Something is Off

Answer: DUAL

Authors: Ivan Koswara, Alex Pei, Anderson Wang

Each logic puzzle actually has two solutions. For some puzzles, this is rather obvious, giving a clue that something is off:

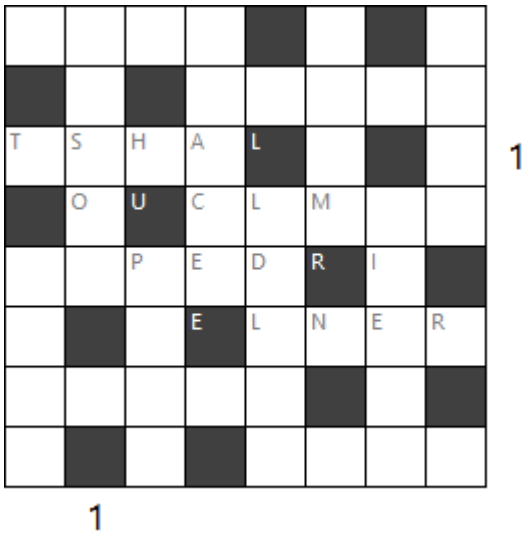
- In Heteromino, the region containing R1C4 cannot be symmetric over the line of symmetry.
- In Scrabble, no word is repeated, so the solution won't be the same upon reflection over the main diagonal.
- In Battleship, the column clues are symmetric, but there is an odd row clue, so the row's contents cannot be symmetric.
- In Skyscrapers, column 3 cannot remain the same upon rotation.

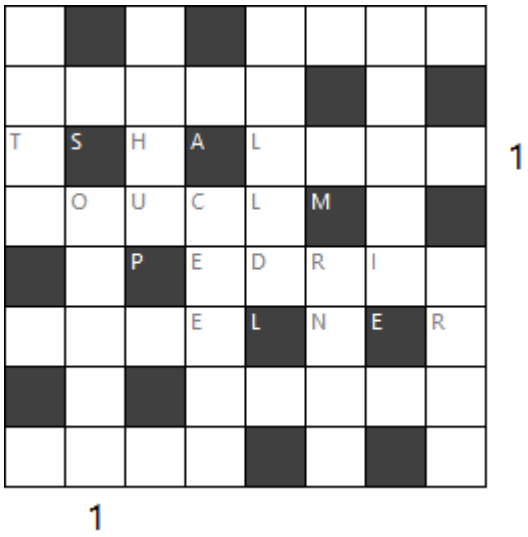
Each solution extracts an English word as instructed, so each puzzle gives a pair of words. These words are one letter off each from making a common "X and Y" phrase (which also disambiguates which solution goes "first"):

Puzzle	Solutions	Actual phrase	Letters replaced	
Gaps	LURE/SAMPLE	PURE and SIMPLE	L	A
Heteromino	HINT/NECK	HUNT and PECK	I	N
Masyu	WINK/DONE	WINE and DINE	K	O
Yin-Yang	BREED/CUTTER	BREAD and BUTTER	E	C
Akari	QUACK/DITTY	QUICK and DIRTY	A	T
Kurodoko	CAR/WADE	FAR and WIDE	C	A
Scrabble	SHOUT/SHEET	SHORT and SWEET	U	H
LITS	HERB/NEW	HERE and NOW	B	E
Battleship	STARE/STRIDES	STARS and STRIPES	E	D
Tapa	FALL/CHAIR	BALL and CHAIN	F	R
Tetropia	SHOO/TOLL	SHOW and TELL	O	O
Skyscrapers	FRESH/BLOND	FLESH and BLOOD	R	N

The letters that need to be changed spell out "LIKE A CUBE FOR AN OCTAHEDRON", which clues the mathematical **DUAL** of a polyhedron, the answer to this puzzle.

