ALL LETTER-ORDERS IN A WORD

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In the word **reiterate**, the letters R, E and T appear in all possible orders: REiTerate, ReiTErate, rEiTeRate, rEiteRaTe, reiT-ERate, and reiTeRatE. This property is not particularly unusual, being shared by thousands of Websterian words. The shortest letter-sequences possessing this property are seven letters long:

ABCABCA alfalfa entente Samsams Sarsars semsems (or simsims)
ABACABA
ABACBAB cachaça tathata
ABCBACB Barabra
ABCBABC patapat, Sarasar (or Sereser)
ABCABAC
ABCACBA

Longer words containing all six orders of three different letters have one (or more) of these patterns imbedded in them; for example **reiterate** reveals the pattern ABCBACB (r = A, e = B, t = C).

It is considerably more difficult to find words containing all 24 arrangements of four different letters. The minimum necessary word length is 13. Some, but not all, of the patterns can be generated by preceding and following the letter D with one of the above patterns; for example ABCABCADABCBACB is a valid pattern. (Note that the second and third patterns in the above list are similarly derived from the minimum-length patterns containing all arrangements of two letters, ABA and BAB.)

Since there are no 13-letter Websterian words using only four different letters, it is unnecessary to search for words with these patterns. When checking a longer word to see whether or not it qualifies, a necessary (but not sufficient) condition is that it contain four different letters a total of at least 13 times. Thus, for example, in evaluating **transubstantiationalist**, one need check only the letter-sets ANST (15), AINT (15), AIST (15), INST (14), and AINS (13); all sets including the single letters B,O,L,R and U are eliminated because none of these letters is near enough to the center of the word. A quick way to check a letter-set is to find the latest appearance of the four letters, followed by the latest appearance of the remaining three letters, and so on. For example, for AINS the critical order is transubstantlationaliSt, proving that the letter-orders ISAN and ISNA do not appear. However, this method is not guaranteed to eliminate a letter-set; for ANST, one has tranSubstaNtiATionalist, yet the letter-order ATSN (trAnsubsTantiationaliSt) does not occur.

The only two Websterian words known to exhibit all 24 arrange-

ments are **pneumonoultramicroscopicsilicovolcanoconiosis** (ClNO,ClOS, ClLO) and **trinitrophenylmethylnitramine** (lNRT). The word **antidisestablishmentarianism** contains at least two dozen different sets of four letters with 13 or more representations, but none of these leads to a full group of 24 arrangements.

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In the **reiterate** example, the letters R, E and T appeared in all six possible orders with other letters intervening. What if one imposes the more stringent requirement that all six orders must be illustrated by trigrams (three adjacent letters) in a single word? I know of no English word possessing this property, and doubt that any exist. (How many different trigrams based on the same set of three letters can one find in a single word?) One can, however, devise a pattern of only nine letters which satisfies all requirements: ABCABACBA (a palindrome). No shorter patterns are possible, but longer ones are not hard to construct.

FANTASTIC ECHOES

This is the title of an anthology of verse by Walter Shedlofsky, taken from many publications including **Word Ways** *("The Dream and the Sword" in May 1969, "Hispahan" in August 1968, and "Sandrahar" in May 1969). It is available for two dollars from Walter Shedlofsky, 7923 Lafon Place, St. Louis MO 63160.*