old, and none of the respondent is aged below 18.

###### Question 2: Does the DSS for Malaysian Undergraduate Student's Study Loans able to suggest loan provider based on your input?



*Significance of the question: To ascertain whether the system is able perform decision support functionality*

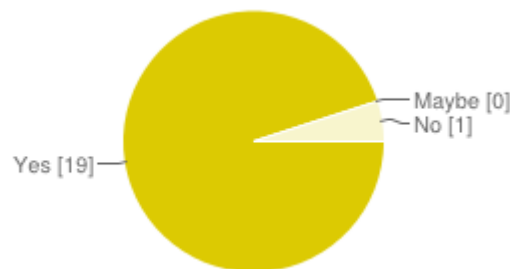


**Figure 4.21: UAT – System is able to generate output based on input**

The results in **Figure 4.21** show that 17 respondents think that the decision support system is able to suggest loan provider based on their input. Another 3 respondents are not sure about whether the system is able to suggest loan provider based on their input. None of the respondents think that the system cannot suggest loan provider based on their input.

**Question 3: Does the DSS for Malaysian Undergraduate Student’s Study Loans assists you in selecting a study loan provider?**

*Significance of the question: To find out whether information generated by system is as per respondents’ expectation.*

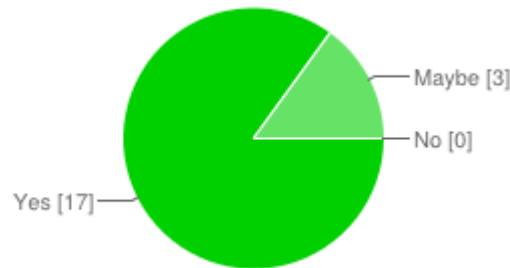


**Figure 4.22: UAT – Assist in suggesting study loan provider**

**Figure 4.22**, 19 respondents think that the system is help them in selecting a loan provider. Only one respondent thinks that the system cannot assist in selecting loan provider.

**Question 4: Does the DSS for Malaysian Undergraduate Student’s Study Loans able to assist you in estimating the reimbursement period?**

*Significance of the question: To find out whether information generated by system is as per respondents’ expectation.*

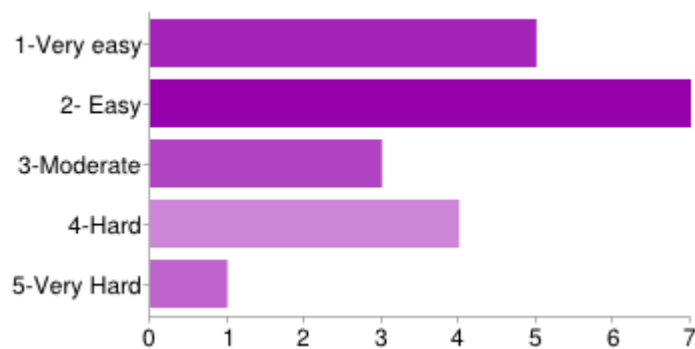


**Figure 4.23: UAT – Assist in suggesting reimbursement period**

**Figure 4.23**, 19 respondents think that the system is help them in selecting a loan provider. Only one respondent thinks that the system cannot assist in selecting loan provider.

**Question 5: Do you find it easy to navigate around in the system?**

*Significance of the question: To find out whether respondents can easily navigate in the system.*



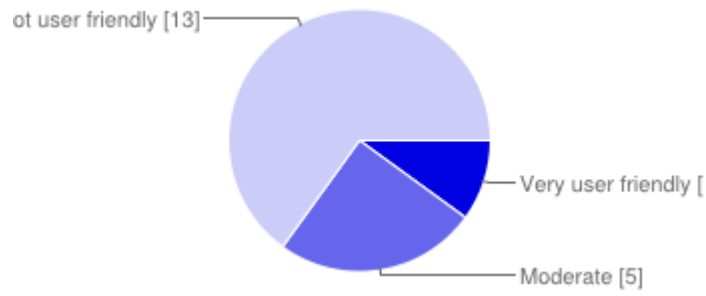
**Figure 4.24: UAT – Difficulty to navigate**

