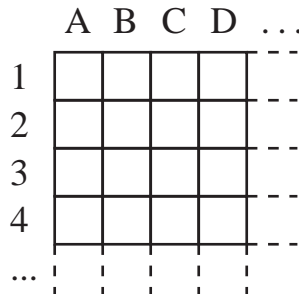


PUZZLE DESIGN TOURNAMENT 2005

PUZZLE 01

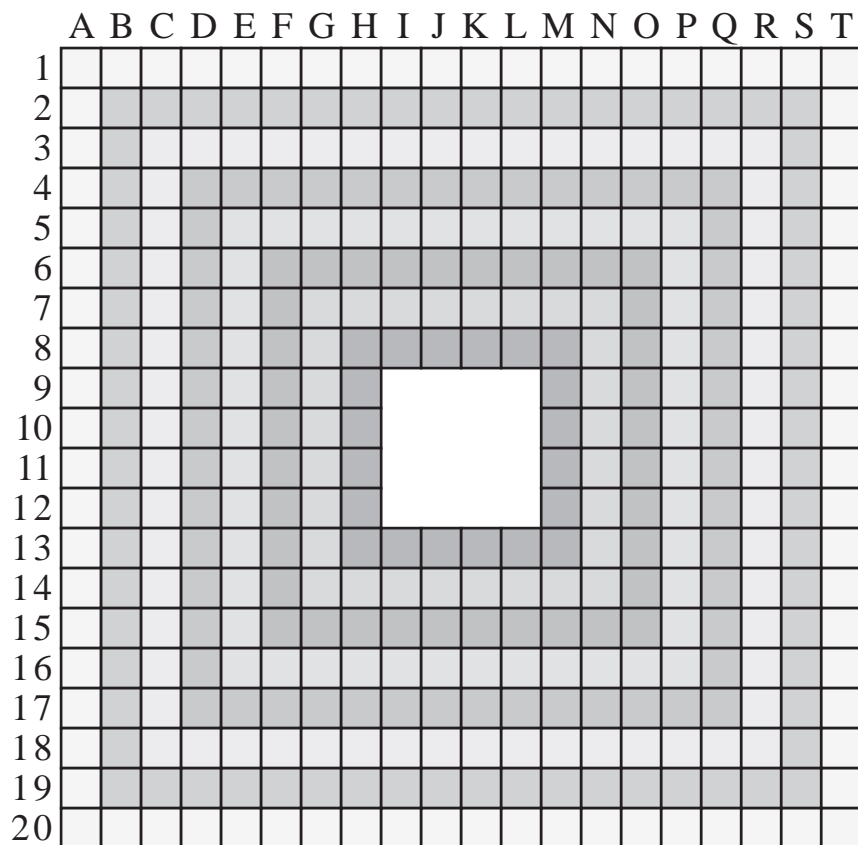
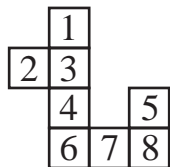
Draw an “mxn” rectangle with a square array of cells. “m” and “n” may be any number from 1 to 10. Place all of the numbers from 1 to “mxn” once each into the cells of this rectangle. Call a cell “Special” if the number on it can be expressed as a combination of addition and/or subtraction of some or all of its neighbouring cells (using each one at most once). Two cells are neighbours if they share a common edge (diagonally adjacent cells are not neighbours). Maximize the score of: $3x(\text{Number of special cells}) - 2x(\text{mxn})$



Answer key: Write your score first. Then write the contents of your rectangle row by row. Add the coordinates of all of the special cells. The answer key will look like: 20:1,2,3,4; 5,6,7,8; 9,10,11,12; 13,14,15,16. A1,B1,...

PUZZLE 02

The figure below consists of eight unit squares with digits on. Place some number of copies of this figure into the grid with a hole in the center, following the grid lines. Figures can not overlap each other. You may rotate and/or reflect the figures. The grid is made up of eight loops, each in a different color. Your score is the sum of all digits in cells which belong to completely covered loops. Maximize this score.



