Instruction booklet for the qualifying round of
Logic Masters 2010

On Saturday, April 17, the official contest file will be available for download. Make sure you have read and understood the rules of the contest.

Welcome to the qualification round for the Logic Masters 2010!
We hope you enjoy the competition, regardless of whether you compete seriously or just for fun.

The contest will consist of 20 puzzles, some of them being extremely difficult. We believe nobody will be able to solve all of them in time. Solve those puzzles you can solve and skip the others; if you have time left, you can always come back to them.

The points for the puzzles have been assigned according to their difficulty. You may use these information to decide which puzzles to try first. However, keep in mind your estimation of a puzzle's difficulty may differ from ours.

We wish you good luck, enjoy the puzzles!

Last minute changes:
If there are any changes or clarifications, they will be announced in our forum at
http://forum.logic-masters.de/showthread.php?tid=585

Remember:

- Wrong answers will yield a penalty of 5 points.

- Incorrect answer keys for an otherwise correct solution may be accepted. However, in such a case only 80% of the puzzle's points will be given.

- Enter the answer keys you already have, to avoid time trouble at the end of the test. Remember, late answers will yield a penalty of 1 points per 8 seconds.

- You are solely responsible for sending your answers in time.

- You must solve the qualification puzzles without outside help. Computer programs, Sudoku solvers or similar are not allowed.

Answer key:
Please try to obey the following guidelines when entering your answer keys:

- If not specified differently, enter your solution from top to bottom.

- For clarity's sake, you may use commas and spaces in your answer keys; they have no bearing on the correctness of your solutions.

- The solution form does not distinguish between capital and lower case letters.

Instructions

The following instructions come directly from the contest file; only the diagrams have been removed. Instead of them, small examples are shown. These examples can not be found in the test file. You should read and understand the instructions and examples before the test.

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1. Arithmetics   10 points

Place digits from 1 to 9 into the grid, each digit exactly once, to make six correct equations. All calculations are done from left to right or from top to bottom, ignoring mathematical precedence rules.

Example:

Answer key: Enter the nine digits line-by-line from top to bottom.
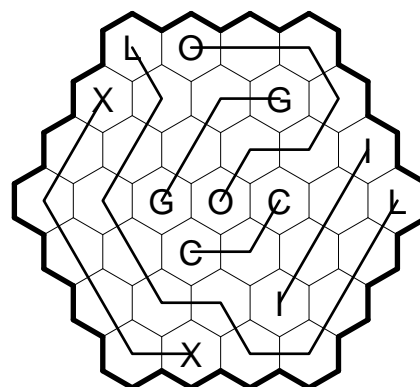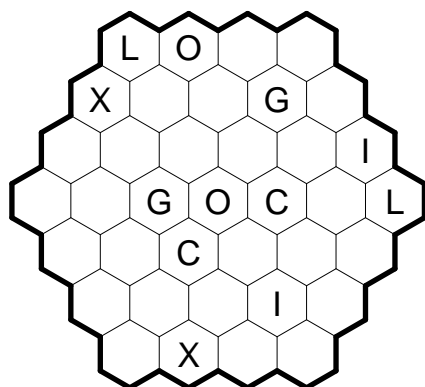
For the example, the answer key would be: 891, 476, 523

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2. Hexagonal Arukone   10 points

Connect same letters with continuous lines along the centers of adjacent cells. These connections may make any number of turns. Each cell must be used exactly once.

Example:

Answer key: For each letter from 'LOGIC MASTER' *(in the example: 'LOGIC')* in that order, enter the number of turns the respective connection makes.

For the example, the answer key would be: 64101

3. Sudoku   15 points

Place digits from 1 to 9 into the grid, so that each digit appears exactly once in each row, column and outlined area.

Example (using digits from 1 to 4):

Answer key: Enter the digits in the marked row from left to right, followed by the digits in the marked column from top to bottom.

For the example, the answer key would be: 2134, 2413

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4. Tapa   15 points

Blacken some empty squares, so that all black squares are connected horizontally and vertically. No 2×2 area may be completely black, and squares containing numbers may not be blackened at all.

The numbers indicate how many of the horizontally, vertically and diagonally adjacent squares are black: each number corresponds to a group of horizontally and vertically continuous black squares, several groups are separated by one or more white squares. Position and order of the numbers within a square are irrelevant.