As portrayed in Figure 4.2 the results are quite distributed where 5 respondents found it very easy to navigate around. 7 respondents think that it is easy to navigate in the system, 3 respondents think that it is moderate. 4 respondents found it hard to

navigate in the system and only one respondent think it is very hard to navigate in the system

**Question 6: How user friendly is the system?**

*Significance of the question: To find out user friendliness of the system*



**Figure 4.25: UAT – User friendliness**

Figure 4.25 depicted the result of user friendliness. Most respondents think that the system is not user friendly which comprise of 13 respondents. 5 respondents think that it moderate and only 2 respondents found that the system is very user friendly

#### **4.10.2 User Acceptance Testing (Discussion)**

The user acceptance testing for DSS for Undergraduate Students' Study Loan was conducted 20 respondents had gain their first-hand experience on using the prototype of the DSS for Undergraduate Students' Study Loan

The main concern of this testing is to find out whether the prototype of the proposed system is able to generate necessary information which is able to satisfy the respondents' expectation. Question 3, 4 and 5 are to ascertain whether the information generated by the system satisfy the respondents' expectation. Based on the result of the testing most respondents satisfied with the decision support for it is able generate necessary information for decision support functionality

Nonetheless, Question 6 and 7 is to determine the user-friendliness of the system. Based on the result obtained in Question 6 and Question 7, most respondents think that the system is not user friendly. Most respondents think that the system is not user-friendly because the system required user to re-enter the value of the textbox if there is error occurred. For instance, if the user does not complete the whole form before click "Submit button", the value in all textbox will be reset.

## **CONCLUSION AND RECOMMENDATION**

### **5.1 Conclusion**

The DSS for Malaysian Undergraduate Student's Study Loans is propose system that is use to provide guidance for its user in choosing the most equitable loan and recommend the shortest payback time based on their financial ability as stated in the objectives of the project. At this time, most users mainly students were found out that they choose study loan 'blindly' without ascertaining their loan reimbursement period and amount. In other words, students were choosing study loan without realizing the repayment ability. Using DSS for Malaysian Undergraduate Student's Study Loans, it is hope that users will able to gain some insight on a particular loan provider before actually choosing take up the loan. Due to the time limitation of project only a handful loan provider had been actively studied. Thus, there will be a tendency of less accuracy knowledge generated by the system.

All in all, the prototype developed in accordance to the proposed system does perform the functionality as per stated in objectives and scope defined in the beginning of this project.

## **5.2 Recommendation and Future Work for Expansion**

The project is yet complete and there is plenty of room for improvement.

### **Pending work**

- 1) Not all Malaysian study loan providers were approached throughout the system development period.
- 2) The “Estimate Loan Repayment Period” functionality is only applicable for 3 loan providers – MIED, PTPTN, and KOJADI.

### **Recommendation**

The current decision support system was developed mainly using PHP and HTML. When users entered incorrect data into the textbox, it will be automatically reset and less user-friendly. Thus, it is recommended that in future, Javascript should be used.

Apart from that, the system should have a forum box and comment box features in order to promote interaction between users and system admin. By having these features, system admin can update the system according to the user preference.