Answer key: Write your score first. Then write the location of each figure. For a figure’s location, enter the coordinates of its cell 1, and then the coordinates of its cell 8. Also write R if the figure is reflected. The answer key will look like: 100: B1-D4, D7-A5-R, ...

PUZZLE 03

There is a 6-unit long snake in the position shown on the grid; its head being on cell C5. Put foods into 10 cells of the grid so that these cells don't touch each other not even diagonally; and there is one food-cell in each row and each column. The snake moves towards the foods horizontally and vertically in the order you prefer, but always using the shortest way between two consecutive foods. After eating the food on a food-cell, its length increases by one cell; resulting 16 units at the end. Snake shouldn't hit its own body while moving and it can not pass over another noneaten food-cell along the way. You may pass any cell more than once. Maximize the road length.

Example: (An invalid one, because two food-cells touch each other diagonally)

	A	B	C	D	E
1	X				
2					X
3		X			
4				X	
5			X		

	A	B	C	D	E
1	X				
2					X
3		X			
4				X	
5			X		

	A	B	C	D	E
1	X				
2					X
3		X			
4				X	
5			X		

	A	B	C	D	E
1					
2					X
3		X			
4				X	
5			X		

	A	B	C	D	E
1					
2					X
3		X			
4				X	
5			X		

	A	B	C	D	E	F	G	H	I	J
1										
2										
3										
4										
5										
6										
7										
8										
9										
10										

Answer key: Write your score first. Then enter the coordinates of the food-cells in order. For the example, the answer key would be: 23: C5, A1, D4, B3, E2

PUZZLE 04

Choose some number of cells in the grid, so that no three of them forms a straight line in any direction. For example; 49, 99, 83 form a straight line and therefore choosing all of them is forbidden. Maximize the sum of the numbers on chosen cells.

19	18	17	16	15	14	13	12	11	10
20	51	50	49	48	47	46	45	44	9
21	52	75	74	73	72	71	70	43	8
22	53	76	91	90	89	88	69	42	7
23	54	77	92	99	98	87	68	41	6
24	55	78	93	100	97	86	67	40	5
25	56	79	94	95	96	85	66	39	4
26	57	80	81	82	83	84	65	38	3
27	58	59	60	61	62	63	64	37	2
28	29	30	31	32	33	34	35	36	1

Answer key: Write your score first. Then write the numbers you chose in increasing order. The answer key will look like: 902: 46,49,60,63,66,69,76,79,97,98,99,100

PUZZLE 05

Locate the 10-ship fleet into the grid so that they don't touch each other not even diagonally. Then count the letters on the occupied cells. Take the square of each letter's appearance (a for A, b for B, ...). Your Letter Point is the sum of all these five square numbers.

Then, prepare a Battleships puzzle that gives the location of your fleet as the only solution. In a Battleships, the hints outside the grid give the number of ship segments in the representing row or column and there maybe hints inside the grid which are either a ship segment or a waer mark.

Your Puzzle Point is 5 times the number of hints outside, plus 3 times the number of hints inside.

Maximize the score of: Letter Point - Puzzle Point

Example:

A	C	B	A	D	1
D	A	D	E	D	2
B	D	E	C	E	3
E	B	C	B	A	4
B	A	E	C	E	5
A	B	C	D	E	

A	C	B	A	D	1
D	A	D	E	D	2
B	D	E	C	E	3
E	B	C	B	A	4
B	A	E	C	E	5
A	B	C	D	E	

$$LP = 0 \times 0 + 2 \times 2 + 0 \times 0 + 4 \times 4 + 4 \times 4 = 36$$

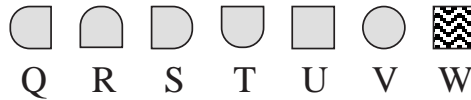
					4
					1
					2
0					3
					4
					5
A	B	C	D	E	

$$PP = 5 \times 3 + 3 \times 2 = 21$$

$$Score = 36 - 21 = 15$$

A	C	B	A	D	E	D	B	A	A	1
D	A	D	E	D	B	A	B	C	A	2
B	D	E	C	E	B	D	D	A	C	3
E	B	C	B	A	C	C	E	D	E	4
B	A	E	C	E	D	A	C	A	B	5
A	D	B	E	C	B	D	A	E	D	6
C	E	D	A	E	C	E	B	C	E	7
B	C	E	B	D	B	A	D	E	C	8
D	B	A	D	D	E	C	A	D	B	9
A	C	B	A	C	E	D	C	C	B	10
A	B	C	D	E	F	G	H	I	J	

