Clueless Word Puzzles

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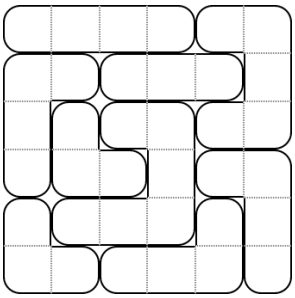
for G4GX

numeric puzzles

For the past couple years, Gerard Butters and James Henle (also attending G4GX) have been exploring with me what we call *clueless puzzles*, similar to Sudoku or KenKen, but with the æsthetic that the puzzle be empty of clues, that is, not partially filled in. There still have to be constraints to ensure that each puzzle has a unique solution, but we prefer global constraints and constraints based on the shape of the puzzle.

The puzzle is an $n \times n$ array of empty boxes, and the solution is a *Latin square*, where each row and column of the array is a permutation of the numbers $(1, \ldots, n)$. In other words, no number may appear more than once in the same row or in the same column. In common with KenKen, our puzzles are also partitioned into groups of adjacent boxes (sometimes called *cages*) with some constraint applied to them. For example, in this puzzle



the numbers in each of the nine regions must add up to the same sum. Each row is a permutation of $(1, 2, 3, 4, 5, 6)$ and therefore must sum to 21. There are six rows and nine regions, so the sum is $6 \cdot 21/9 = 14$ per region.

For a great many more puzzles of this variety, see

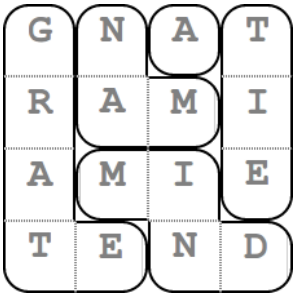
`http://fredhenle.net/puzzles/`

word puzzles

I've always loved word games and puzzles, and so I wished to develop something similar to the clueless numeric puzzles, but using letters instead of numbers. Each row and each column should be a word—this is known as a *word square*. If we also define regions of boxes, each region should also form a word.

In the spirit of G4GX, I consider only the letters `[MARTINGARDNER]`, or `[ADEGIMNRT]`. As a further constraint, just as with Latin squares, no letter should appear more than once in any given row or column. I use *The Word List* (TWL06) which is a standard list of words for word game tournaments. At the end, I provide a list of words which might be used as a row or column in one of these puzzles.

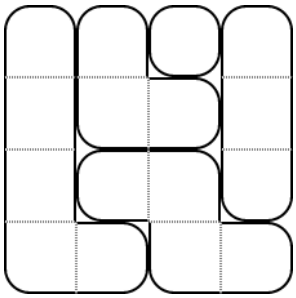
Here is an example:



Note that each row and each column is a word, and each region also defines a word. All regions are narrow enough that there is no ambiguity in the order of the boxes within the region—the first letter of the word is the leftmost topmost box, and each box is adjacent only to at most two other boxes.

Having defined what a solution should look like, it's less clear what the puzzle definition should be; that is, what information should be given in order to make the puzzle neither trivial nor intractable. With the numeric puzzles, there is often a clear mathematical and logical path to the solution. Here are a few possible ways to turn the solution into a puzzle:

- Provide the empty regions, with no guidance on the words:



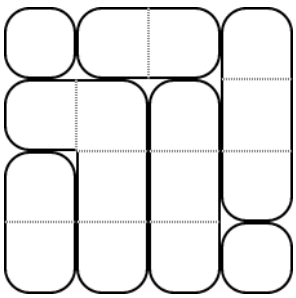
  This is open-ended enough that there is probably not a unique solution.

- Provide the list of words that go in the regions, but not the regions themselves: `A,GRATE,MIND,NAM,TIE`. For any puzzle of this type, there is always a pair of symmetric solutions, unless both the word square and the regions are symmetric.

- Provide both the empty regions and the list of words to fill it. This is probably much too easy. In this example, there are only two possible ways to attempt it, since all but two of the regions are different lengths.

Ready for some actual puzzles? Try these:

1. Fill the following 4×4 word square:



With the added constraint that that only six different letters out of `[MARTINGARDNER]` are used in this square, the solution is unique.

2. Fit the following words into a 4×4 word square: `AGIN,GRATING,MI,RAD`. It's acceptable for the word `GRATING` to have the letter `G` twice because they are not in the same row or column.

3. Find a 4×4 word square that can be partitioned one way and filled with `AGE,EM,GAD,I,ID,ME,RID` or partitioned a different way and filled with `AD,DE,EGAD,GEM,I,I,MIR`.

4. Fit the following words into a 5×5 word square: `AM,AMEN,DIM,EN,GENT,RAGE,RAM,I,TA`. The word square is symmetric, but the arrangement of regions is asymmetric, so there is a pair of solutions.

It turns out that there are no word squares of order six or higher using only the letters `[MARTINGARDNER]` and allowing no letter to appear more than once in a given row or column. There is only one such word square of order five, and like many word squares, it is symmetric (the five rows are the same as the five columns). There are hundreds of word squares of order four, even if you ignore the symmetric ones.

word lists

These are all the words in TWL06 containing only the letters `[MARTINGARDNER]` and containing no more than one of each letter. TWL06 does not include any one-letter words, but of course I also accept `A` and `I` as valid words.

