WORD WAYS CHALLENGES (PART 2)

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For an introduction to this series of articles classifying and sum-marizing unsolved logological problems in Word Ways, see the Feb-ruary 1979 issue.

Word Ladders

In the PD 'an' has 8 near neighbors, or one-step ladders (ad, am, as, at, ax, ay, in, on), 'say' has 25, 'ware' has 24, 'share' has 15, 'batter' has 13, 'petting' has 11, and 'slipping' has 7 (73-67, 156). Can these be improved? More generally, extend to longer words and larger dictionaries such as NI or OED.

A word network consists of all words of a given length that can be joined by word ladders (a succession of one-step ladders, like faint to feint). Each pair of words in a network has a minimum ladder (few-est one-step moves) joining them; what word-pair has the longest min-imum ladder? For PD networks, it is TV-up, with a ladder of 11 (up-us-as-ay-my-ma-pa-pi-GI-go-to-TV); for three-letter words, ivy-you has a ladder of 12; for six-letter words, sudden-giggly takes 30 steps; for seven-letter words, parting-longing takes 17 steps; for eight-letter words, wrapping-swapping needs 10 (73-67,156). Can longer ones be found? What about four-letter and five-letter PD words?

Settle-settee-setter-better-batter-banter-banner is a PD word lad-der in which each letter is changed once; the number of steps equals the word-length (73-156). What is the longest word ladder of this type in NI or OED (even UD)?

Find an onalosi (a word transformable into another word by alter-ing any letter) longer than 'pasters' using NI (or UD) words (72-54). Find a four-letter isolano (a word not transformable into another word by altering any letter using NI words ('llyn' is an isolano in NI3, but not NI, because 'loyn' is in NI2 (70-108)). What is the minimum isolano size as a function of dictionary size, from PD through UD (in PD, there are at least 12 isolanos of length three)?

Scrambled Alphabets

If the alphabet is arranged in typewriter-keyboard order (qwerty... bnm), the longest words known with letters in order and reverse order are 'wettish' and 'chapitre' (70-176, 71-118). Find better UD exam-ples if possible.

If the alphabet is UIAOEYSDBPMHTGNLRKCFWVJQXZ, 'iaos' is the only NI word of 4+ letters spelled out in order (71-170). Can an

arrangement be found with no NI words this long? Or can one be found with no words of 3+ letters from PD (74-77)? What alphabet scramble preserves the arrangement of the most PD boldface words (see 74-73 for an arrangement preserving 398 four-letter words)?

Scramble the alphabet so that the length of an NI word in new-alphabetic order, plus the length of another NI word in reverse new-alphabetic order, is maximized: 'dermatoglyphics/unbigoted' (24), or 'uncopyrightable/deflations' (25) using an attested coinage (73-111, 172). Do better in NI; do better than 'questionably/anchorite' (21) in 8C; do it for PD.

If the alphabet is scrambled QURGHFICKJAWNTZVOMSPLYBDEX and closed in a ring, the 26 trigrams can be embedded in 19 NI words: QURsh, buRGH, ... , EXQUisite (77-189). Will another scramble embed fewer NI words? A scramble of the alphabet (omitting Q) is known giving 22 tetragrams embeddable in NI + RHD words; can a scramble of the full alphabet be found so that 23 tetragrams are embeddable in UD words? Can a ring be created and 26 tetragrams be embedded in AD words? Find a longer sequence than UWJCFMGKVB QPZDXR such that none of its bigrams are embeddable in PD words (77-189).

Insertions, Deletions

A charitable word can give up any letter and remain one (seat: sea, eat, sat, set); a hospitable word can accept a letter anywhere (rap: trap, reap, rasp, rapt) (71-171, 72-53, 109). In NI, find a longer charitable word than 'chains' or 'pleats' (preferably without doubled letters), a longer hospitable word than 'cares', and a longer charitable-hospitable word than 'sale'.

The longest word successively beheadable to a single letter using NI words is 'aspirate' (73-202); find a longer NI or UD chain. For curtailments, it is 'angelicals' (76-63) in NI, or 'bitternesses' (78-152) in the OED; find a longer NI or UD chain. For words successively deleted anywhere, can the NI2 'strangelings' (73-210) be improved upon with an NI or UD chain? Beheadable words beginning with all letters of the alphabet, and ending with all letters of the alphabet except J and Q, have been found in NI (73-199). Many ---J words in AD have been suggested; find ---J or ---Q words in UD (avoiding abbreviations or all-capitalized words like IQ, DJ, etc.).

Find a seven-letter NI word such that any consecutive substring of letters in it is also in NI (that is, it can be either beheaded or curtailed in any order down to a single letter). 'Morales', though not pluralized in NI2, lacks only 'ral' (in Wright's English Dialect Dictionary); 'sheaves' lacks only 'eav' (74-168, 213, 75-87, 174). Find an eight-letter word with UD substrings.