For the answer key:



Answer key: Write your score first. Then list the coordinates of the inside hints with their representing letters (Q-W), and list the outside hints with their representing row number or column letter. For the example, the answer key would be: 15: A3-T, C3-T, E3-T; 4-0, E-4

PUZZLE 06

Locate all numbers from 1 to 36 into the grid once each. You will score different points for each specific set of numbers. A set is a group of numbers in adjacent cells of the same row or column. For example; if a row reads 1,4,9,16,25,36, there are three sets of 4 perfect squares. Numbers can be part of more than one set.

Example:

1	2	3	4	5	6
7	8	9	10	11	12
13	14	15	16	17	18
19	20	21	22	23	24
25	26	27	28	29	30
31	32	33	34	35	36

$$Score = 0 \times 6 + 0 \times 5 + 0 \times 4 + 0 \times 3 + 4 \times 2 + 3 \times 1 + 0 \times 10 = 11$$

Scores:

- Set of 3 perfect cubes: 6 points
- Set of 4 perfect squares: 5 points
- Set of 3 multiples of 5: 4 points
- Set of 4 multiples of 4: 3 points
- Set of 5 multiples of 3: 2 points
- Set of 6 multiples of 2: 1 points
- Numbers 13,17,19,23,29,31 are in different rows and columns: 10 points

Answer key: Write your score first. Then write the content of the grid row by row. For the example, the answer key would be: 11: 1,2,3,4,5,6; 7,8,9,10,11,12; 13,14,15,16,17,18; 19,20,21,22,23,24; 25,26,27,28,29,30; 31,32,33,34,35,36

PUZZLE 07

Start on any cell of the grid and draw a 25-unit long path moving horizontally and vertically. The path may touch itself side by side, but must not overlap or cross itself. Black out five cells of the path and label the remaining cells as C1, C2, ... C20, in order from start to finish.

Maximize the score of: $C1 - C2 + C3 - C4 + C5 - C6 + \dots + C19 - C20$

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O
a	7	4	8	7	6	9	2	6	5	1	2	1	5	7	6
b	1	2	2	2	3	7	4	7	7	3	5	5	9	2	2
c	4	5	8	8	7	2	3	9	3	1	7	6	4	2	6
d	3	3	3	7	2	9	6	1	1	9	6	7	6	4	7
e	4	4	2	7	6	9	2	1	2	9	5	3	2	2	2
f	9	8	2	2	2	2	3	7	6	6	7	2	8	6	3
g	4	5	6	7	3	8	8	2	9	2	2	2	7	8	8
h	4	2	1	6	9	7	7	6	7	8	8	2	2	2	9
i	6	6	5	1	8	9	2	3	4	5	1	8	8	2	2
j	8	4	3	7	8	2	2	1	8	5	6	5	3	4	6
k	4	1	7	7	8	2	2	5	2	7	5	7	8	2	8
l	3	4	9	2	3	4	6	1	8	6	5	4	9	3	2
m	4	5	9	3	2	9	2	1	1	6	6	6	8	2	2
n	5	4	4	3	9	3	3	4	1	9	2	3	3	3	8
o	9	2	3	4	5	1	2	8	4	3	4	2	7	8	9

Answer key: Write your score first. Then write the coordinates of the starting cell, followed by each row or column you enter. Put an "x" immediately after a blacked out cell. The answer key will look like: 18: eB, CDEFxGHfgIJKxLhixjxklmKxIJIImn

PUZZLE 08

Choose any six words of this paragraph, that are different from each other. Define a starting letter and give the number "1" to it, and set a length of distance which will be used to get to the next letter that will take the number "2" and so on until number "26". If a reached letter already is numbered, find the first unnumbered letter. Using these numbers for the letters, identify each of your chosen words' value as the sum of the numbers it consists of. First, order the words by their value, then order the words alphabetical. Match two orders and find the difference of the values for each match. Maximize the total of these differences.