## REFERENCES

1. Hofler, D. (2012, June 21). *A Transformation in Procurement*. Retrieved from Supply Chain Digital:  
<http://www.supplychaindigital.com/procurement/a-transformation-in-procurement>
2. Flynn, M. J. (1999). *Decision Support Systems*. Page 3-5. :  
<http://www.pitt.edu/~druzdzjel/psfiles/dss.pdf>
3. Vyas and Sharma (2007). *Indian Organized Apparel Retail Sector and DSS*. Page 3-5: <http://www.iimahd.ernet.in/publications/data/2007-07-01Preeta.pdf>
4. K.P.Tripathi (2011) *Decision Support System Is A Tool for Making Better Decisions in The Organization*. Page 1-6.  
<http://www.ijcse.com/docs/IJCSE11-02-01-054.pdf>
5. Hayen (2006) *Investigating Decision Support Systems Frameworks*. Page 1-5:  
<http://iacis.org/iis/2006/Hayen.pdf>
6. Asefeh Asemi, Ali Safari and Adeleh Asemi Zavareh (2011) *The Role of Management Information System (MIS) and Decision Support System (DSS) for Manager's Decision Making Process*. Page 1-10:  
<http://www.ccsenet.org/journal/index.php/ijbm/article/view/8940/7938>
7. Vennapoosa. C (2012) *The Waterfall Model at*  
<http://www.exforsys.com/career-center/project-management-life-cycle/the-waterfall-model.html>
8. Saura.J (2011) *Measuring Usability With The System Usability Scale (SUS)* at <http://www.measuringusability.com/sus.php>

## APPENDIX

### Appendix 1: Questionnaires for Decision Support System for Undergraduate Students' Study Loan

This survey is for all Malaysia undergraduate students regardless of the course and the universities of the students. The purpose of this survey is to determine the feasibility of DSS in choosing study loans for Undergraduate Students.

*\* must answer (Required)*

#### *Demographics*

1) Please specify your age range. *\*(Sila nyatakan lingkungan umur anda.)*

- 18 and below
- 19-20
- 21-23
- 24-26
- 26 and above

2) Please specify your highest level of education *\*(Sila nyatakan tahap pendidikan tertinggi anda)*

- SPM (Sijil Pelajaran Malaysia)
- STPM (Sijil Tinggi Persekolahan Malaysia)/Diploma
- A-level
- Matriculation
- Foundation Studies

3) Please state the total monthly income in your household. *\*(Sila nyatakan pendapatan bulanan keluarga anda.)*

- Below 4,000
- 4,001-5,000
- 5,001-6,000
- 6,000 and above



4) What is your family size? \*(Apakah saiz keluarga anda?)

- ≤ 3
- 4-5
- 6-8
- 9 and above

***Users' understanding about the current study loan***

To identify the users' understanding about the current study loan in Malaysia

5) How well do you know the current study loans payback interest? \*(Sejauh manakah anda tahu tentang kadar faedah pinjaman pelajaran?)

- Good understanding/deep knowledge
- Fairly good understanding/shallow knowledge
- Do not understand/Do not know at all

6) Do you find it difficult to select study loan? \*(Adakah anda menghadapi kesukaran untuk memilih pinjaman pelajaran?)

- Yes
- Not really
- No

7) How do you choose a study loan? \*(Bagaimanakah anda memilih pinjaman pelajaran?)

- Based on 'word-of-mouth'
- Based on information obtained from Internet
- Based on parents' opinion
- Based on the interest rate charged
- Other:

***Feasibility of DSS in study loan.***

To find out DSS is applicable in choosing their study loan.

- 8) If there is a system that can help you in choosing a suitable study loan for you. Would you use it? \*(Jika adanya sistem yang dapat menolong anda untuk memilih pinjaman pelajaran yang sesuai untuk anda. Pada pendapat anda, adakah anda akan menggunakannya?)

- Yes
- Maybe
- No

## Appendix 2: System Usability Scale

### System Usability Scale (SUS)

This survey is conducted to find out the level of usability. Users are given 5 to 10 minutes browse through the Web-system. Users were allowed to raise any question about the system if they found any difficulties while navigating in the system.

Please rate the usability scale below. Your answers will be much appreciated and will be used to improve the usability of the web application.

