A PANGRAMMATIC VARIANT OF SUDOKU

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A sudoku grid contains 81 squares. Any three subgrids contain 27 squares. To my knowledge, no one has exploited how close this number is to 26, the size of the English alphabet. In this article, I propose a simple way to link the full alphabet to the standard sudoku grid.

I call the new format *sudopang*, because it is pangrammatic. That is, the grid contains all 26 letters of the English alphabet plus the hyphen (-) for a total of 27 characters. Each of the letters and hyphen are repeated three times, and so fill all 81 squares of a sudoku grid.

In any sudopang, the top three rows should contain all 27 characters. The center three rows should also contain all 27 characters, as should the bottom three rows. Similarly, the left three columns should contain all 27 characters. The center three columns should also contain all 27 characters, as should the right three columns. These conditions will insure that no row, sector, or column contains two of the same character.

Shown below is an example of a sudopang. Notice how it fulfills all the criteria of non-repetition laid out above. This particular sudopang is highly stylized. The top three rows form the famous pangrammatic sentence: Cwm, fjord-bank glyphs vext quiz. The middle rows form a pangrammatic set of words. The bottom rows contain words, along with two sets of initials, DJ and SQV.

The fact that adjacent letters form word chains is NOT a requirement of sudopang. It is only an accidental property of this example. In fact, none of the columns of Figure 1 contains any word of even four letters. I should note that Figure 1 employs word chains continuing from row to row. In the sudopang described in Figures 2 and 3, no embedded words overlap columns or rows. This makes the embedded words more readily visible.

C	W	M	F	J	O	R	D	-
B	A	N	K	G	L	Y	P	H
S	V	E	X	T	Q	U	I	Z
F	L	Y	C	W	M	J	A	B
K	U	R	D	Z	I	N	G	S
Q	O	P	H	-	V	E	X	T
D	J	Z	E	N	S	Q	V	K
I	T	H	P	U	B	F	L	O
G	X	-	R	A	Y	C	W	M

Figure 1. A highly stylized sudopang

Since sudopang includes the multiple use of every letter in the alphabet, creative readers should easily find attractive thematic arrangements that fit its new format. Does it seem to you that making arrays of sudopang words is too easy? The following discussion will show that the task is not trivial.

Suppose that I have decided to make a sudopang grid with the theme 'Circus Sights.' Two nine-letter circus-related phrases, each with no repeated letters, are 'lion tamer' and 'magic show.' I cannot place both phrases so as to intersect, because then some column-set or row-set of the sudopang grid would contain two a's, two i's, two m's, or two o's. However, I can put the words into a sudopang grid as shown:

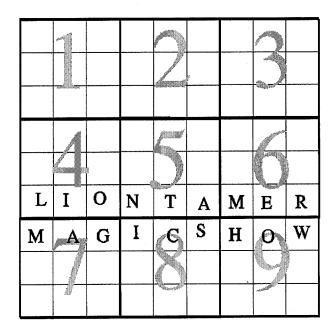|								
	1			2			3	
	4			5			6	
L	I	O	N	T	A	M	E	R
M	A	G	I	C	S	H	O	W
	7			8			9	

Figure 2. First iteration of a circus-related sudopang

What other words or phrases might I now add? Well, some mainstays of the circus scene are acrobats, trapezes, elephants, ringmasters, tent, carnival, popcorn, to name just a few. However, each of these words has a repeated letter, and so is unsuitable for sudopang. Other words just might work: crowds, clowns, tiger, big top, carny, and peanuts, for example.

'Tiger' proves not to fit. A close examination of why this is so illuminates the internal dynamics of sudopang. I have numbered the subgrids above as 1 to 9. One cannot use the 't,' 'i,' 'e,' or 'r' in subgrids 4, 5, 6, or 8 to anchor the word 'tiger,' because of conflicting letters. The 'r' in subgrid 6 cannot be the end of 'tiger,' otherwise we would have two e's in subgrid 6. So if 'tiger' appears, it has to be unanchored. Furthermore, the grid already contains two i's – in subgrids 1 and 9. Thus the remaining 'i' must be in subgrid 3, or else some three-row or three-column sector will have two i's, which would violate the rules of sudupang. 'Tiger' cannot appear horizontally with its 'i' in subgrid 3, because then 'tiger' would extend past the grid. 'Tiger' cannot appear vertically, because then 'e' or 'r' would appear twice in sector 6. By similar logic, 'peanuts' does not fit.