Example:

Chosen words: choose, any, six, words, of, this

Starting letter: F

Distance: 13

A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X	Y	Z
18	20	22	24	26	1	3	5	7	9	11	13	15	17	19	21	23	25	2	4	6	8	10	12	14	16

	Value order		Difference		Alphabetical
THIS	18	31	49		ANY
OF	20	73	93		CHOOSE
SIX	21	1	20		OF
ANY	49	28	21		SIX
WORDS	80	62	18		THIS
CHOOSE	93	13	80		WORDS

Total: **208**

Answer key: Write your score first. Then write the starting letter and distance, followed by the six words you chose. For the example, the answer key would be: 208: F, 13, choose, any, six, words, of, this

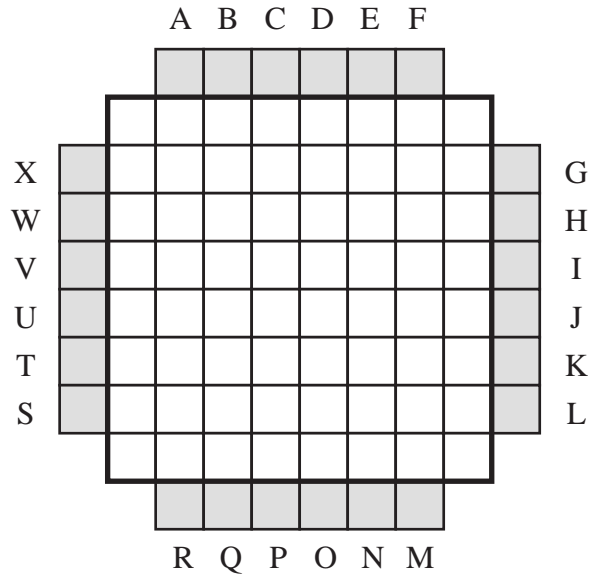
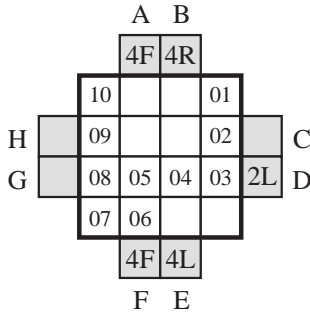
PUZZLE 09

Place some radar stations into cells A through X. Radar beam starts from one of the directions L, F or R and then change its direction cyclically from left to right per second. Power of a radar station defines the number of cells seen in the current direction.

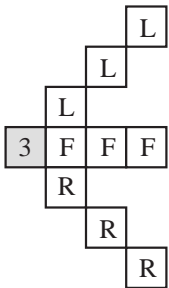
Then, start from one of the inside cells and draw a route which goes horizontally and vertically, moving one cell per second, without being caught by the radars.

Maximize the product of: (Sum of squares of individual radar powers) x (Square of the length of the route)

Example:



Radar with 3-cell power:



Answer key: Write your score first. Then list the radar stations, followed by the content of the grid row by row, using "X" for empty cells. For the example, the answer key would be: 6800: A-4F, B-4R, D-2L, E-4L, F-4F; 10XX01, 09XX02, 08050403, 0706XX

PUZZLE 10

Fill all cells of a 4x4 grid with numbers from 0 to 16. A cell is satisfied, if it is the difference between the sum of top and bottom numbers and the sum of left and right numbers. Otherwise it's unsatisfied. Maximize the score of: (Sum of the different numbers used) - (Square of the number of unsatisfied cells)

Example:

2	1	1	3
3	4	5	4
5	3	2	16
5	0	2	4

	Satisfied cell
	Unsatisfied cell

A satisfied cell:

	T	
L	$X = [T+B-L-R]$	R
	B	

Score:
(0+1+2+3+4+5+16) - (5x5)=6

Answer key: Write your score first. Then write the coordinates of the grid row by row. For the example, the answer key would be: 6: 2,1,1,3; 3,4,5,4; 5,3,2,16; 5,0,2,4

PUZZLE 11

Place a white king on one of the cells of the grid, and a black one in the symmetric cell (For example; B3 is symmetric to I7). Then move the kings simultaneously in a reciprocal symmetric way, constructing two expressions between the numbers you get during the movement. The cyclic order of the operations is -, x, +, /. The two expressions and the two paths are independent of one another, but a single path cannot cross or retrace itself. You may stop any time. Obtain a total (the sum of the results of two expressions) as close as possible to 2005.

Operations are done without priority and calculated up to the second decimal digit. You cannot divide by 0. Kings move to a neighbouring cell in each move and the two kings can never be in two adjacent cells any time, not even in diagonal neighbours.

Example (with object 100):

	A	B	C	D	E	F
1	1	2	3	8	5	3
2	6	1	5	2	1	0
3	2	7	8	2	8	1
4	6	0	4	3	7	9
5	4	5	5	9	1	0

White: $6-1 \times 3+5/2-1 \times 8+7/1-0=79$

Black: $9-7 \times 9+3/4-0 \times 7+1/2-1=17,87$

Total: 96,87

	A	B	C	D	E	F	G	H	I	J
1	0	4	3	7	4	3	2	4	6	3
2	1	8	6	2	0	5	9	0	5	2
3	7	9	5	1	8	6	7	1	8	7
4	6	3	4	7	3	4	2	3	4	6
5	2	0	8	2	0	0	5	9	0	2
6	5	9	1	6	9	8	1	6	7	5
7	6	7	3	5	7	3	4	2	8	1
8	4	2	0	4	2	0	5	9	0	4
9	8	1	6	9	1	6	8	7	3	6

Answer key: Write your score first. Then write the coordinates of the white king's beginning cell, followed by the numbers white king visits during its move. For the example, the answer key would be: 96,87: A2, 6135218910

PUZZLE 12

Place digits (0 to 9) and operators (only +, -, x, /) into an 8x8 grid so that one can find expressions equalling all of the integers from 1 to N. Maximize N. Expressions may start anywhere in the grid and read in a straight line up, down, left, right or diagonally, as in a word search. Each expression must contain at least one operator. Operators are evaluated from left to right (For example; $1+2 \times 5=15$). Expressions must not begin or end with an operator, and they must not contain consecutive operators. Numbers within an expression may begin with a "0"; and in this case "0" is ignored (For example; $6+01=7$).

Example:

Expressions for 1 through 11:

1 = 6/6

2 = 8/4

3 = 6-3

4 = 6-2

5 = 4+1

6 = 12-6

7 = 13-6

8 = 64/8

9 = 6+3

10 = 16-6

11 = 66/6

1	6	-	6
3	4	6	-
-	/	+	2
6	8	3	1

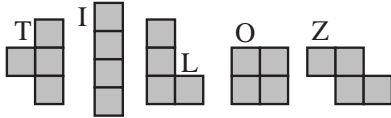
Answer key: Write your score first. Then write the content of the grid row by row. For the example, the answer key would be: 11: 16-6, 346-, -/+2, 6831

PUZZLE 13

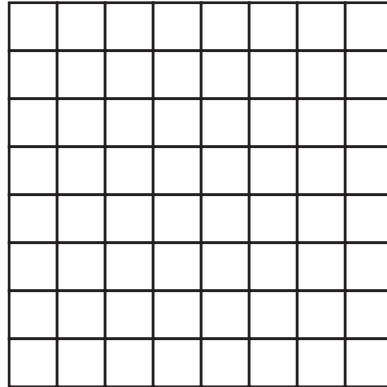
Place a full set of pentominoes into an 8x8 grid following the grid lines, without overlapping each other (so that 4 empty cells will remain). Pentominoes may be rotated and/or reflected. Then, divide the grid into some number of areas following the grid lines, along with the pentominoes and the empty parts. Two cells from two different pentominoes are different fragments from each other.

