WORD WAYS CHALLENGES (PART 1)

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Word Ways has presented a great many challenges, explicit and implicit, since 1968; many were never taken up, and many are not available to newer readers. In this series of articles, we have attempted to gather them in one place.

What is a challenge? Briefly, it is a word problem of one of the following types:

(1) find the most extreme example of a word (words being characterized by some countable or measurable property, such as length, number of vowels, etc.)
(2) find examples which will complete a type-collection of words (such as all 676 possible bigrams contained in words)
(3) construct (or complete) a group of words having specified interrelationships (such as a word square)

In contrast to open-ended research problems, a challenge is relatively easy to define, and success (or at least some progress) must appear possible. More subtly, we feel that a good challenge should have a property known as "elegance" to the mathematician -- that is, it must appeal to one's esthetic sense or excite one's imagination. Some challenges approach this ideal more closely than others, but for each challenge given below we believe there is at least the possibility that it will strike some reader's fancy.

A challenge, on the other hand, is not considered to be:

(1) a request to list all words having a certain property
(2) a request to discover literary examples of a property (such as the shortest sequence of letters in a literary passage containing all the letters of the alphabet)
(3) a request to identify the unknown reference(s) containing a certain obscure word (such as "interinter" or "uqfidn")
(4) a request to solve a puzzle such as a crossword or cryptogram (one strives against English, not man).

The reference that must contain the words used to solve a challenge is often a vital component of the challenge. For challenges of types 2 or 3, it is important to solve them using the commonest words possible; frequently, the challenge becomes trivial if a more inclusive reference

in which a maximum or a minimum number of different letters are used.
Current records are 3 and 16 letters for the 4x4 using NI2, 5 and 21 let-
ters for the 5x5 using NI2 and OED, respectively (72-105, 172, 74-227,
78-36). Extend to 6x6 squares, or better the earlier records using
UD or AD. (Can any form (diamond, pyramid) contain all 26 letters?)

Create a 9x9 single word square (horizontal words repeated on the
vertical) using mostly NI words, or a 10x10 single word square using
tautonyms (words of the form Walla Walla or chimachima) drawn from
O sources; the best example of the latter uses only four different tauto-
nyms, not the maximum five (73-151).

Find a univocalic 5x5 double word square using only PD words; the
closest example uses 9 E's, 2 A's (77-174). The corresponding chal-
lenge for univocalic 6x6 double word squares requires NI at least; 8C
looks impossible (76-80). Univocalic single word squares of size 6x6
may be possible to find in 8C.

Find 5x5 word squares using three or fewer consonants, or six or
fewer vowels (69-221).

A 6x6x6 word cube has been found using only OED words (78-156);
find a 6x6x6 triple word cube using 108 different UD words.

The largest-known 2xn crossword using CTC   PASSEMEASURE
words is given at the right (77-242). Find long-   INTERORBITAL
er examples using NI, or more generally UD.

Word squares with mathematical properties: (1) With A = 1, B = 2,
etc., find 5x5 word squares with letter sums less than 63 or more than
467 (69-221); (2) Build a 6x6 single word square entirely of numerical
tautonyms; 537 such tautonyms are given in (70-244, 71-82); (3) Cre-
ate a 5x5 word square that becomes a magic square when its letters
are replaced by A = 1, B = 2, etc.; (4) Find a 5x5 word square using
ten different letters, its five words having the patterns 12345, 24680,
36925, 48260 and 50505, like the units digit of a 5x5 multiplication
table (69-115).

Letters, Bigrams, Trigrams in Words

NI words containing four identical letters are known for all but J,
Q, V and X (69-53); can UD or AD examples be found for these (an AD
Q-example is given in (70-180))? For five repetitions, H, K, P, U, W,
Y and Z also lie outside NI ('zenzizenzizenzic', in the OED, is an im-
provement), and M is an NI lexeme ('multimammate mouse') (70-
252). Can AD or UD examples be found for H, J, Q, V, W, X and Y?

A word containing the same letter in every other position for a se-
quence of three or more is an alternating monotony, such as 'monogo-
noporous' and 'pitot-static (tube)'. Beat the NI3 records of eight U,
six O, five AEI (six for 'Panama balata'), four KRT, three CDLMN
PSTV (and three BG for 'baby blue', 'go gage') (71-77, 72-73). Can
better examples be found in GD?

NI words are known to contain all three-letter sets but FJQ FXZ
JJQ JJX JJZ JQV JQX JQZ JXX JXZ KQX QQW QQX QWX QXX XXX
XXZ (72-162, 206). Can any be found in NI, or, failing that, in UD
(for example, 'hexahydroxycyclohexane' is an XXX word in RHD)?

627 of the possible 676 bigrams are embedded in NI words (69-215,
70-19, 75-88, 76-17), and unpublished research has located UD or
AD examples for several more. However, only O words are known

for the bigrams fx jq px qg qk qp zx; can these be upgraded to AD or UD?

O words with two pairs of doubled letters (as OL in 'football') -- ignoring the letters JQVX which rarely form doubles -- are known for all cases but AW BI BM BU BW CH CK CU CW CY DU DW DY EI FH FU FY GH GI GU GW HI HK HP HU HW HY HZ IW IZ KW KZ MW OY PW UW VZ WY WZ(73-17, 77-246). Can any be found in O? (Examples containing JQVX are IQ JO JT JV KV LV OQ OV (see 77-109).)