1. I think that I would like to use this system frequently

1	2	3	4	5
Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree

2. I found the system to be unnecessarily complex

1	2	3	4	5
Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree

3. I thought the system was easy to use

1	2	3	4	5
Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree

4. I think that I would need the support of a technical person to be able to use this system

1	2	3	4	5
Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree

5. I found the various functions in this system were well integrated

1	2	3	4	5
Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree

6. I thought there was too much inconsistency in this system

1	2	3	4	5
Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree

7. I would imagine that most people would learn to use this system very quickly

1	2	3	4	5
Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree

8. I found the system very cumbersome to use

1	2	3	4	5
Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree

9. I felt very confident using the system

1	2	3	4	5
Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree

10. I needed to learn a lot of things before I could get going with this system

1	2	3	4	5
Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree

### Appendix 3: Qualitative Survey (Interview)

<b>Interview Outline</b>	
Interviewer: Yen Mun S'ng	Interviewee: Officer on duty (Customer Relationship Service)
Appointment Details	
Date: 24/09/2012 Start time: 8:00A.M      End time: 9:00 AM Venue: KL Sentral One Stop Center Department: PTPTN	
Objectives & Reminders	
<ul style="list-style-type: none"> <li>• To gather loan provider information (terms and condition)</li> <li>• To gather information on reimbursement period</li> </ul>	
Agenda & Estimated Time	
Introduction <ul style="list-style-type: none"> <li>• Topic 1: Questions on loan provider</li> <li>• Topic 2: Questions on loan reimbursement</li> </ul>	1 min 15 min 14 min
General Observations: Most of the time the officer ask me to refer to the PTPTN official/corporate Website	
Questions: <ol style="list-style-type: none"> <li>1) Can you briefly explain on the basic requirement to apply PTPTN loan?</li> <li>2) Is there any decision support functionality in PTPTN official/corporate Website?</li> <li>3) What is the interest rate of the loan currently?</li> <li>4) How long would you suggest the loan repayment of a particular loan amount?</li> </ol>	
Relevant questions/Unresolved issues: No	

#### Appendix 4: User Acceptance Testing (UAT)

This survey is designed to identify user's acceptance of towards a Decision Support System that can assist individual in choosing study loan and estimate loan repayment period. The questions in this survey are specifically related to an implementation of DSS for Malaysian Undergraduate Student's Study Loans.

- 1) Are you financially bonded to any of the loan provider?
  - Yes
  - No
  
- 2) State your age group
  - Less than 18 years old
  - 19 years old – 21 years old
  - 22 years old - 24 years old
  - 25 years old and above
  
- 3) Does the DSS for Malaysian Undergraduate Student's Study Loans able to suggest loan provider based on your input?
  - Yes
  - Maybe
  - No
  
- 4) Does the DSS for Malaysian Undergraduate Student's Study Loans assists you in selecting loan provider?
  - Yes
  - Maybe
  - No
  
- 5) Does the DSS for Malaysian Undergraduate Student's Study Loans able to assist you in estimating the reimbursement period?
  - Yes
  - Maybe
  - No

6) Do you find it easy to navigate around in the system?

- 1-Very easy
- 2- Easy
- 3-Moderate
- 4-Hard
- 5-Very Hard

7) How user friendly is the system?

- 1-Very user friendly
- 2-Moderate
- 3-Not user friendly

# DECISION SUPPORT SYSTEM FOR MALAYSIAN UNDERGRADUATE STUDENT'S STUDY LOANS

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**Abstract – Decision Support System (DSS) has been extremely studied in the both individual and group decision making. Until today, there is no DSS that assists individual in selecting suitable study loan. This report presents the research and techniques used in developing DSS that assists Malaysia undergraduate students in selecting study loan. The objectives of this study is to develop a DSS that guides students in choosing the most equitable study loan as well as the shortest payback time for their study loan. The DSS was developed based on waterfall model. The system can provide its users updated information about the amount needed in a particular program offered by a college in order to make effective decision in choosing the amount of study loan. In addition, users will also know about the amount to be reimbursed to its loan provider upon their completion of study.**

**Keyword – Decision Support System; Study loan; Reimbursement period; Interest rate;**

## I. INTRODUCTION

For centuries, human had been using available knowledge to make important decision. The development of Management Information System in

1960s had increased the number of decision being ever made before as well as the complexity of the decision. Gradually, the Internet had given an additional opportunity to DSSs such as OLAP and other web-drive systems where decisions were made easily with the data stored in database and able to access easily. Drew Hofler, the Senior Manager of Financial Solutions for Ariba, Inc.<sup>[1]</sup> presents an article on transformation in procurement method – claiming that consumers are more connected to the business, where information are readily available and better quality of decisions can be make.