Maximize the score of: (# of pentomino fragments) + (# of empty cell fragments) - (# of areas)x1,7

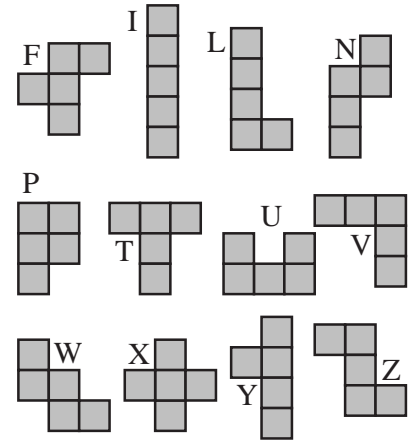
Example (with tetrominoes):



A	B	B	C	C
A	B	C	C	C
A	B	A	A	C
A	B	A	A	C
A	A	A	C	C



Pentominoes:



Number of tetromino fragments: 15
 Number of empty cell fragments: 4
 Number of areas: 3
 Score: $15 + 4 - 3 \times 1,7 = 13,9$

Answer key: Write your score first. Then write the content of the grid row by row using representing letters for pentominoes and “E” for empty cells. And add the content of the grid row by row using a different letter for each area. For the example, the answer key would be: 13,9: IIIIE,LLLZE,EELZZ,OOETZ,OOTTT: ABBC,ABCCC,ABAAC,ABAAC,AAACC

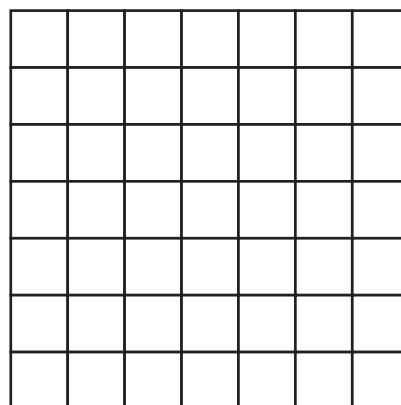
PUZZLE 14

In each cell of a 7x7 grid, place a digit from 1 to 9 or a black square. Numbers are formed by adjacent digits, horizontally or vertically. Each digit may be used only once within a number, and the sum of the digits in each number must be unique (different from each other).

Maximize the score of: (Sum of all digits) + (Every appearance of a full set of 1-9)x10

Example:

9	8	7	6	5	Sums	
8	3	4	9	6	35	
7	9	8		9	30	
1	7	6	9	8	24	9
3	2	9	8	4	31	
Sums	28	29	34	15	32	
			17			



Sums 28 29 34 15 32
17

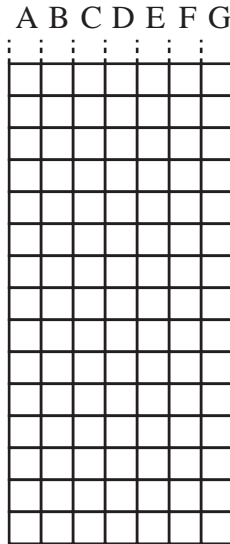
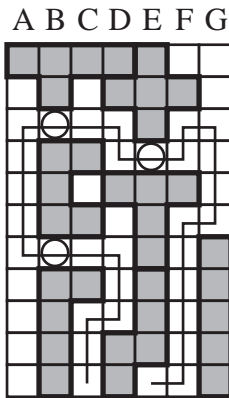
Score: $155 + 1 \times 10 = 165$

Answer key: Write your score first. Then write the content of the grid row by row, using “B” for black cells. For the example, the answer key would be: 165: 98765, 83496, 798B9, 17698, 32984