Example:

Answer key: For each row from top to bottom, enter the number of black squares in that row.
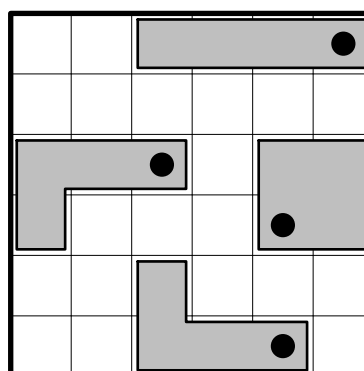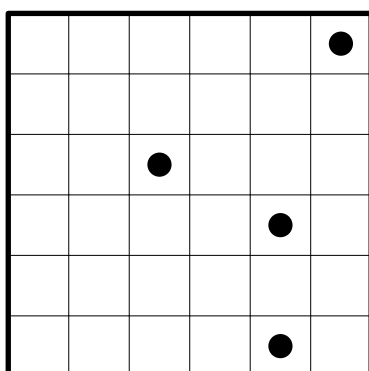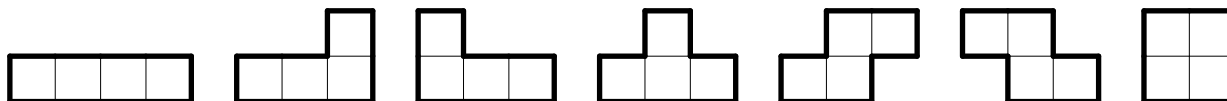
For the example, the answer key would be: 632325

5. Tetrominoes   20 points

Place the seven tetrominoes into the grid, so that they do not touch each other, not even diagonally. Each tetromino must contain exactly one black circle. The tetrominoes may be rotated, but not reflected.

Example (using four out of seven tetrominoes):

Answer key: For each row from top to bottom, enter the number of squares used by tetrominoes in that row.

For the example, the answer key would be: 405313

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6. Tents   20 points

Place some tents into the grid, so that they do not touch each other, not even diagonally. Each tent belongs to exactly one tree and vice versa, and each tent must be horizontally or vertically adjacent to the tree it belongs. The numbers above the grid indicate how many tents are located in the respective column.

Example:
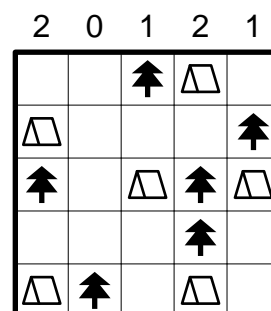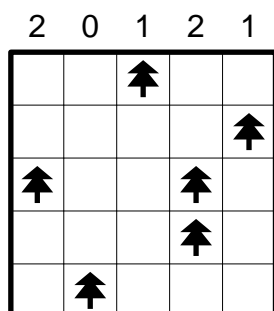
Answer key: For each row from top to bottom, enter the number of tents in that row.

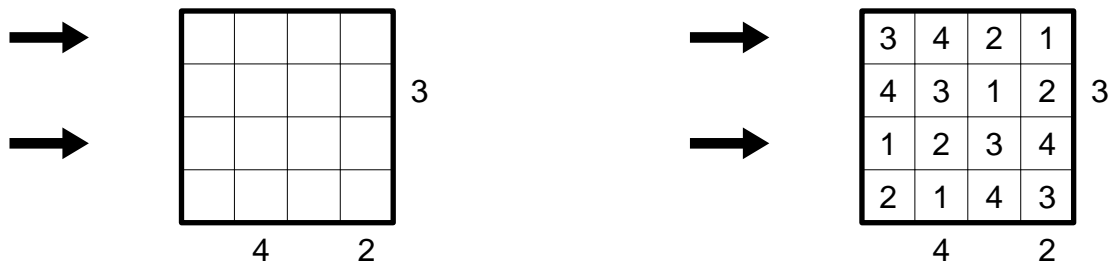*For the example, the answer key would be: 11202*

7. Skyscrapers   25 points

Place digits from 1 to 7 into the grid, so that each digit appears exactly once in each row and column. The digits represent skyscrapers of different heights; the numbers outside the grid indicate how many skyscrapers can be seen in the respective row or column from the respective direction. Smaller skyscrapers are hidden behind higher ones.

Example (using digits from 1 to 4):

Answer key: Enter the digits in the marked rows from left to right.

