Magic Word

Question:

A magic word is needed to open a box. A secret code assigns each letter of the alphabet to a unique number. The code for the magic word is written on the outside of the box.

**What is the magic word?**

Possible Answers:

LOOSER
WINNER
LOTTOS
TICKET

Falling Ball

Question:

A ball is placed at the top left corner of a maze. It falls down the maze from platform to platform until it reaches one of the slots at the bottom.

The ball always moves in the same way. It starts by going to the right. Every time it falls from one platform to another, it changes direction. Here is an example:
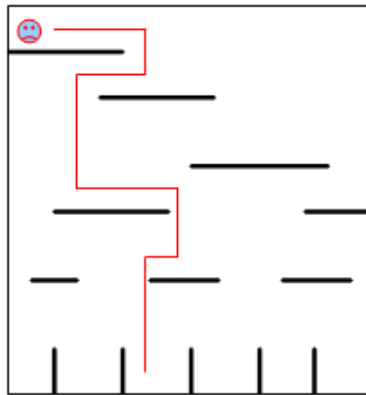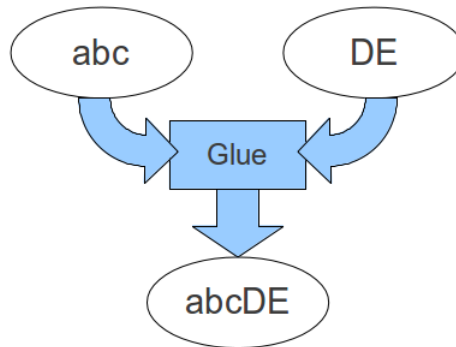

Which slot will the ball reach in the maze below?
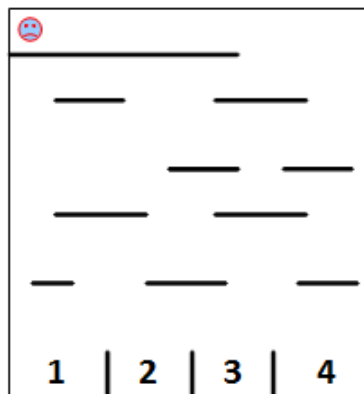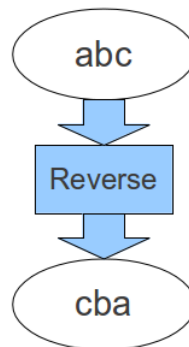

Possible Answers

1

2

3

4

Text Machine

Question:

A *Glue* machine takes two pieces of text and puts one after the other. An example is shown below:

A *Reverse* machine takes one piece of text and puts the characters in reverse order. An example is shown below:

Two Glue machines and one Reverse machine are combined to create the *Combined* machine shown below. The *Combined* machine takes three pieces of text (in the grey ovals) and after processing them, gives one piece of final text (in the bottom-most oval).
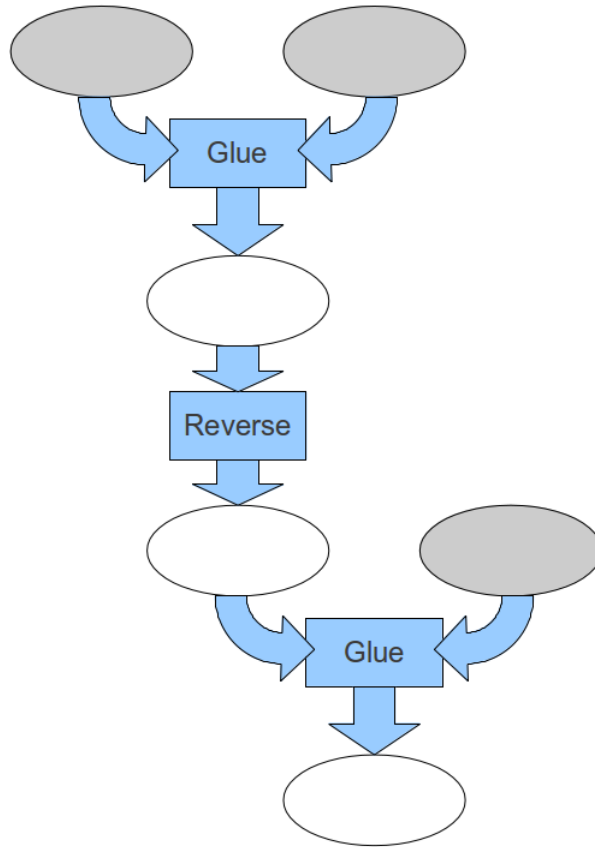
Which three pieces of text will produce the final text **QUESTION** when given to the Combined machine, in the order specified?
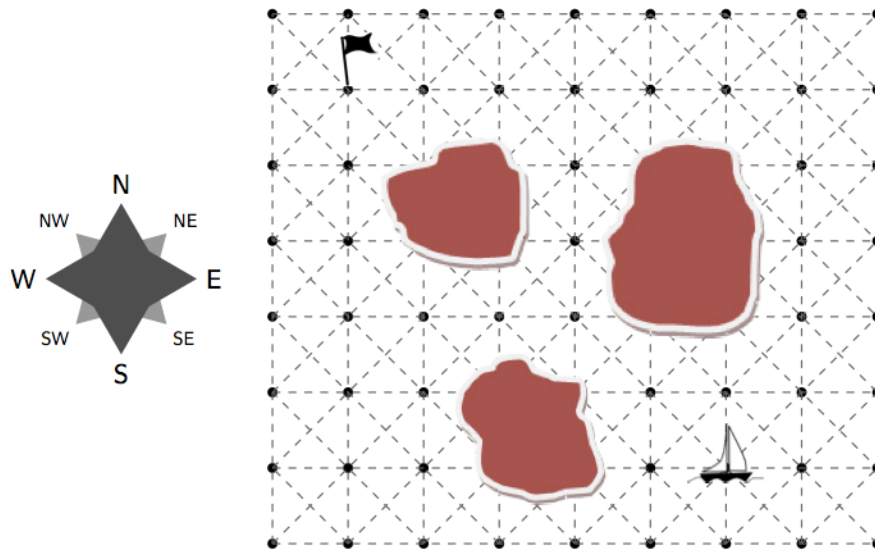
Possible Answers:
EUQ TS NOI
TSE UQ NOI
I TSEUQ ON
QU EST ION

Beaver Navigation

Question:

A sailor takes her boat on the lake with islands shown below. Her aim is to sail to the flag by programming the boat's autopilot. The autopilot commands the boat to sail along the dashed lines. In one step, the boat moves from a point to the nearest point along a dashed line in one of eight different directions. For example, the command *1 N* means take 1 step in the northern direction, and the command *2 NE* means take 2 steps diagonally in the northeastern direction.

Each point is a small black circle on the map. The 8 different directions (N, NE, E, SE, S, SW, W, NW) are also shown below.

Which of the following routes to the flag avoids the islands using the smallest number of steps?
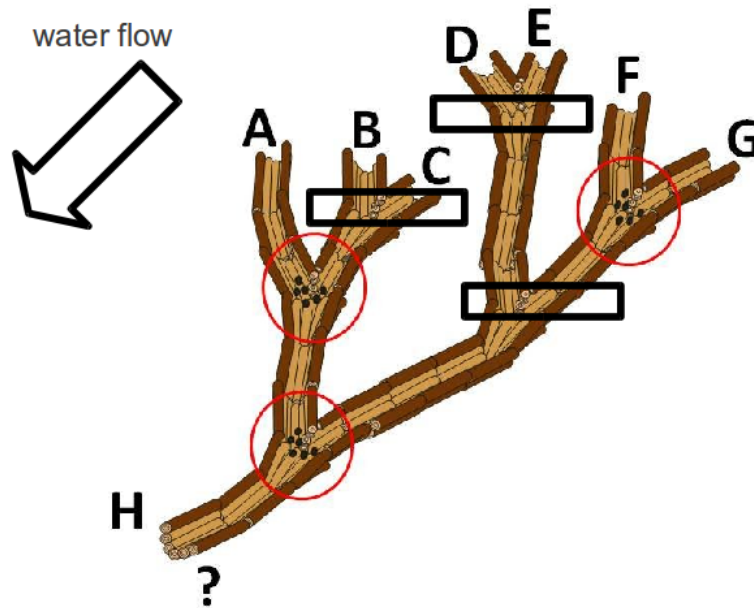
Possible Answers:

5 NW

2 NW, 2 W, 1 N, 1W, 2N

2 NW, 3 N, 3 W

2 NW, 2 W, 1 NW, 2 N

Power Generation

Question:

Beavers have built a system of wooden pipes (shown below) to supply a power plant at H. Water enters from some of the locations A to G and flows downward toward H.