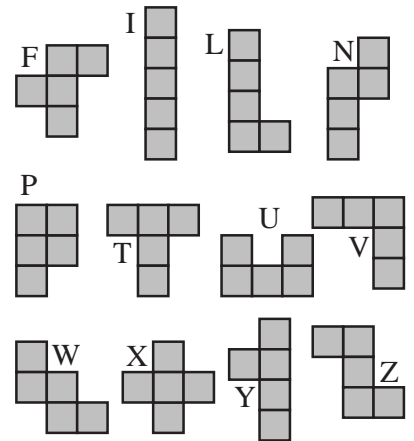
PUZZLE 15

There are 12 pentominoes and three 1-square-unit space holders which fall from above to a 7-unit wide and n-unit tall area, as in a TETRIS game. Each pentomino can be used at most once, and they can be rotated and/or reflected. Pentominoes can only stand on another object (base, pentomino or space holder) if their center of gravity is supported below. After finished, find the longest path that passes through empty spaces. Maximize the score of: $(n - \# \text{ of "2x2" squares of empty spaces}) \times (\text{Length of the longest path})$

Example:



Pentominoes:



n: 11
 Number of 2x2 squares of empty cells: 1
 Length of the longest path: 31
 Score: $(11 - 1) \times 31 = 310$

Answer key: Write your score first. Then write the content of the area row by row, using representing letter for pentominoes and “.” for empty cells. Add the location of each space holder by using its column name and the pentomino just above it. For the example, the answer key would be: 310: YYYYYX..., .Y.XXX.,X..., .UU....., .U.TTT., .UU.T.,T.I, .LL.N.I, .L.N.I, .L.NN.I, .L.N.I, B-U, E-X, B-Y

PUZZLE 16

Split the 10x10 grid below into 10 sections of 10 contiguous cells and remove some of the digits from the cells so that there must be only one way of filling digits into the empty cells while each row, each column and each section contains all ten digits from 0 to 9.

Score for a valid set-up is (number of digits remaining) + (total of digits remaining)

Prepare two valid set-ups with the same split.

Maximize the score of: (Higher score of set-ups) - (Lower score of set-ups)

Example:

	1	2	3
A	1	2	2
B	2	3	1
C	3	1	2

	1	2	3
A	1	2	
B			
C			

→

	1	2	3
A	1	2	3
B	2	3	1
C	3	1	2

	1	2	3
A	1	2	
B	2	3	1
C	3	1	2

→

	1	2	3
A	1	2	3
B	2	3	1
C	3	1	2

	1	2	3	4	5	6	7	8	9	10
A	3	1	4	1	5	9	2	6	5	3
B	5	8	9	7	9	3	2	3	8	4
C	6	2	6	4	3	3	8	3	2	7
D	9	5	0	2	8	8	4	1	9	7
E	1	6	9	3	9	9	3	7	5	1
F	0	5	8	2	0	9	7	4	9	4
G	4	5	9	2	3	0	7	8	1	6
H	4	0	6	2	8	6	2	0	8	9
I	9	8	6	2	8	0	3	4	8	2
J	5	3	4	2	1	1	7	0	6	7

Answer key: Write your score first. Then write the coordinates of the cells making up each section. And for each set-up, write the score and the coordinates of the cells in which digits are remaining. For the example, the answer key would be: 17: A1,A2,B2; A3,B3,C3; B1,C1,C2 - 5: A1,A2 - 22: A1,A2,B1,B2,B3,C1,C2,C3

PUZZLE 17

Locate letters A, B, C, D, E into each row and each column of the grid once (four cells remain empty in each row and column). Then, draw a path that goes horizontally or vertically and doesn't go twice through the same cell. The letters on the path must be in alphabetical order. Once the path goes through a B, it cannot go through cells containing an A anymore; and once it goes through a C, it cannot go through cells containing an A or a B anymore. Letters may be used in the path any number of times (0-9).