Choosing study loan is one of the major dilemmas for individual that had intention to further their studies. In the process of selecting a suitable loan for individual, advice and information about the loan from someone that has deep knowledge about the loan for instance i.e. the loan issuer or bank officer is vital. However, in most cases, individual tend to follow the majority or buddies blindly without identifying the lowest interest rate and the shortest reimbursement duration of the loan.



## II. RELATED WORK

### A. Definition of DSS

Druzdel and Flynn (1999) think that DSSs are interactive, computer-based systems that aid users in judgment and choice activities that provide data storage and retrieval by enhancing the traditional information access and retrieval functions with support for model building and model-based reasoning. DSS also support framing, modeling, and problem solving. [2] Vyas and Sharma (2007) describe DSS as an integrated entity that provide management with tools and timely plus accurate information to assist in decision making. Tripathi (2011) stated that DSS is a computer-based information systems designed in such a way that help managers to select one of the many alternative solutions to a problem. [4]

### B. Framework of DSS

Hayen (2006) examined the framework of DSS developed by Gorry and Scott Morton and suggested that the framework is useful to assist in gaining perspective on the field of DSS and providing focus on their characteristic as well as improving the effectiveness of the system. [5] Asemi et al (2011) also examined Gorry and Scott Morton DSS Framework and found out that the framework can be classified by its structure into three levels; structured decision, unstructured decision and semi structured decision. [6]

### C. Characteristic of DSS

Asemi et al (2011) had identified that there are 9 characteristic of DSS from various researchers which are [6]:-

- a) Provides support for decision maker. (semi structured & unstructured)
- b) Improve effectiveness. (Davis & Olson, 1985).
- c) Provides support to individuals & groups.
- d) Equipped with knowledge component. (Turban & Aronson, 1998).
- e) Able to handle large amount of data
- f) Can be developed using a modular approach.
- g) Has graphical orientation
- h) Support optimization and heuristic approach.
- i) Can perform “what – if” and goal – seeking analysis. (Stair, 1992)

## III. METHODOLOGY

### A. Research Methodology

The methodology used to develop the DSS for Students’ Study Loan is based on the waterfall model where it is a linear and sequential development process based on the downward flowing stages.

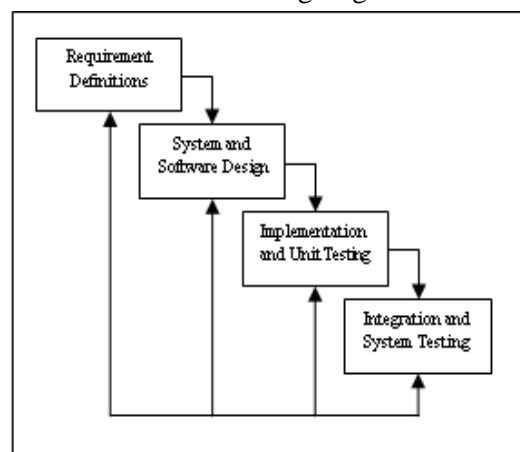


Figure 1: Waterfall model

### B. Method used

Relevance data for this research were collected via both primary and secondary sources of data collection:

- (1) Quantitative survey using questionnaire was conducted to come out with the problem statement. Quantitative data had provided valuable information on how individual choose their study loan as well as the feasibility of the application if DSS in the process of choosing a study loan.
- (2) Existing literatures were reviewed in order to obtain more information about DSS. Appropriate methods were selected to solve the problem statement of this project based on literature reviewed
- (3) Interfaces, databases as well as encoding the system were done in this stage. Continuous completeness and accuracy testing were conducted in the phase.
- (4) Users will register themselves as new user and login to the system to test the functionality of the system. Users' comments were gathered to further improve the system performance.