There are two types of intersections where pipes meet:

1. **Those which allow water to flow without restriction** (highlighted with black rectangles): water flows through the intersection as long as at least one of the two incoming pipes contains water;

2. **Those which restrict water flow** (highlighted with red circles): water flows through the intersection only if both incoming pipes contain water.

For which of the following situations will water reach the power plant at H?

Possible Answers:

Water at A, B, C, F and no water at D, E, G
Water at A, B, G and no water at C, D, E, F
Water at A, C, D and no water at B, E, F, G
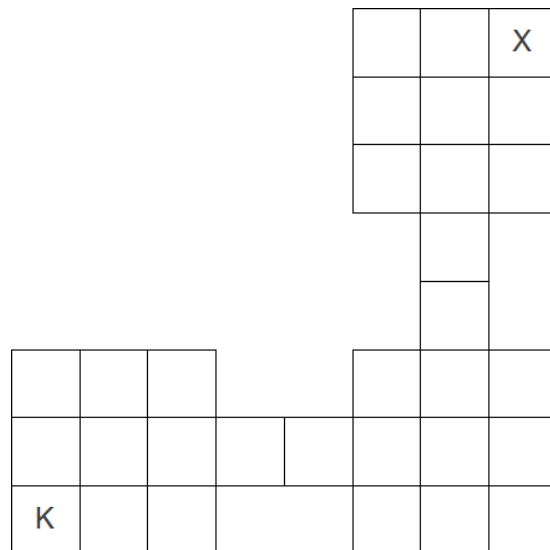Water at B, C, E, G and no water at A, D, F

Knights Over Bridges

Question:

There are eight ways a knight can jump. If it starts at the position marked K on the grid below, in one move it can jump to any one of the eight positions marked A.

	A		A	
A				A
		K		
A				A
	A		A	

Suppose you have three 3-by-3 grids connected in the following way by two bridges of length two.

What is the fewest number of moves needed to move the knight from position **K to position X without ever leaving the grids or bridges?**

Possible Answers:

6

7

8

9

Turn the Cards

Question:

Cards have a letter on one side and a number on the other side. A beaver shows you the four cards below.

The beaver says:

> *"If there is a vowel on one side of a card, then there is always an even number on the opposite side of the same card."*

A vowel is one of A, E, I, O or U.
You only see one side of each card so you do not know if the beaver is telling the truth.
Which cards must be flipped over to determine if the beaver is telling the truth?

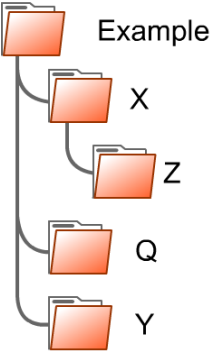## Possible Answers:

All of them
E and 7
E and 2
E, V and 2

Hierarchical Structure

Question:

When sharing files over the internet, programs often encode how files are organized in folders (also known as directories).

Suppose we have the folder Example with various folders underneath it, as illustrated below:


We can encode a folder and all of the folders which it contains using the following rule: each folder is encoded by its name followed by (followed by the encoding of any folders contained within it, followed by).

The encoding for the Example folder would be:

```
Example ( X ( Z ( ) )  Q ( )  Y ( ) )
```

Notice that folders which have no folders within them, such as Z in the example above, are denoted as ( ).