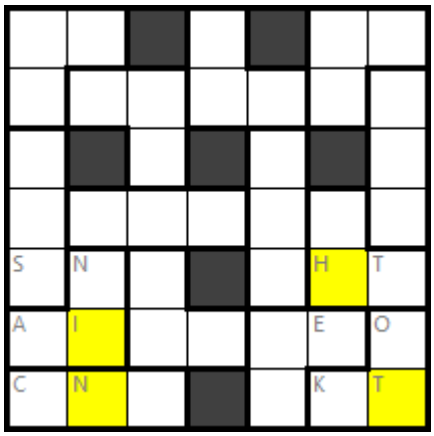
Gaps (by Ivan Koswara)

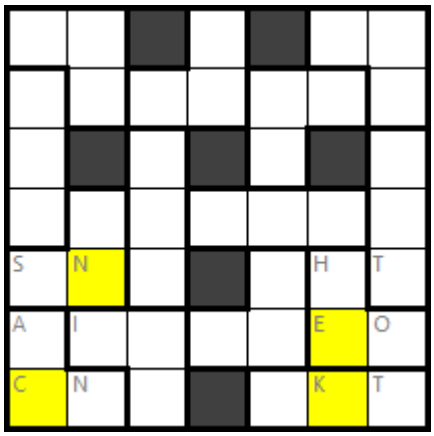




This puzzle is very deceiving. Even without the clues, there are exactly two ways to place the black squares. This generalizes to all 4n × 4n grid containing n black squares in each row/column that are all not touching. The proof is rather mathematical in nature and the case n = 50 was even included in the shortlist of International Mathematical Olympiad 2010.

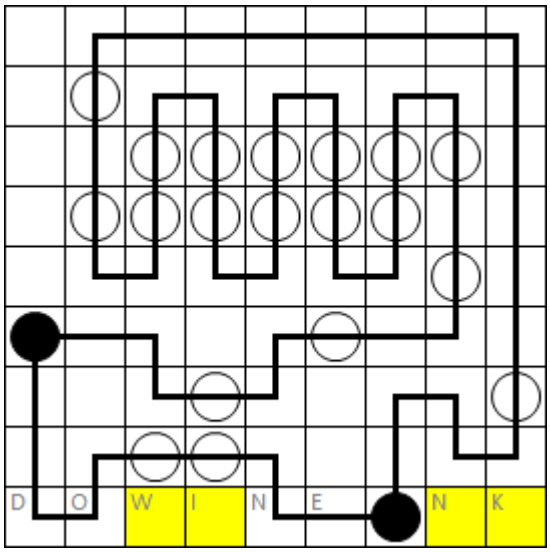
Heteromino (by Ivan Koswara)

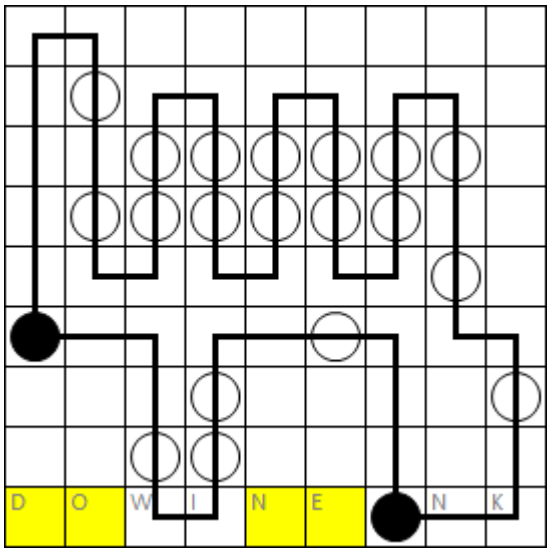




The grid has reflective symmetry, but the region containing R1C4 (row 1 from top, column 4 from left, aka the top-middle cell) cannot be symmetric since it must be an L. Thus the two solutions are simply reflections of each other. After choosing one arbitrarily, the rest is rather standard if slightly tricky. Assuming you pick the one that looks like L (the left solution), the top-right part falls into place right away. Then R4C6 must look like L, which forces bottom-right to form a rectangle and so R3C5 to form an I. Then, if R4C4 looks like L, there's a quick contradiction with R2C3, so it's not the case; the top-left then falls into place. The bottom-left area falls quickly with a little bifurcation on R6C4, and the bottom-right area follows.