For the example, the answer key would be: 3421, 1234

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8. Pentomino Words   25 points

Divide the grid into the twelve pentominoes, so that they do not overlap. Each pentomino must contain the letters of one of the twelve given words, and each word is used exactly once. Conversely, each pentomino is used exactly once; pentominoes may be rotated and reflected.

Example (using four out of twelve pentominoes):
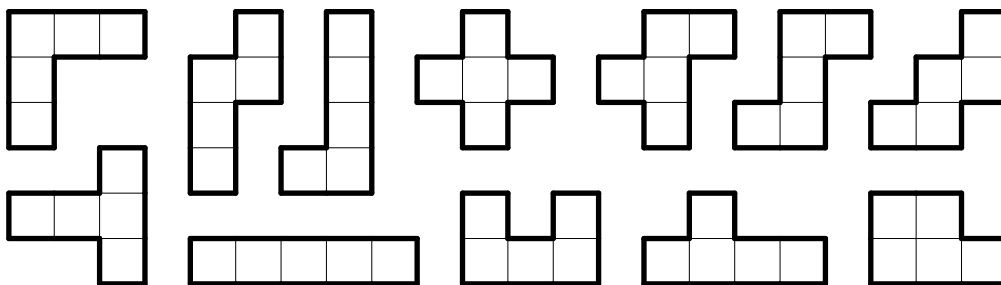
R	A	S	F	A
I	S	P	H	I
K	M	I	N	O
N	E	A	T	S

ATHEN
MINSK
PARIS
SOFIA

Answer key: For each row from top to bottom, enter the number of pentominoes appearing in that row.

For the example, the answer key would be: 2433

9. Deformable Masyu   25 points

Paint some white circles black, and draw a closed loop into the grid, which runs only horizontally and vertically and passes through all squares containing a circle. In squares with a black circle, the loop must make a turn, and it must go straight through the next square in both directions. In squares with a white circle, the loop must go straight and it must make a turn in the next square in at least one direction.
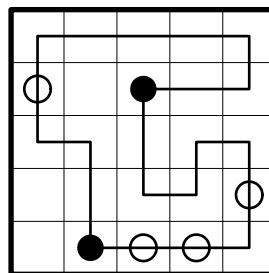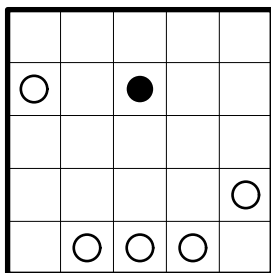
How many circles must be painted black and which ones, is for you to find out.

Example:

Answer key: For each row from top to bottom, enter the number of squares not used by the loop in that row.

For the example, the answer key would be: 01011

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10. LCM-Kakuro   30 points

Enter digits from 2 to 9 into the white squares *(Note: the digit 1 may not be used)*. The numbers in grey squares indicate the *lowest common multiple* of all digits in the corresponding „word". In each word, no digit may repeat.

The *lowest common multiple* is the smallest positive integer that is divisible without remainder by all digits in question.

Some squares are marked with circles. These circles label the squares needed for the answer key and have no meaning for the puzzle itself.

Example:
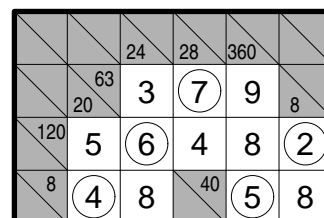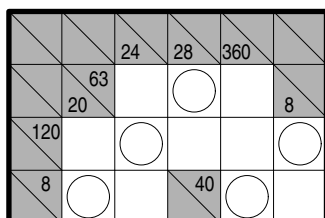
Answer key: Enter the digits in the marked diagonals; the diagonals successively from top left to bottom right, and for each diagonal from bottom left to top right.

For the example, the answer key would be: 467, 52

11. Hakyuu   30 points

Place digits into the grid, so that each outlined area contains digits from 1 to the size of that area, each digit exactly once. If a row or column contains the same digit more than once, those digits must have a minimum distance given by that digit: Between two digits '1', there must be at least one other square; between two digits '2', there must be at least two other squares, etc.

Example:

Answer key: Enter the digits in the marked rows from left to right.

For the example, the answer key would be: 21312, 23542

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12. Jigsaw Puzzle   35 points

Put together an 8×8 square from the given pieces. Pieces may be rotated and reflected, but no piece may be used more than once. One of the pieces remains unused; which one is for you to find out.

For solving purposes, ignore the digits, they are used for the answer key only.