### C. Tools and Equipment used

Hardware that used in developing this system were a regular laptop with Internet connectivity and others computer accessories.

Software that was used includes Adobe Dreamweaver CS5, MySQL and WAMP Server.

## IV. RESULT AND DISCUSSION

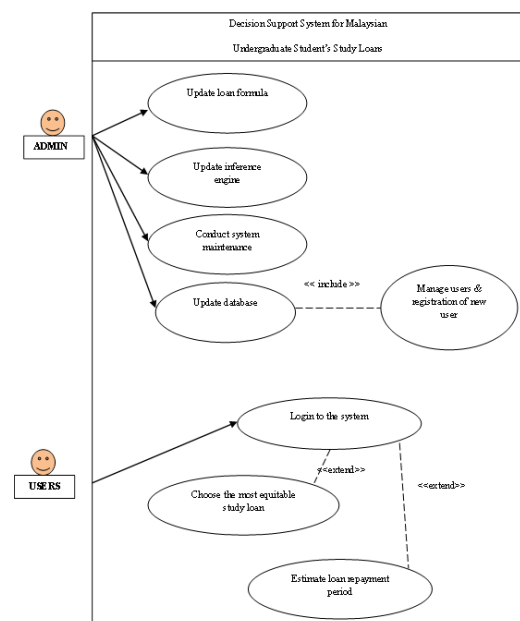
### A. Loan provider

Loan Name	Requirements
PTPTN	Malaysian citizens
MARA	Malaysian citizens only for Bumiputera
MIED	Malaysian citizens
KOJADI	Malaysian citizens KOJADI Member(RM100)
Bank Rakyat Loan (Al-Falah)	Malaysian citizens
RHB Bank (Study Loan)	Registered student of any college or universities

**Table 1: Loan Provider**

Information about study loan provider in Malaysia were gathered and tabulated in Table 1.1 which shows that most of the study loan providers require borrowers to be Malaysian citizens, only one study loan provider that accepts foreign citizenship borrowers which is the RHB Bank Study Loan.

### B. System Architecture



**Figure 1: Use case diagram**

The proposed system will have only two different actors which are the system administrator and the system user.

Actor: System Administrator

Role: Super user of the system

- Update loan formula
- Update inference engine
- Conduct system maintenance
- Update database
- Manage users & registration of new user

Actor: User

Role: Normal user of the system

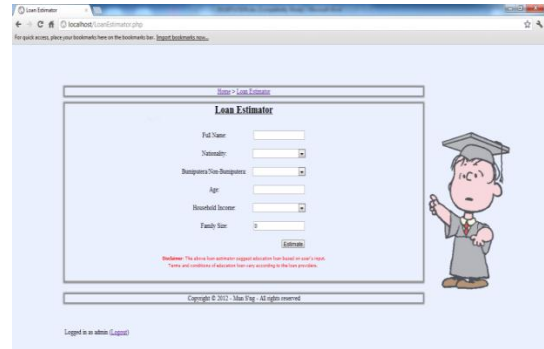
- Login to the system
- Estimate loan repayment period
- Estimate loan repayment period

### C. System Interface



**Figure 2: Homepage**

Figure 2 shows the Homepage of the system where users can select either to estimate the best loan provider or estimate the most equitable study loan reimbursement period and interest rate based on their competence.



**Figure 3: Loan Estimator**

If the users choose to estimate the loan, they will be directed to this page as shown in Figure 3 where users need to provide information such as Name, Citizenship, Bumiputera/Non-bumiputera, Age, Household monthly income and family size to the system.



**Figure 4: Loan Calculator**

If the users choose loan calculator, users will directed to the page as shown in Figure 4 where they can choose to calculate their reimbursement amount as well as to estimate their study loan repayment period using this system

### D. System Usability Testing

System usability scale (SUS) is a survey to assess the usability level of a system by John Brooke. A total of 20 respondents were approached. Before answering the 10 closed-ended questions questionnaires, respondents were given chance to navigate through the Decision Support System for Malaysian Undergraduate

Student's Study Loans. The questionnaires are based on a Likert scale ranging from 1 to 5 to find out users' perception towards the Web system.