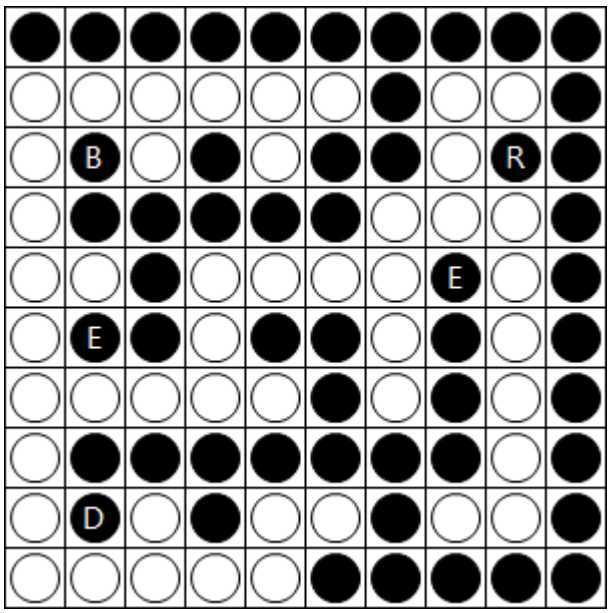
Masyu (by Ivan Koswara)

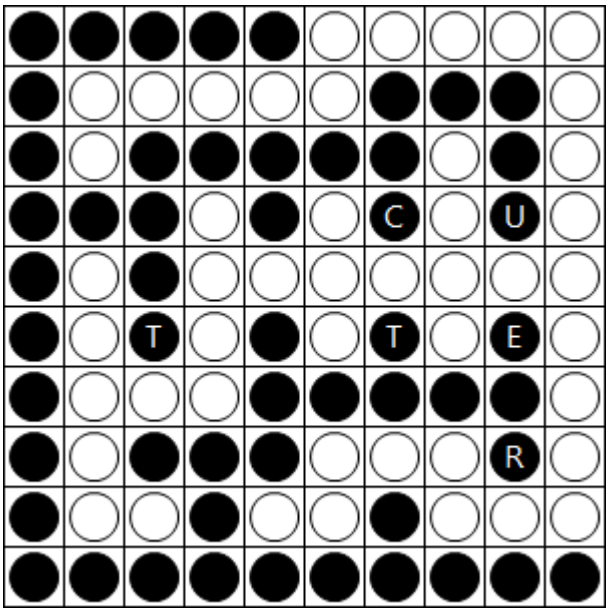




The giant area of white circles has only one way to resolve it, making a zigzagging strand that has a free end at the top and at the bottom. The top end has two ways to go down, through the left side or the right side; each gives a simple Masyu puzzle.

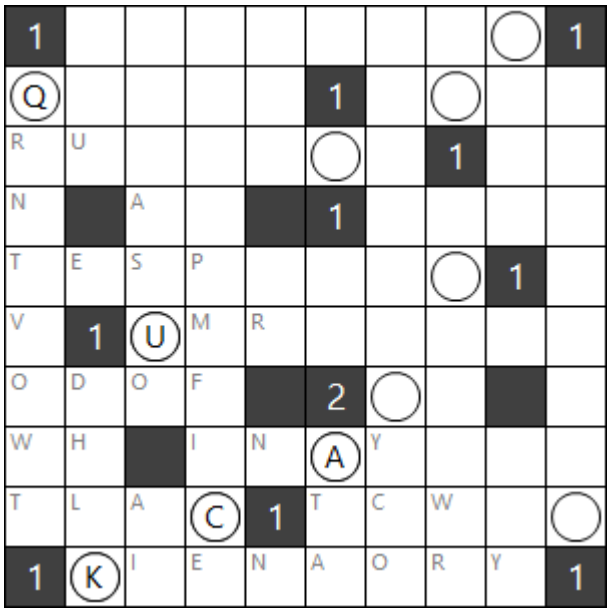
Yin-Yang (by Anderson Wang)