Example (using a 5×5 square):
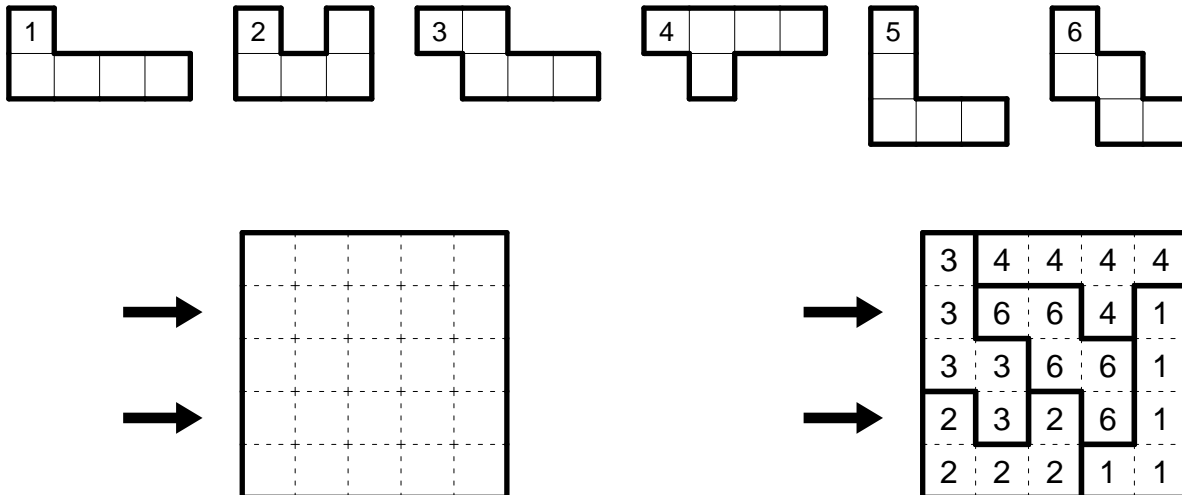
Answer key: For the marked rows, enter the digits corresponding to the pieces covering each square from left to right.

Since the solution can be rotated and reflected, there are several correct answer keys. For the example, one of them would be: 36641, 23261

13. Crossword   35 points

Place the given words into the grid, reading from left to right and from top to bottom. The diagonally split squares must contain two letters each. Note that those letters are in different order for horizontal and vertical words. One word remains unused; which one is for you to find out.
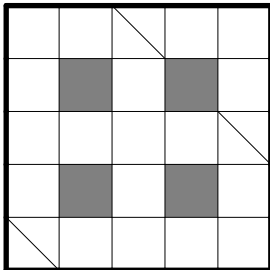
Example:

IKARUS
IMPORT
MISERE
PANZER
RAUNEN
SIRENE
TRANCE
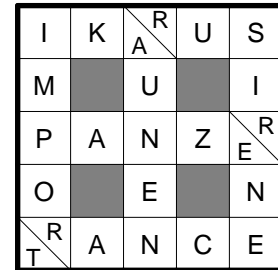
Answer key: Enter the unused word.

For the example, the answer key would be: MISERE

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14. Laser   40 points

Draw a laser beam into the grid that runs only diagonally. It enters and leaves the grid in the places marked by arrows. Place some mirrors at the grid points, so that the following conditions are fulfilled:

The laser beam must cross itself at the marked spots, but nowhere else. Each mirror must be hit by the laser beam on exactly one side.

The numbers to the left and above the grid indicate how many squares in the corresponding row or column the beam passes through. The numbers to the right and below the grid indicate the number of mirrors along the corresponding grid line.

Example:
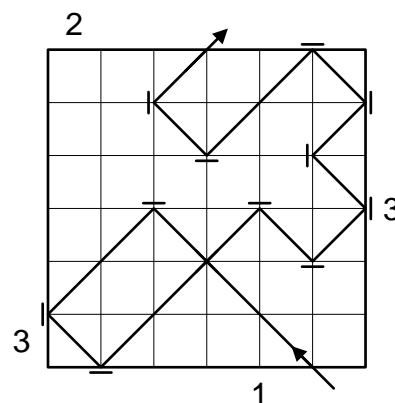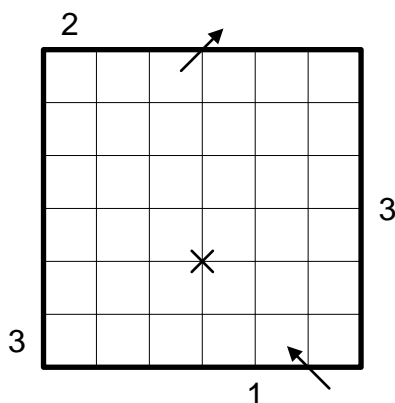
Answer key: Follow the laser beam in the direction indicated by the arrows. Enter the length (number of squares the beam passes through) for each section of the beam till the next mirror or leaving the grid. Ignore the crossings.