The insertion index of a word is the smallest number of letters that must be added to it before another word is formed (excluding derivatives of the original, or variant spellings). What is the shortest NI word with no insertion index (that is, it cannot be enlarged)? The NI word with the largest insertion index? For long words of a specified length, what is the most fecund one (the one with most different words achieved by insertion)? For words of length n, can examples of each of the 26(n + 1) different possible insertions be found (76-163)?

Transpositions

AEGINRST, probably the most transposable set of letters using O words, has been exhaustively investigated (76-216). What is the most transposable letter-set for PD, 8C, NI, OED or UD? AELST has 34 transposals (36, counting plural place-names like 'Etals') using NI + OED + NIl + Bartholomew's Gazetteer + Hyamson's Biography; similarly, AELS has 12 (or 13) (71-6,134). Can these be improved, or better sets found, for words in AD?

In a transposition dictionary, each word is listed under its alphabetized form ('score' under CEORS, for example). In a transposition dictionary based on NI, what are the first and last entries for each alphabetical letter (to eliminate trivialities, the single letter should not be counted). NI-based candidates have been investigated (71-28, 143); are improvements possible?

Special transpositions: find transpositions of 'five', 'eighty' and '(one) hundred' in AD (75-216). Find a longer US place-name than 'Giant Forest/forestating' transposable into a dictionary word; find a longer US place-name transposition pair than 'Masterson/Searsmont' (ignore word transpositions like 'Mount Pleasant/Pleasant Mount'); find a longer US place-name transposition triple than 'Caroline/Colerain/Cornelia'; find a larger transposable set of US place-names than 'Elnora/Larone/Lenora/Lerona/Lorane/Lorena/Orlean' (73-206). Is there a longer reversal-pair of US place-names than 'Orestad/Dotsero', in the same county of CO, or 'Robertson/Nostrebor' in WY and VA, respectively? Is 'Rotavele' the longest US place-name reversible to a dictionary word (73-176)?

A shiftword is a special transposition in which the first letter of a word is moved to the end to form another word, such as 'top' to 'opt'. Find a longer NI shiftword than 'speculation', a longer one without inflections than 'electric', or a longer double shiftword than 'strickle' or 'strinkle'. Using UD words, beat 'sexhibitionism', the inflectionless 'estraunger' or the double shiftword 'straunche' (74-176, 238, 75-47, 112, 233, 78-216).

Alphanumerics

In these challenges, A = 1, .. , Z = 26 are called letter scores.

A numerical tautonym is a word which can be divided into two or more equal-length parts, with the sum of the letter scores in each part being equal. Find a longer two-part tautonym than 'biobiblio/graphical', a longer three-part one than 'tra/nsf/und', a longer four-part one than 'ove/rse/cur/ely', or a five-part UD word to match the town name 'Gl/en/do/ra/do'. Find words with three or more parts (a) longer than 'bu/ll/et' (23,24,25) and 'cr/im/in/es' (21, 22,23,24) having sums of letter scores in arithmetic progression, or (b) longer than 'ai/rb/us' (10,20,40) with sums of letter scores in geometric progression (70-10).

A difference word is formed by taking the absolute value of the difference between the scores of adjacent letters and converting this back to a letter: 'bird' (2,9,18,4) to (9 - 2, 18 - 9, 18 - 4) = (7,9,14) or 'gin'. Find a longer NI difference word than 'mulita/hicks', a longer three-word set than 'Egypt/brid/pie' (70-231, 75-163, 207). A

sum word is found by taking the sum of the scores of adjacent letters, subtracting 26 if this lies between 27 and 52, and converting this back to a letter: 'rid' (18,9,4) to (27,13) = (1,13), or 'am'. Find a longer NI sum word than 'affine/glows', or a three-word set (77-47). By analogy, one can redefine a difference word by taking the difference between the scores of adjacent letters, adding 26 if this is negative, and converting this back to a letter.

In a centrally balanced beam word, the letter scores are multiplied by their distances from the center, and the left and right sides must be equal: 'agenda' (5x1 + 3x7 + 1x5 = 1x14 + 3x4 + 5x1). Find longer NI examples than 'invocation' or 'liquidation' (69-37).