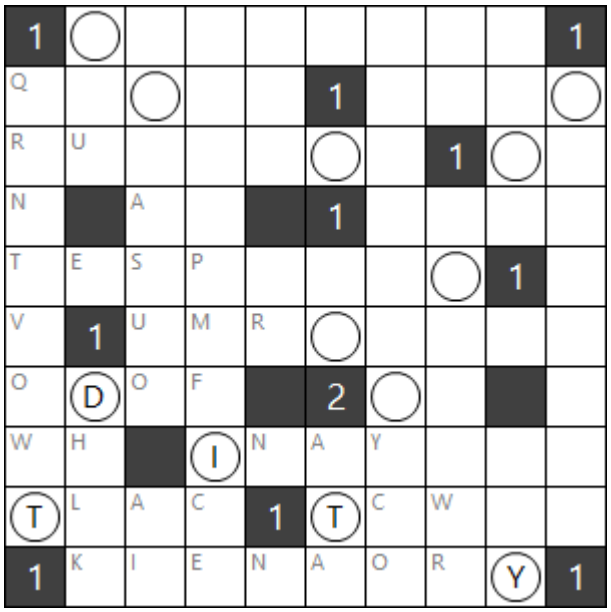




The break-in for this puzzle is the white circle on R2C2. It has three ways to connect to the rest: through the left side, the top side, or directly to the middle. But a direct connection to the middle would have made R5C2 black, and so one of R4C1 and R5C1 must be white. Either way, one of the big empty sides must have a white circle, and so the black circles connect the remaining border area. (Recall an important deduction in Yin-Yang, that along the borders, blacks and whites must form a contiguous area each.) The rest is relatively easy.

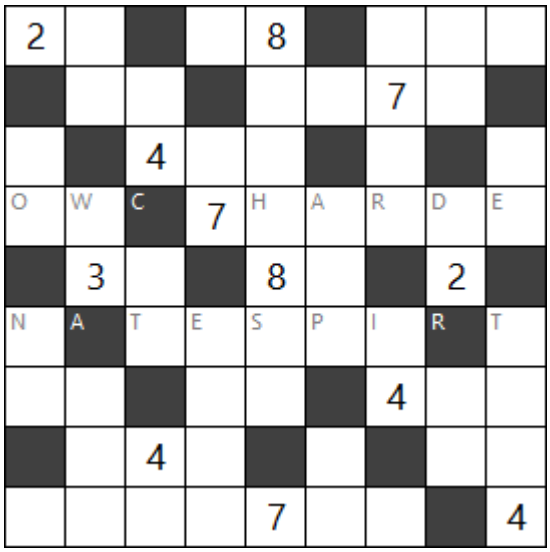
Akari (by Anderson Wang)

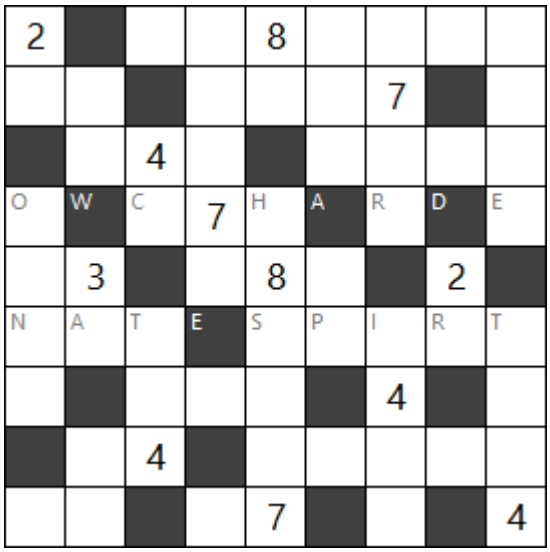




The outer border has two ways to resolve it; indeed, this is where you bifurcate. The left case resolves by noticing the middle two rows have lightbulbs next to the 1s, and in particular not in the middle. For the right case, R8C6 is not a lightbulb due to the 1 in R9C5.