Questions	Rating Average (minus 1 or 5 minus the rating average)
1. I think that I would like to use this system frequently	4.25 - 1 = 3.25
2. I found the system to be unnecessarily complex	5 - 1.35 = 3.65
3. I thought the system was easy to use	4.4 - 1 = 3.4
4. I think that I would need the support of a technical person to be able to use this system	5 - 1.3 = 3.7
5. I found the various functions in this system were well integrated	4.25 - 1 = 3.25
6. I thought there was too much inconsistency in this system	5 - 1.6 = 3.4
7. I would imagine that most people would learn to use this module very quickly	4.15 - 1 = 3.15
8. I found the module is very cumbersome to use	5 - 1.55 = 3.45
9. I felt very confident in using this module	4.1 - 1 = 3.1
10. I needed to learn a lot of things before I could get going using the module	5 - 1.65 = 3.35
<b>Total</b>	<b>33.7</b>

**Table 2: SUS Testing**

Table 2 shows the method of calculating the system usability scale based on the result obtained from 20 respondents. To calculate the score, first, mean for each questions must be obtained. Next, the mean scores for odd numbered questions (1, 3, 5, 7, and 9) will be minus 1. For the even numbered questions (2, 4, 6, 8 and 10) 5 is use to minus the mean scores. Then sum up all the scores obtained and multiply it by 2.5 to get the value of SUS.

$$33.7 \times 2.5 = 84.25$$

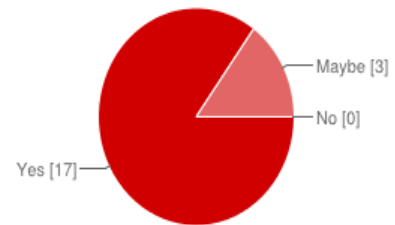
For this project the sum score is 33.7. Thus the value of SUS will be 84.25

Based on the percentile rank obtained from Measuring Usability with the System Usability Scale (SUS) website [8], the Decision Support System for Malaysian Undergraduate Student's

Study Loans has a higher perceive usability.

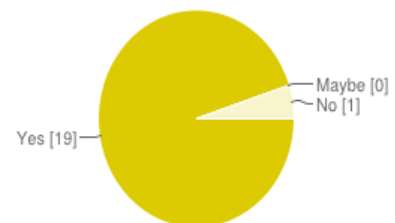
### E. System Usability Testing

The User Acceptance Testing (UAT) was conduct simultaneously with the System Usability Scale (SUS). The questionnaires were designed to ascertain whether the DSS for Malaysian Undergraduate Student's Study Loans is accepted by the user, user-friendliness of the system and is the system performing the functionality as expected by the users.



**Figure 4: UAT – System is able to generate output based on input**

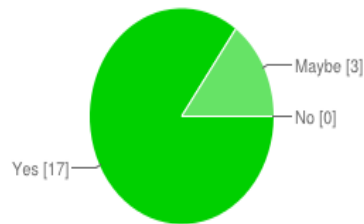
The results in Figure 4 show that 17 respondents think that the decision support system is able to suggest loan provider based on their input. Another 3 respondents are not sure about whether the system is able to suggest loan provider based on their input. None of the respondent thinks that the system cannot suggest loan provider based on their input.



**Figure 5: UAT – Assist in suggesting study loan provider**

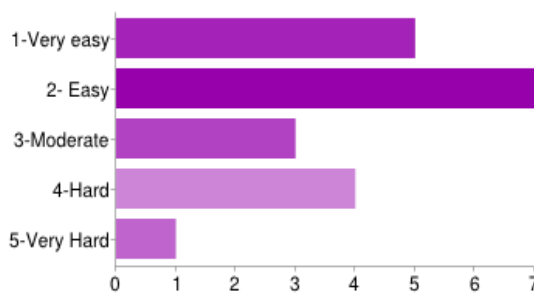
Figure 5 shows 19 respondents think that the system is help them in selecting a loan

provider. Only one respondent thinks that the system cannot assist in selecting loan provider.