For the example, the answer key would be: 321311111211

15. Outside False Fences

40 points

Draw a single continuous loop by connecting neighboring dots along the dotted lines. The digits indicate how many edges of that square are used by the loop. The loop may not touch or cross itself, and it doesn't need to touch all of the dots.

However: Only the digits *inside the loop* are correct. Digits *outside the loop* are one more or one less than the respective correct number.

Example:

Answer key: Enter the size (number of squares) of all areas outside the loop. Start in the top left corner of the grid and proceed clockwise.

For the example, the answer key would be: 1, 4, 2

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16. Kropki-Fillomino

45 points

Divide the grid into several areas and fill in a number into each square. Within each area, all numbers must be the same and be equal to the number of squares of that area. Areas of same size may touch each other only diagonally.

Given numbers may belong to the same area, and there may be areas from which no number is given at all, even with higher numbers than all the given ones.

A black circle between two horizontally or vertically adjacent numbers indicates that one of these numbers is exactly twice the other; a white circle indicates that the difference between these numbers is exactly 1. If there is no circle between two adjacent numbers, none of these two properties may hold.

Example:

Answer key: Enter the digits in the marked rows from left to right.

For the example, the answer key would be: 33415, 66661

## 17. Anti-Magnets   50 points

Fill the grid with neutral (black) and magnetic plates.

Each magnetic plate has a positive ($+$) and a negative ($-$) halve. Unlike standard magnets, only same symbols may touch each other horizontally or vertically; $+$ and $-$ from two different plates may never be horizontally or vertically adjacent.

Numbers outside the grid indicate the number of $+$ or $-$ symbols in the respective row or column.

Example:
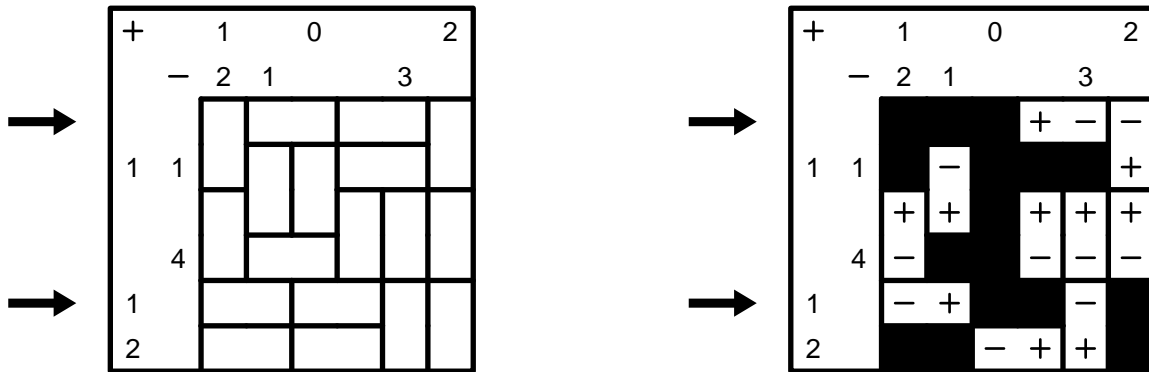
Answer key: Enter the content of the marked rows from left to right. Use $+$ and $-$ along with 'N' for neutral plates.