Kurodoko (by Anderson Wang)





The easy way to bifurcate here is with the 2 in R1C1, but during testing it was found that it's possible to bifurcate much later from R3C5, but with much more difficulty. Either way, the rest of the puzzle solves pretty normally in both cases.

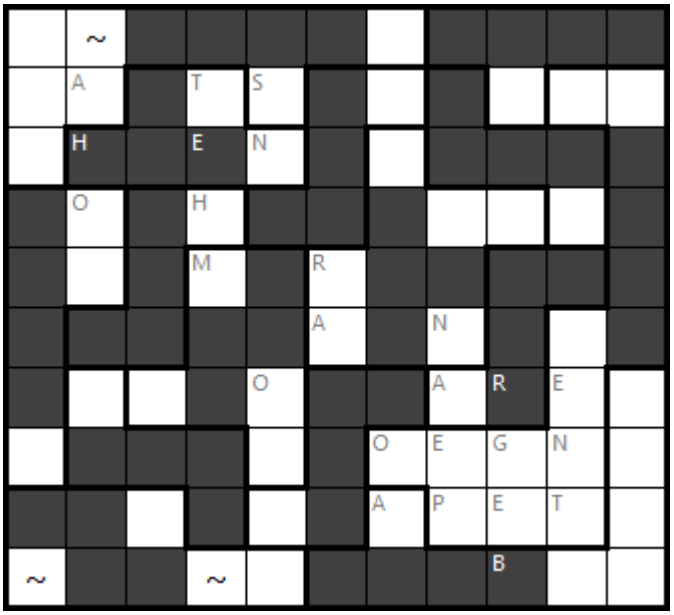
Scrabble (by Alex Pei)

P d	A c	S c	E c		T a
	E a	U d	S b	H c	W b
H a	G b	N a	L b	O c	M a
T c	E c	R b	V a	I b	E c
X b	U d	E a	C c	N a	
R c		P a	S a	O d	T b

P d		S a	E c	R b	T c
N c	E a	U b	S c	H d	
H c	G d	N a	L b	O a	M a
T c	E b	R b	V a	I c	E a
	U c	E c	C b	N a	A d
R a	W b	P a	S c		T b

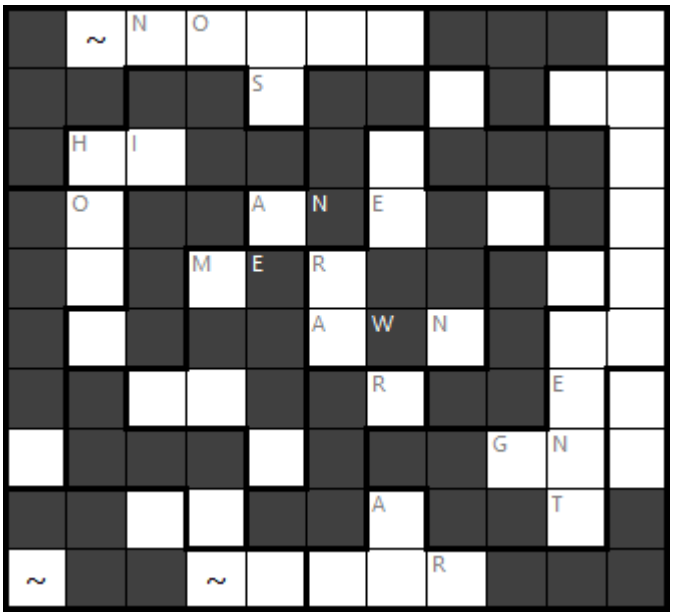
This might be one of the most difficult puzzles in the set. The important observations are:

- There are 12 words, all 4+ letters long. So each row/column has one word; moreover, the middle rows/columns are all filled with letters, so they have the 6-letter words.
- Each letter appears an odd number of times, so there is at least one occurrence of each letter that only belongs to one word. Each such letter must be in the same row/column with a 4-letter word, so each 4-letter word belongs in a row/column that looks like ####X# (or its reverse) where # is a letter.
- Three of the 6-letter words end with a, so some word contains aa. This must be aadb. Placing this one way or another breaks the symmetry and we can solve the rest logically.