Beat the records for the lightest UD words of various lengths (a = 1, aa = 2, baa = 4, .. , to Coleochaetaceae = 102) and the heaviest (z = 26, wy = 48, zuz = 73, .. , to untrustworthily = 263) (72-226). Lightness and heaviness can be extended to the concept of center of gravity -- multiply each letter score by its position in the word, sum, and divide by the sum of the letter scores: 'catch' (1x3 + 2x1 + 3x20 + 4x3 + 5x8)/(3 + 1 + 20 + 3 + 8) = 117/35 = 3.34. The normalized center of gravity compensates for the fact that the center of gravity increases with length: ncg = cg/(length + 1). Find an NI word with a smaller ncg than 'tab' (.300) or one with greater ncg than 'babby' (.745) (74-117).

There are prime letters ABCEGKMQSW, square letters ADIPY, and Fibonacci letters ABCEHMU. Find a longer prime NI word than 'ambassages' or 'embassages', a longer square word than 'ippiappa', or a longer Fibonacci word than 'Amahuaca', 'cachucha' or 'Chamacea' (72-108, 51).

Morse Code

Two words with the same pattern of Morse dots and dashes (call them 'bits') but different spacing, like 'dean' (-.. . .- -.) and 'nip' (-. .. .--.) are isomorses. Find the largest groups of isomorses of four to ten bits (two records are six for -..., 17 for -...,.--.). Find the longest isomorsic word pair (counting either letters or bits). Group letters of the alphabet by numbers of bits (et, aimn, dgkorsuw, bcfhjlpqvxyz) and make longer words from each group than 'teetee', 'minima', 'woodworks' and 'flyby' (or 'xylyl'). Find a longer Morse inverse pair (formed by interchanging dots and dashes in each letter) than 'kneel/ratty'. Find the longest words that can be made from various repetitive sequences of bits by inserting spaces, like 'yeggman' from .--.--.--.-- etc. Find words isomorsic to the 512 possible nine-bit sequences (solutions exist for shorter ones) (75-171, 209).

Pangrams

For PD, 8C, NI or UD, find word lists that exhaust as much of the alphabet as possible. For PD, one can get 14 letters in one word, 19 in two words, 22 in three words, 24 in four words, 25 in five words (all 26 impossible). If repeated letters are allowed, one can improve to 20 with two words, 23 in three words, and 26 in four words. Minimize the total number of letters needed as well: 39 letters in four words, 29 let-

ters in five words, 27 letters in six. For NI, one can get 15 letters in one word, 20 in two words, 22 in three words, 24 in four words, and all 26 in five. If repeated letters are allowed, one can improve to 16 with one word (18 in a multiword entry), 22 in two words, and 26 in three words. Minimize the total number of letters needed: 36 letters in three words, 31 letters in four words, 26 letters in five. Using O, one can pack 26 letters in four words, into three words using 28 letters (using an unattested reformed spelling), and into two words using 115 (using two unlikely words) (72-107, 72-22, 77-41).

Special pangrams: Find two US place-names that between them use more than 16 letters, each only once, or three place-names beating the 22 letters of 'Gravel Switch/Duxby/Knopf', or four or more using more than 22 letters (73-206). This question can be generalized (as for words) by allowing repeated letters; what is the smallest set of place-names containing all 26 letters, counting either names or total letters?

Sight and Sound

Find NI words that begin with a letter different from what the sound indicates, for all initial letters, as A - aisle, B - bdellium, C - czar, etc.; F and N have not been found, and R is 'Rzeszow', not in the main text of NI2 (73-164). Also, find homophonic pairs of words differing in only one letter (variant spellings not allowed), as in 'oar/or', 'lamb/lam', ... (77-26, 83, 152, 78-89). Allowing NI words, only J and V are unknown.

Can a five-syllable word shorter than 'oxyopia' be found in NI? What are the shortest words of 6+ syllables in NI (9 syllables and 16 letters, 10 syllables and 20 letters, 12 syllables and 21 letters have been found) (70-148)? It seems unlikely that a longer one-syllable word than 'scraunched' or 'scroonched' will be found in NI (70-173, 72-27); what about UD or AD? Is there a longer two-syllable word than 'straight-grained' in NI (70-149, 74-22)? In UD?

Find a better six-way heteronym than 'as' in NI2 (71-9, 63, 78-217) using UD or AD (variant pronunciations of the same word not allowed).

Interlingual Problems

The Roman letters AEKMNORSTUV correspond to the Cyrillic AEKMHOPCTYB. Find a longer Roman-Cyrillic cipher pair than 'restate/pectate', or 'teammate' with no letters changed (72-179, 73-49).

Find a longer English-foreign transposable word pair than 'imprecations/crispamiento' (Spanish). The record is also 12 for French, German and Italian (73-3).

Create a 4x4 double word square containing words from eight different languages, no word having a meaning in more than one language. A near-solution has been achieved (77-84).

'Four' is the only truthful cardinal number in English; it contains four letters. Find examples of truthful numbers in other languages for 20, 21, 24, 26, 29, 30 (69-179, 70-46, 76-170).