However, the word 'clowns' does fit into the remaining squares of the sudopang grid. It can be placed in the first row, as shown in Figure 3. 'Clowns' can alternately be placed in the second or third row instead. As soon as these three theme words are placed, then we already have eight letters of the alphabet that appear twice. Each of those letters will appear a third time in the sudopang – but the placement of that letter is restricted to a single subgrid. In Figure 2, for example, 'i' appears in subgrid 4, and so the remaining 'i' cannot occur in subgrids 1, 5, 6, or 7. And since 'i' also appears in subgrid 8, the remaining 'i' cannot occur in subgrids 2, 5, 7, or 9. This leaves only subgrid 3 for the third 'i.' This is an important consideration in selecting embedded words for sudopang.

We continue to add words to our grid, at each stage, noting the increased number of letters whose final occurrence is restricted. In keeping with the pangrammatic character of sudopang, I chose the progression of words for Figure 3 so as to form a pangrammatic set. Thus, the words in the completed sudopang include: bask, debt, fun, gap, hex, ivy, jog, jug, oft, puny, quiz, sky, and x-ray, as well as, of course, clowns, lion tamer, and magic show.

Any sudopang grid will contain a few letters that are not used in words. To position them uniquely, we will add a further condition. Any 'unchecked' letters (letters not part of a word of three letters or longer) within a subgrid must be positioned in alphabetic order, reading left to right, and top to bottom.

Our completed circus-theme sudopang looks as follows:

B	T	C	L	O	W	N	S	Q
V	H	Z	J	M	P	G	K	U
F	E	D	X	-	R	A	Y	I
K	X	S	F	H	Q	P	C	Z
W	Y	J	U	G	B	D	V	-
L	I	O	N	T	A	M	E	R
M	A	G	I	C	S	H	O	W
R	Q	-	V	Z	K	J	F	L
P	U	N	Y	D	E	B	T	X

Figure 3. Final version of a circus-related sudopang. The grid contains three longer themed words, and thirteen other words of at least three letters.

A sudopang set such as Figure 3 can be transformed into a puzzle in at least three ways. First, the grid could be displayed with only a couple of theme words filled in, as in Figure 2 above. Additional words to add into the grid would also be specified. Alternatively, following the model of sudoku, the grid could be displayed with only a few isolated letters filled in. A complete set of words to add into the grid would be specified. A third form of presentation would be as a crossword puzzle. One would insert small numbers into squares to mark the beginnings of words, and give numbered definitions of those words. As a surprise, one would describe the theme words only as "Theme Word A" and such.

In either presentation, the basic rules for solving sudopang would remain the same:
(1) Every letter of the alphabet (and the hyphen mark) must appear exactly once in the top three rows; every such character appears once in the middle three rows; every character appears once in the bottom three rows.
(2) Similarly, every character must appear exactly once in the leftmost three columns; every character appears once in the middle three columns; every character appears once in the rightmost three columns.
(3) Some letters may occur in a given subgrid, but not be part of longer words. They should be placed in alphabetic order, left to right, top to bottom, in the subgrid in which they appear.
(4) (optional:) words specified in a puzzle description must each occur in a single column or row. No overlapping of rows or columns is allowed. No diagonal words are credited.

I hope that readers will develop sudopang grids with larger sets of theme words. One way to enrich the set of usable words is to allow embedded words to be embedded diagonally. (For instance, 'elephant' can be placed diagonally.) Diagonal words are already allowed if optional rule 4 is ignored. In practice, I found a severe restriction on available letters in each sector once two or three theme words had been placed, whether or not diagonal words are allowed. Some topics will prove richer than others as troves of sudopang theme words. Let the search for such topics begin.

If someone sees a way to improve the basic rules of sudopang, that insight is also welcome. Happy exploring to all, as you prowl among these vext fjord-bank glyphs!