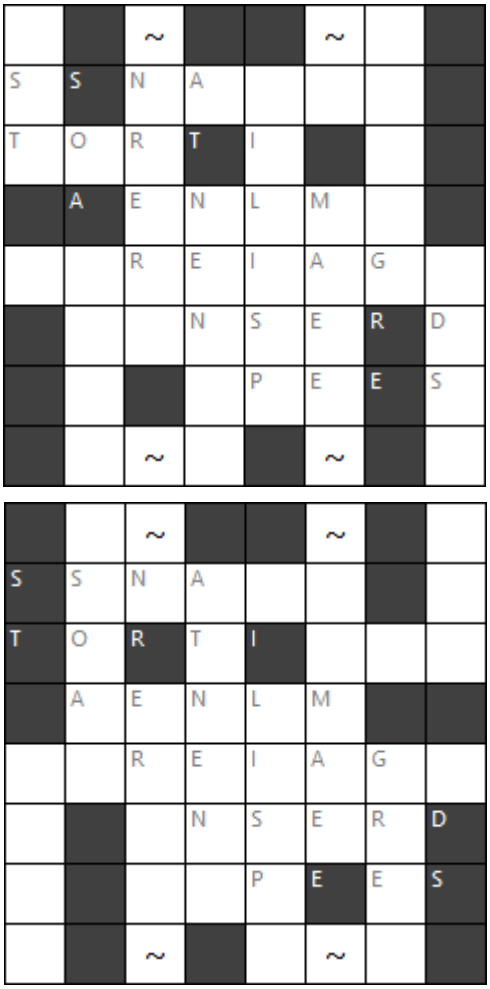


LITS (by Anderson Wang)

There is a ring of S-pentominoes in the middle. Each pentomino can only be filled with an L-tetromino, and each forces the next in the chain to avoid touching. There are two ways to resolve this ring, so this is where you bifurcate; the rest turns out rather easily in both cases. Turns out constructing this genre is incredibly difficult that we need some clued white squares.