For the example, the answer key would be: NNN+$--$, $-+$NN$-$N
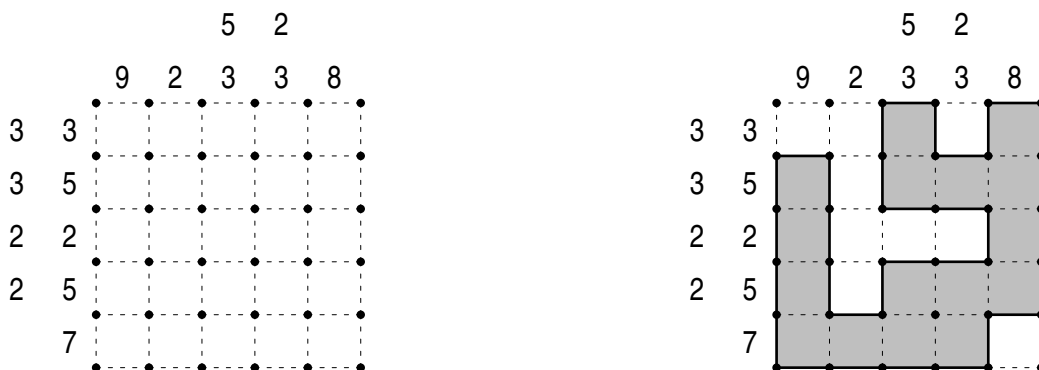
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18. Summenbild-Rundweg   55 points

Draw a single continuous loop by connecting neighboring dots along the dotted lines. The loop may not touch or cross itself, and it doesn't need to touch all of the dots.

Each number outside the grid corresponds to a continuous group of squares inside the loop in the respective row or column. The number indicates how many edges adjacent to that group are used by the loop. Between two such groups there must be one or more squares outside the loop; the numbers of each row are in the same order as their corresponding groups.

Example:

Answer key: Enter the size (number of squares) of all areas outside the loop. Start in the top left corner of the grid and proceed clockwise.
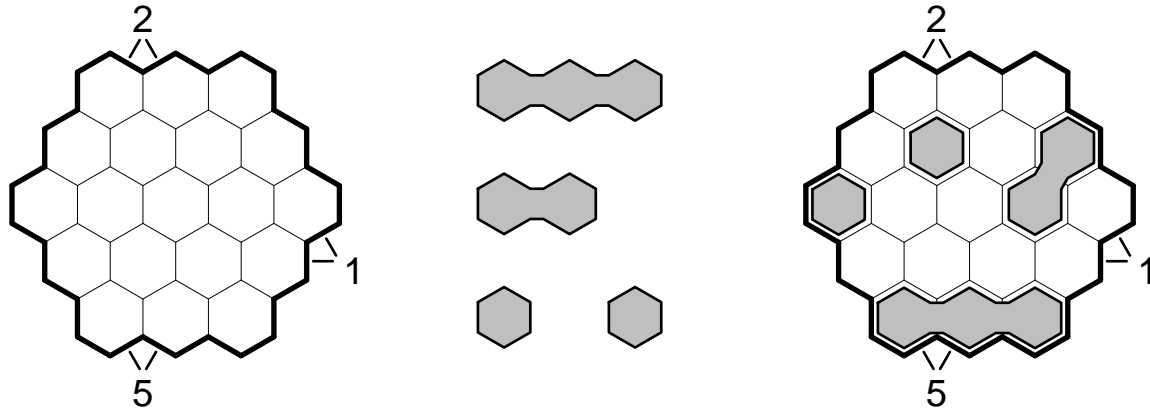
For the example, the answer key would be: 7, 1, 1

19. Tetris Reconstruction   60 points

Assign letters from A to G to the seven tetris pieces (pieces may be rotated, but not reflected). Place some tetris pieces into the left grid and fill those pieces with their corresponding letters. Remove all completely filled rows, and the grid on the right must remain.

There is no restriction on how many pieces of each kind may be used; however, after removing completely filled rows, at least one letter from each used piece must remain. There are nowhere three or more consecutive rows completely filled.

Note: There is no „gravity", stones are simply placed in the grid and do not fall down. Completely filled rows are simply cut out of the grid.

Example (using five out of seven Tetris pieces):

Answer key: Enter the letters of all completely filled rows from top to bottom.

For the example, the answer key would be: AAAABB, CCCAAD, EEEAAD

20. Hexagonal Battleships

65 points

Place the given fleet into the grid, so that ships do not touch each other. All ships may be rotated. Numbers outside the grid indicate the number of ship segments in both adjacent rows.

Example:

Answer key: For each row from top to bottom, enter the number of ship segments in that row.

For the example, the answer key would be: 02203

The puzzles were created by the following authors:

- Silke Berendes: 6, 7, 10, 15, 17
- Florian Kirch: 2, 16
- Roland Voigt: 13
- Ulrich Voigt: 1, 3, 4, 5, 8, 12, 20
- Philipp Weiß: 9, 11, 14, 18, 19