WORD-SEARCH PACKING

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Given a list of words, what is the minimum-area rectangle they can be packed into, using word-search rules for placement? Any word can read forward or backward, up or down, or in any of the four diagonal directions, but must be in a straight line. Unlike word-search puzzles, which are typically packed in squares, there is no constraint on the shape of the rectangle, nor is there any requirement that all eight directions be used. However, there is a requirement that any word is connected to any other by means of a chain of intermediate words, each sharing one or more letters with its neighbors. (Note that diagonal words crossing each other do not always meet this condition.) This property of connectivity, although honored in crosswords, is not always observed in word-search puzzles.

I conjecture the optimum packing strategy is to construct k rows of similar length consisting of overlapping words (such as grasSaiBeATad, where capitals denote overlaps), and connecting these with a word of k letters aligned vertically or diagonally, to join the rows. If more than one such word can be placed, so much the better; the requirement that each row be fully connected can be relaxed.

To fix ideas, consider the 37 different presidential surnames, containing 247 letters if VANBUREN is written without a space, or 248 if it is. Leonard Gordon, using pencil-and-paper techniques, has constructed the 5x42 packing below with five vertical or diagonal words, which is difficult to better. The packing ratio of 210/247 = .85 is, it is true, outdone in standard word-search puzzles having ratios as low as .76, but it is likely that their advantage rests with the ability to pick and choose suitable words from a larger list (just as crossword constructors do).

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t r u m a N o T g n i h s a W i l s o n d l e i f r a G r e t r a C l e v e l a N D
k e n n e d Y e l n i K c m   h a y e S m a d A r t h u R o o s e v e l T a y l O R
l i n c o L n c o o L i d g e     r e v o o H s u B u c h A n a N e r u b n a v x o
j e f f E r s o N O s k c a J o h n s o N a g a e R e w o h N e s i E r o m l l I F
h a r R i s o n P i e r c E o r n o M a d i s o N o t n i l c T a f t h a r d i N g
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There's even an open slot for Gore!

Leonard challenges **Word Ways** readers to solve a slightly different word-packing problem: what is the smallest rectangle in which one can pack the 37 presidents with at least one name spelled in each of the eight directions? Connectivity is not required.