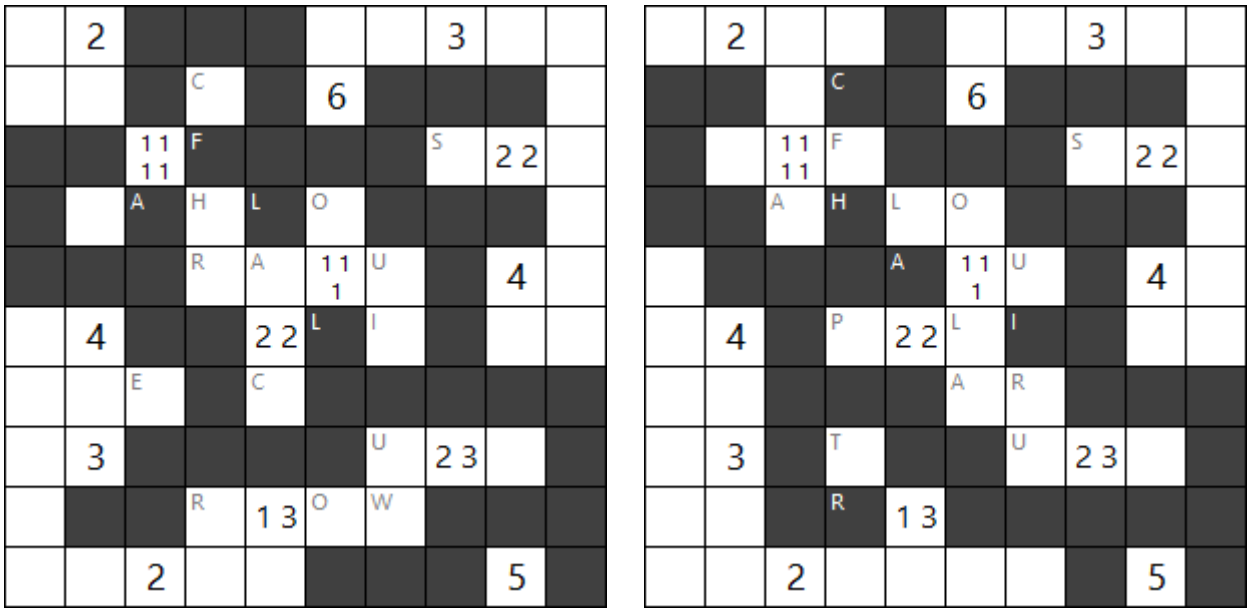


Battleship (by Ivan Koswara)



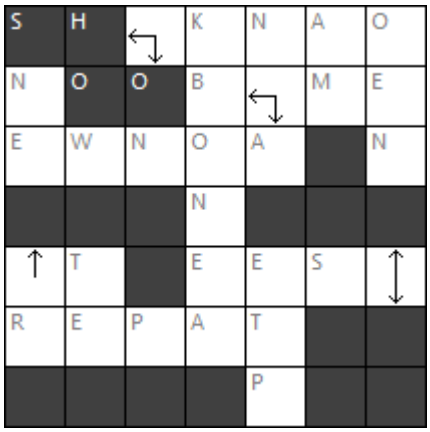
The intended break-in is rather complicated and crucially depends on the following: each 2x2 square has at most 2 ship segments. In particular, R1-2C1-2, R3-4C1-2, R7-8C1-2 has at most 2 ship segments each, so R5-6C1-2 has at least 1; same with R5-6C7-8. But now all ship segments are accounted for: the 18 clued by row clues and the 2 we deduced above, so equality happens everywhere. Now the 4-ship must go in one of the outer columns, and it must be paired with a vertical 3-ship next to it; our conclusion above says that the 4-ship must be flush with the top edge (instead of the bottom, where then it would contribute 2 ship segments to the 2x2 square). We break the symmetry by placing the 4-ship in R1-4C8, and now we consider the other 3-ship. This must be in column 1, and moreover due to R5-6C1-2 having only 1 ship segment, the 3-ship must be in rows 3-5 or 6-8. Only one leads to a solution.

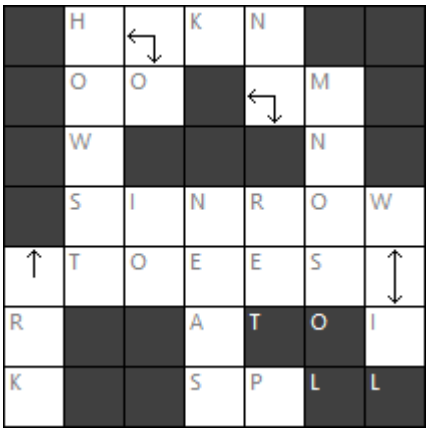
Tapa (by Anderson Wang)



This is actually a fairly standard Tapa with no particular tricks or anything, although it's somewhat tricky. The bifurcation begins on the 1-1-1-1 clue; after that, most of the puzzle relies on the connectivity being broken by the 1-1-1 clue, so the two halves of the puzzle must meet up through bottom-right.