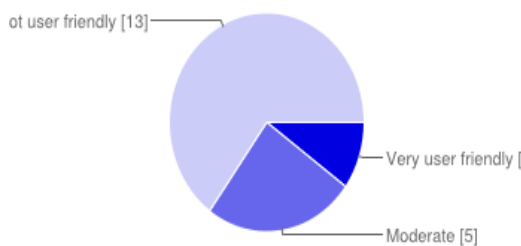
**Figure 6: Assist in suggesting reimbursement period**

Figure 6 shows that 19 respondents think the system is help them in selecting a loan provider. Only one respondent thinks that the system cannot assist in selecting loan provider.



**Figure 7: UAT – Difficulty to navigate**

As portrayed in Figure 7 the results are quite distributed where 5 respondents found it very easy to navigate around. 7 respondents think that it is easy to navigate in the system, 3 respondents think that it is moderate. 4 respondents found it hard to navigate in the system and only one respondent think it is very hard to navigate in the system.



**Figure 8: UAT – User friendliness**

Figure 8 depicted the result of user friendliness. Most respondents think that the system is not user friendly which comprise of 13 respondents. 5respondents think that it moderate and only 2 respondents found that the system is very user friendly

The main concern of User Acceptance testing is to find out whether the proposed system is able to generate necessary information which is able to satisfy the respondents' expectation. Question 3, 4 and 5 are to ascertain whether the information generated by the system satisfy the respondents' expectation. The result shows that most respondents satisfied with the decision support for it is able generate necessary information for decision support functionality. Question 6 and 7 is to determine the user-friendliness of the system. Results show that the system is not user friendly. The main reason of the system is not user-friendly because the system required user to re-enter the value of the textbox if there is error occurred.

## V. CONCLUSION AND FUTURE WORK

The DSS for Malaysian Undergraduate Student's Study Loans is propose system that is use to provide guidance for its user in choosing the most equitable loan and recommend the shortest payback time based on their financial ability as stated in the objectives of the project.

The current decision support system was developed mainly using PHP and HTML. When users entered incorrect data into the textbox, it will be automatically reset and less user-friendly. Thus, it is recommended that in future, Javascript should be used. Apart from that, the

system should have a forum box and comment box features in order to promote interaction between users and system admin. By having these features, system admin can update the system according to the user preference.

#### REFERENCES

- [1] Hofler, D. (2012, June 21). A Transformation in Procurement. Retrieved from Supply Chain Digital: <http://www.supplychaindigital.com/procurement/a-transformation-in-procurement>
- [2] Flynn, M. J. (1999). Decision Support Systems. Page 3-5. : <http://www.pitt.edu/~druzdzl/psfiles/dss.pdf>
- [3] Vyas and Sharma (2007). Indian Organized Apparel Retail Sector and DSS. Page 3-5: <http://www.iimahd.ernet.in/publications/d/ata/2007-07-01Preeta.pdf>
- [4] K.P.Tripathi (2011) Decision Support System Is A Tool for Making Better Decisions in The Organization. Page 1-6. <http://www.ijcse.com/docs/IJCSE11-02-01-054.pdf>
- [5] Hayen (2006) Investigating Decision Support Systems Frameworks. Page 1-5: <http://iacis.org/iis/2006/Hayen.pdf>
- [6] AsefehAsemi, Ali Safari and AdelehAsemiZavareh (2011) The Role of Management Information System (MIS) and Decision Support System (DSS) for Manager's Decision Making Process. Page 1-10: <http://www.ccsenet.org/journal/index.php/ijbm/article/view/8940/7938>
- [7] Vennapoosa. C (2012) The Waterfall Model at <http://www.exforsys.com/career-center/project-management-life-cycle/the-waterfall-model.html>
- [8] Saura.J (2011) Measuring Usability With The System Usability Scale (SUS) at <http://www.measuringusability.com/sus.php>
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