Maximize the score of: (Length of the path) + (Number of letters on the path)

Example:

	1	2	3
A	A		B
B	B	A	
C		B	A

	1	2	3	4	5	6	7	8	9
A									
B									
C									
D									
E									
F									
G									
H									
I									

Answer key: Write your score first. Then write the content of the grid row by row, using "x" for empty cells. Add the starting cell's coordinates, followed by the directions for each move using R, L, U, D (right, left, up, down). For the example, the answer key would be: 11: AxB,BAx,xBA; A2,DRDLLU

PUZZLE 18

Take one or more names from the given fruit list and place them side by side to form one big string of letters. Create the largest waves of letters, where a "wave" is created by having 3 or more consecutive letters either increasing or decreasing alphabetical order. For each wave of 3-unit length or more, you score $(n-1) \times (n-2)$ points where "n" is the length of the wave. If a letter is duplicated, it doesn't count towards the wave length, nor it breaks up the wave. Each name may be used at most once.

Maximize the score of (Sum of the wave scores) - (number of letters in all words used)

APPLE	APRICOT	AVOCADO	BANANA	BLACKBERRY	BLUEBERRY
BOYSENBERRY	CANTALOUPE	COCONUT	CRABAPPLE	FIG	GRAPE
GRAPEFRUIT	HONEYDEW	KIWI	KUMQUAT	LEMON	LIME
LOGANBERRY	MANGO	NECTARINE	ORANGE	PAPAYA	PEACH
PEAR	PINEAPPLE	RASPBERRY	STRAWBERRY	TANGERINE	WATERMELON

Example:

B A N A N A G R A P E F R U I T K I W I L O G A N B E R R Y

4 waves with length 3: $4 \times 2 = 8$
 2 waves with length 4: $2 \times 6 = 12$
 Number of letters: 30
 Score: $20 - 30 = -10$

Answer key: Write your score first. Then write the string of letters you formed. For the example, the answer key would be: -10: BANANAGRAPEFRUITKIWILOGANBERRY

PUZZLE 19

Place numbers from 1 to 10 into each row and each column of the grid once. Even numbers cannot be neighbours; and similarly odd number cannot be neighbours. Some numbers are already placed. Letter A denotes the sum of the numbers in the upper-left lower-right diagonal. Letter B denotes the sum of the numbers in the lower-left upper-right diagonal.

Minimize the score of: (Sum of the numbers in the shaded region) x (AxA)/(BxB)
Results will be rounded to the first decimal digit.

Example:

3	2	5	6	1	4
6	1	4	3	2	5
5	4	1	2	3	6
2	5	6	1	4	3
1	6	3	4	5	2
4	3	2	5	6	1

A: 12

B: 24

Shaded region: 10

Score: $10 \times (12 \times 12) / (24 \times 24) = 2,5$

			1			10			
5									
									9
	6								
				3					4
8									
		7					2		

Answer key: Write your score first. Then write the content of the grid row by row. For the example, the answer key would be: 2,5: 325614, 614325, 541236, 256143, 163452, 432561

PUZZLE 20

Draw a 40 cells long loop starting from the center of the grid, that goes horizontally, vertically or diagonally. The loop cannot cross or retrace itself. Starting with the center cell, take every other number and find the sum of all these 20 numbers. Maximize this sum.

Example with 12-cell loop:

1	24	21	14	8
20	4	19	12	5
15	9	13	23	2
6	22	10	11	18
16	3	17	7	25

Score: $13+22+17+25+23+19=119$

1	37	42	15	14	58	38	50	23
51	5	29	49	22	54	6	48	59
17	70	76	2	77	71	39	63	18
36	28	16	40	61	31	7	79	47
44	11	53	68	41	75	72	24	55
10	62	4	21	30	57	13	19	32
26	34	56	43	20	3	80	46	73
35	52	9	45	25	64	33	66	60
27	12	69	78	65	74	8	67	81

Answer key: Write your score first. Then write the numbers on your loop starting with number "41". For the example, the answer key would be: 119: 13,10,22,3,17,7,25,18,23,12,19,9

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Errata page: www.otuzoyun.com/puzzledesign/errata2005.html