Tetropia (by Ivan Koswara)





This puzzle is a variant of Pentopia, and most of the same idea applies, except for the requirement that each piece appears. A 7x7 grid is a tight fit for tetrominoes. The break-in here is the R1C3 clue; there are clearly two ways to satisfy it, either with closest distance of 1 or of 2, and each resolves very differently. The left case continues with R2C5 needing closest distance of 2 (otherwise the pieces touch), and then R5C1 needing closest distance of 1 (otherwise there are too many empty squares, leaving no space for all 5 pieces). The right case continues with the I-tetromino resolved, then R2C5 needing closest distance of 1 (otherwise there is no space for all 5 pieces, since the bottom-left becomes empty), then the L-tetromino in top-right (so R5C7 pointing up can be satisfied).

Skyscrapers (by Ivan Koswara)

F 2	B 3	C 1	T 4	P 5
L 5	O 4	R 2	E 1	S 3
A 1	E 2	I 5	O 3	U 4
R 3	A 1	N 4	I 5	S 2
T 4	K 5	S 3	H 2	D 1

F 1	B 2	C 3	T 5	P 4
L 2	O 5	R 4	E 1	S 3
A 4	E 3	I 5	O 2	U 1
R 3	A 1	N 2	I 4	S 5
T 5	K 4	S 1	H 3	D 2

Column 3 is the key to break symmetry. The 5 clearly goes to the middle, but we can rotate the grid to get another solution. The 1 in column 3 must be visible by one of the observers, so it must be on an edge; break symmetry by placing it in R1C3. This resolves the 4 clue from the left of R1 (because the 1 is not visible). Now, if the 4 was in R2C3, this forces the 2 in column 3 to be in R5C3, and thus also resolves the 4 clue from the right of R5. But now R4 cannot be resolved. So the 4 is in R4C3, and so the 3 clue from the left of R3 sees both 4 and 5. Thus R4C1 must be a 3; if it's a 1, it wouldn't hide R4C2. The 4 in C5 must be in R3C5 to avoid it being visible too early in R2 and R5, and so this completes rows 1, 3, 4. Only one permutation of the 1-2-3's in columns 3-5 work to give the 3 clue in R2 the correct number of buildings, and in turn this also finishes the 4-5 in columns 1-2.

Author (Ivan) notes:

Making puzzles that intentionally have multiple solutions is hard. This is largely because I wanted the solutions to differ as much as possible which meant placing the bifurcation point early in the puzzle, at which point I basically had to make twice as many puzzles.

The initial idea for this puzzle was a tile matching puzzle (basically jigsaw) that had multiple solutions; each tile would have a letter and you would extract something from each solution to spell out the full answer. Then, simultaneously, we came up with the current extraction aha – which required many puzzles instead of just the one jigsaw – and another of my puzzle ideas involving logic puzzles died, so this absorbed the logic puzzles. And then the jigsaw part died somehow.

Midway through writing, I was slammed by an insane amount of other obligations, and I recruited Anderson and Alex to help write the puzzles. Also, my standards decreased a lot. If I had more time, I would consider replacing / revamping a few of the puzzles here that are just ugly: Tetropia (no particular aesthetic), Masyu (also no particular aesthetic), LITS (for having cheater squares), Kurodoko (for having nearly, but not, symmetric givens), Yin Yang (no particular aesthetic), Tapa (rightmost three columns are identical) are some that come to mind. The very first puzzles I created were Gaps, Battleship, and Skyscrapers (Gaps was an instant in because it was just so silly; we were thinking of using it or Star Battle with the same deduction), and I consider them as examples of the quality bar I was hoping all the subpuzzles could meet, but time crunch, oh well.

The wordplay extraction was a different matter. I wasn't sure if the aha was gettable and wanted to clue it somehow. Several of my ideas were: include examples that extracted to a hint to redo the examples (for the main meat) and the other solutions extracted to a hint for the extraction, and making the title "Block and Write" as an example of the extraction. It turned out that our testsolvers solved the puzzle without these additions, so we proceeded without any hinting. I slipped in the title "Something is Off" to clue both that the puzzles were off (in that they have two solutions) and that the words extracted were off (in that they need something changed), without expecting people to really get this intention.