1. A I

2. AD AE AG AI AM AN AR AT DE ED EM EN ER ET ID IN IT MA ME MI NA NE RE TA TI

3. AGE AID AIM AIN AIR AIT AMI AND ANE ANI ANT ARE ARM ART ATE DAG DAM DAN DEN DIE DIG DIM DIN DIT EAR EAT END ENG ERA ERG ERN ETA GAD GAE GAM GAN GAR GAT GED GEM GEN GET GID GIE GIN GIT IRE MAD MAE MAG MAN MAR MAT MED MEG MEN MET MID MIG MIR NAE NAG NAM NEG NET NIM NIT RAD RAG RAI RAM RAN RAT RED REG REI REM RET RIA RID RIG RIM RIN TAD TAE TAG TAM TAN TAR TEA TED TEG TEN TIE TIN

4. ADIT AGED AGER AGIN AIDE AIRN AIRT AMEN AMID AMIE AMIN AMIR ANTE ANTI ARID DAME DAMN DANG DARE DARN DART DATE DEAN DEAR DENI DENT DERM DIET DIME DINE DING DINT DIRE DIRT DITA DITE DRAG DRAM DRAT DREG EARN EDIT EGAD EMIR EMIT ETNA GADI GAED GAEN GAIN GAIT GAME GANE GATE GEAR GENT GERM GETA GIED GIEN GIRD GIRN GIRT GITE GNAR GNAT GRAD GRAM GRAN GRAT GRID GRIM GRIN GRIT IDEA IDEM IRED ITEM MADE MAGE MAGI MAID MAIN MAIR MANE MARE MART MATE MEAD MEAN MEAT MEGA MEND META MIEN MINA MIND MINE MINT MIRE MITE NAME NARD NEAR NEAT NEMA NERD NIDE NITE RAGE RAGI RAID RAIN RAMI RAND RANG RANI RANT RATE READ REAM REIN REND RENT RIDE RIME RIND RING RITE TAIN TAME TANG TARE TARN TEAM TEAR TEND TERM TERN TIDE TIED TIER TIME TINE TING TIRE TRAD TRAM TRIG TRIM

5. ADMEN ADMIT AGENT AIDER AIMED AIMER AIRED AMEND AMENT AMIDE AMINE ANGER ANIME ANTED ANTRE ARMED ARMET DATER DEAIR DEIGN DEMIT DENAR DENIM DERAT DERMA DIMER DINAR DINER DINGE DIRAM DIRGE DRAIN DREAM ENTIA GAMED GAMER GAMIN GARNI GATED GATER GIANT GRADE GRAIN GRAND GRANT GRATE GREAT GRIDE GRIME GRIND IMAGE INARM INERT INTER IRADE IRATE MADRE MANED MANGE MARGE MATED MATER MATIN MEANT MEDIA MENAD MENTA MERIT MIDGE MINAE MINED MINER MIRED MITER MITRE NADIR NAMED NAMER NITER NITRE RAGED RAMEN RAMET RAMIE RANGE RANID RATED REDAN REDIA REGMA REGNA REIGN REMAN REMIT RENIG RETAG RETIA RIANT RIDGE RIMED TAMED TAMER TARED TARGE TEIND TENIA TERAI TERGA TIGER TIMED TIMER TINEA TINED TINGE TIRED TRADE TRAGI TRAIN TREAD TREND TRIAD TRIED TRINE

6. ADMIRE AIDMEN AIGRET AIRMEN AIRTED ARDENT ARGENT ARMING DAIMEN DAMNER DANGER DARING DATING DEGAMI DENARI DETAIN DINGER DREAMT EARING EATING ENGIRD ENGIRT ENGRAM ENIGMA ETAMIN GAINED GAINER GAITED GAITER GAMIER GAMINE GANDER GARDEN GARNET GERMAN GIRNED GIRTED GRADIN GRATED GRATIN GRIMED IMAGED IMAGER IMARET INGATE INMATE MAGNET MAIDEN MAIGRE MANGER MANTID MARGIN MARINE MARTED MARTEN MARTIN MATIER MATING MEDIAN MEDINA METING MIDGET MINDER MINTED MINTER MIRAGE MITRED NIDATE NIDGET RAGMEN RAINED RANGED RANTED RATINE RATING REAGIN REDING REGAIN REGINA REMAIN REMAND REMIND REMINT RETAIN RETINA RIDENT RINGED TAMEIN TAMING TANDEM TANGED TARING TINDER TINGED TIRADE TRIAGE TRINED

7. ANTIRED DARTING DERAIGN DETRAIN DRAGNET GARMENT GERMINA GRADINE GRAINED GRANITE GRANTED GRATINE INARMED INGRATE MANGIER MARGENT MARTING MEDIANT METRING MIGRANT MIGRATE MINARET MINTAGE RAGTIME RAIMENT READING READMIT REAMING TANGIER TEAMING TEARING TEGMINA TERMING TRADING TRAINED TRIAGED

8. DERATING DREAMING EMIGRANT GRADIENT MARGINED MIDRANGE MIGRATED REDATING REMATING TREADING