Lexemes

Many NI entries, like 'azoic diazo 37', contain numbers. All numbers 1-100 have been found except 65 67 68 69 77 82 91 96 97; find these in UD. Also find Roman numerals XIX XX XXI, the only gaps up to XXIII inclusive (72-57).

NI lexemes containing isolated letters, like potato X virus, have been found for only EQRTX. Find others in O (71-100).

Find names like 'L. Frank Baum', the most famous person for each initial letter. Examples for ABCEFGHIJLORUW at (71-38), all but BGIOU well-known.

Alphabetic Letter Order

The longest NI3 word formed from the first half of the alphabet is 'hamamelidaceae' (72-26), although longer lexemes ('black-backed jackal', 'lead-lead acid cell') exist (68-35). Find longer examples in NI or UD. The longest NI2 word from the last half of the alphabet is 'unsonorous'; so can this be topped in NI or UD? Find UD words containing all 5+ initial letters of the alphabet shorter than 'backed' (or 'baced' inferred in the OED), 'feedback', 'bright-faced' (74-187). Any UD or AD words containing the letters ABCDEFGH (or more)? Find UD words containing more than ten consecutive alphabetic letters; 'quasi-complimentary' and 'quasi-importantly' in RHD contain LMNO PQRSTU (78-35). Any unhyphenated tenners?

If words containing only four consecutive letters are sought, NI words exist for all the 26 sequences but UVWX VWXY WXYZ (71-10); find examples in UD (or AD if this is not possible). (For five consecutive letters, TUVWX, UVWXY and VWXYZ are unsolved (71-144).) If words must contain the letters in order, NI words exist for all 26 sequences but the above plus GHIJ IJKL TUVW; find AD examples for these. If words must have the four consecutive letters adjacent (but in any order), one has a sequential tetragram permutation, as STUV in 'KaryUVTSi'. Examples from UD are known for all sequences but HIJK JKLM KLMN NOPQ PQRS TUVW UVWX VWXY WXYZ XYZA ZABC (74-61). Can these be filled with AD words? Finally, if words must have the four consecutive letters adjacent and in order, NI contains MNOP ('gymnoplast') and RSTU ('understudy'), the OED STUV ('stuver').

A group of letters is alphabetically invariant if its letters occur with the same spacing as the alphabet, as elOPeRs (72-140). Find a longer group than six, as in iNOPeRaTiVe or coOPeRaTiVelY. Find words with the last letter alphabetically invariant for each letter of the alphabet, as in A, oB, saC, ... (71-96). NI words exist for all but

JQUVWXYZ, and AD words exist for all but **VWXZ**; find missing ones using AD or O. (The reverse sequence Z, mY, heX, ... has also been investigated, with holes at BDF (71-91).)

The longest-known NI word with letters in alphabetic order (no repeated letters) is 'aegilops', and in reverse-alphabetic order, 'wronged' (78-246). Are there longer UD words? What are the longest alphabetic-order UD words in the first and last halves of the alphabet? 'Noruz', in F&W, and 'Achim', in NI2, are the only five-letter ones known (73-172, 78-246).

Find the longest NI word with total alphabetic disorder (when the letters are arranged in alphabetical order, every letter changes position, as 'desirable' to 'abdeeilrs'). Is it possible to do better than the English village 'Rumboltswhyke' (an AD word, not in NI)?

Vowels and Consonants

Seven-letter words with all possible vowel-consonant patterns but vvvcccc and vvvvccc have been found; however, ccccccv ('Štrbské') is part of an AD lexeme, and vccccc ('Ehrnsch') is a nickname in no printed source (68-138, 77-221, 78-215). Find AD (or O?) words for these. (Purists may wish to replace vocalic Y in 'archspy' and 'earthly', possibly with UD words, certainly with AD.)

UD words with one each of the vowels AEIOU have been sought for all 120 permutations of these letters (fAcEtIOUs, sEqUOIA, UnsOcIAblE, ...); all but AEIUO IAEUO IAUEO IEAUO IUEOA OAIEU OEIAU have been found (69-208, 70-18, 75-20, 77-84). Find these in UD if possible, AD otherwise (for example, OrnAcIEUx is a French populated place). Two AD words containing each vowel exactly twice have been found (70-18, 147); is a UD word possible?

Find a longer word not containing AEIUO than 'symphysy' in NI or 'Mynyddyslwyn' (see F&W) in UD; find a longer word not containing AEIOUY than 'crwth' in NI or 'bzzzbzzz' (Amer. Thesaurus of Slang) in UD (72-108, 174).

Word Stairs

In WASHERAYETAGEMUD, every three-letter substring is in 8C; in TSARIDESK, every four-letter substring is in 8C: in SAGRASPARELICA, every five-letter substring is in NI (68-156, 70-49, 79-37). Find longer strings within NI, OED or in general UD, with no repeated words. (If no letters are repeated, the longest-known NI sequences with all three-letter, four-letter and five-letter substrings forming words are GJANTHYEDOPSIMURF, XMASURICHOPENT, and STOMANICER; if the sequence ends are also closed to form a ring, the first two are ANTHYEDOPSIMULAN, HALOWERISHAL.)

Find the longest NI word made up of two-letter NI words, linked (sore: so, or, re) or unlinked (domain: do, ma, in). 'Ureterocystanastomosis' (using 'cy' in cy pres) is the record for both (75-104, 76-41).

Find a longer chain of overlapping state abbreviations (without repeats) than WVARINMNVTNCOHIALAKSCAZ. Including DC GU PR VI, beat GUTNMNCALAKSCOHIARINVIDCTX (76-241, 77-46).