Which of the following is the encoding of the Question folder shown below?
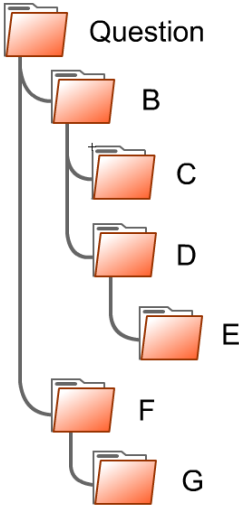
Possible Answers:

```
Question ( B ( C ( ) D ( E ( ) ) ) F ( G ( ) ) )
Question ( B ( C D ( E ) ) F ( G ) )
Question ( B ( C ( D ( E ( ) ) ) ) F ( G ( ) ) )
Question ( B ( C ( D ( ) E ( ) ) ) F ( G ( ) ) )
```
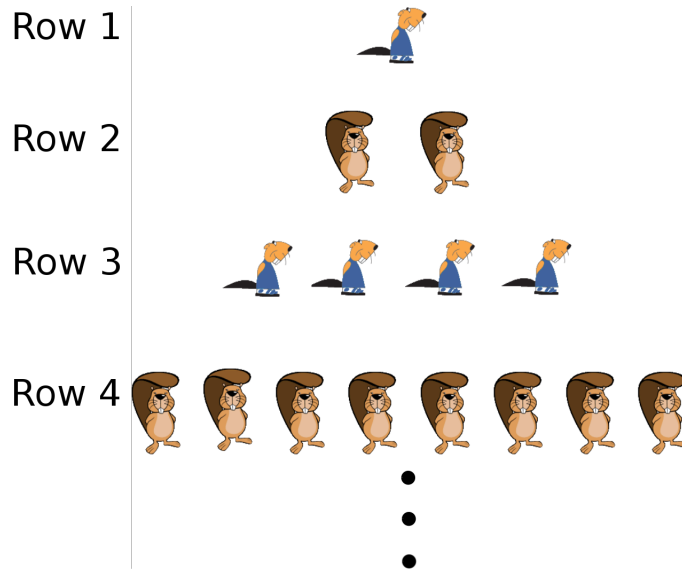
Beaver Pyramid

Question:

Beavers arrange themselves in rows. There is one beaver in Row 1. Each row after Row 1 contains twice as many beavers as the previous row. The odd-numbered rows contain beavers facing sideways. The even-numbered rows contain beavers facing forwards.

In the first 4 rows, there are a total of 15 beavers.

If the pattern continues until there are a total of 511 beavers, how many beavers are facing sideways?
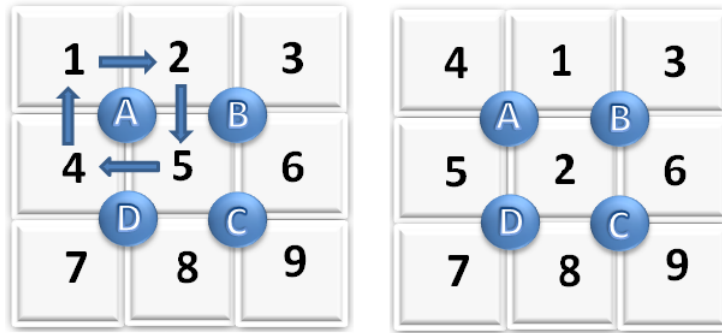
Possible Answers:

161
255
341
363

Rotating Puzzle

Question:

Henry Beaver plays a new game. If he presses one of the buttons A, B, C or D, the four numbers adjacent to the button will be rotated clockwise as shown in the picture on the left. The result of pressing the button A is shown in the picture on the right.

Starting from the picture above on the left, Henry Beaver pressed four buttons in the order of D, C, B, B.

Where is the number 4 after Henry pressed the buttons?

Possible Answers:


12
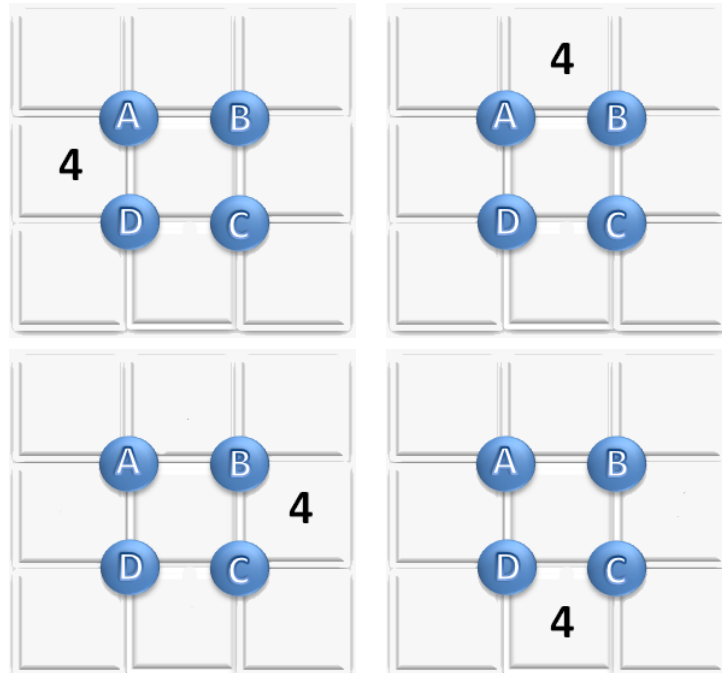
Programmed Robot

Question:

A robot is programmed to find a target (the green field marked with X) on a map of square fields. The robot has its movements programmed as follows:

- The robot moves straight forward until it reaches an obstacle (black field) or the edge of the map.

- When reaching an obstacle or the edge of the map, the robot turns right by 90°.

- When the robot moves out of a field, the field becomes a black obstacle.

The arrows on the maps below show the starting position as well as the starting direction of the robot.

On which map does the robot NOT eventually reach the target (green field marked with X)?

Possible Answers:
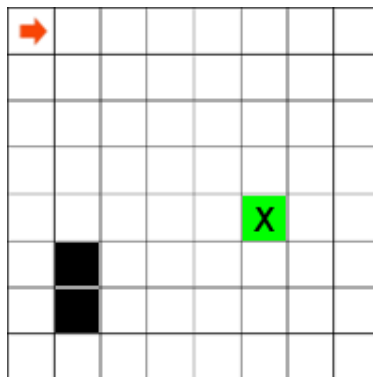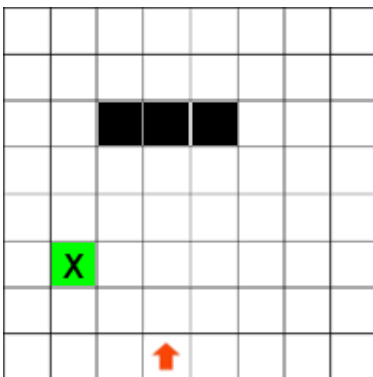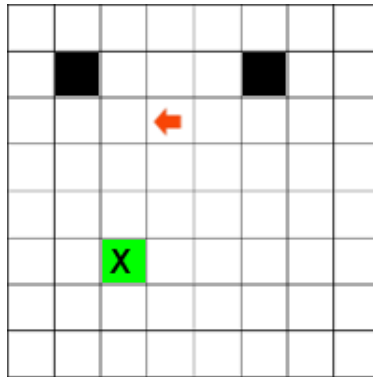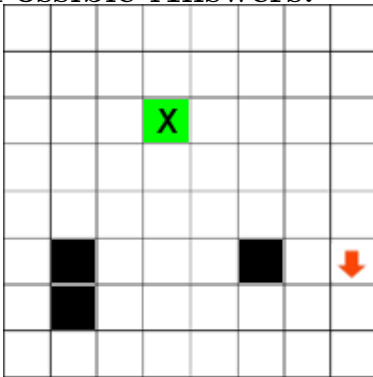
Glasses

Question:

There are 5 empty glasses on a table. One is facing down and four are facing up.

Flipping a glass changes it from facing up to facing down, or from facing down to facing up. In one turn, you must flip exactly three different glasses. The glasses which are flipped do not need to be adjacent.

What is the minimum number of turns to make all glasses facing up?

Possible Answers:

2 turns
3 turns
5 turns
it is not possible to make all glasses facing up

Bebrocarina

Question:

A bebrocarina is a musical instrument with the following features.

- It can play only 6 different tones.

- The tones can be arranged from lowest to highest

- After having played one tone, it is possible to play only the same tone, the next higher tone (if it exists) or the next lower tone (if it exists).

This means that melodies can be represented using only three different symbols:

- = means "the current tone must be the same as the previous tone", and

- - means "the current tone must be one lower than the previous tone", and

- + means "the current tone must be one higher than the previous tone."

For example, melody - + means "play 3 tones, the second tone is lower than the first one and the third tone is higher than the second tone (i.e. the same as the first tone)."

For which of these melodies is there no starting tone that makes playing the melody possible?

Possible Answers:

+ = = = + = = = + = = = + = = = +

- - - = + - = - - = = = +
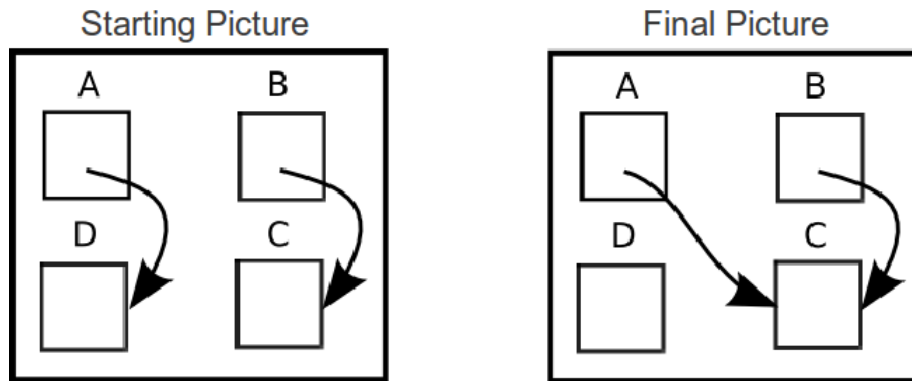
- - - - - = + + + + + = - - - - -

- - + - - + - - = - + - -

Change Direction

Question:

The instruction A<=B changes a picture of boxes and arrows in the following way:

- The arrow which points out of the box labelled A is removed.

- Then, a new arrow out of the box labelled A is added. This new arrow points to the same box as the arrow out of the box labelled B points to.

For example:

What sequence of instructions (performed in order) changes the following starting picture to the following final picture?
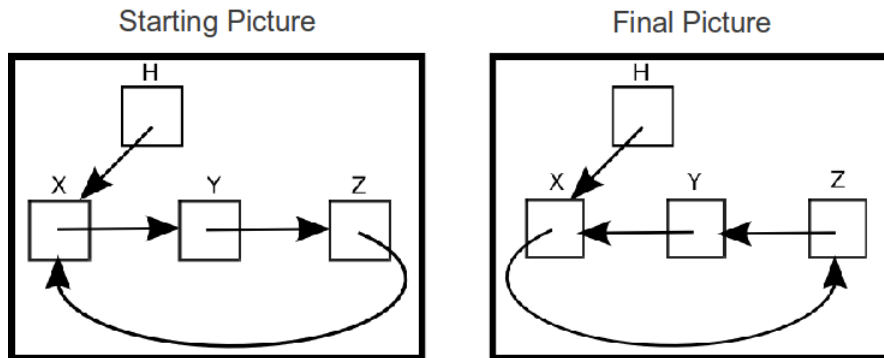
Possible Answers:

X<=Y	X <= Z	Z <= Y	Z <= X
Y<=Z	Z <= X	X <= Z	X <= Y
Z<=X	Y <= H	Y <= H	Y <= H

Find and Transpose

Question:

Randi is often given a name to find in a long list of names. She looks for the name by comparing it to each name in the list from left to right. She always finds the name and then stops looking. If the name is found anywhere but the first position in the list, she then swaps it with the name to the left of it in the list.

For example, if Randi is given the list:

<center>Trevor, Julia, Mark, Isaac, Florence, Bob, Henry</center>

and asked to find Mark, she compares Mark to Trevor, Julia and Mark and then changes the list to:

<center>Trevor, Mark, Julia, Isaac, Florence, Bob, Henry</center>

If she is then asked to find Henry, she compares Henry to every name in the list and then changes the list to:

<center>Trevor, Mark, Julia, Isaac, Florence, Henry, Bob</center>

Over these two searches, Randi performs a total of $3 + 7 = 10$ comparisons.

If Randi starts with a list of 10 different names and is asked to find each name exactly once, what is the maximum number of total comparisons she could possibly perform?

Possible Answers:

55

60

64

100