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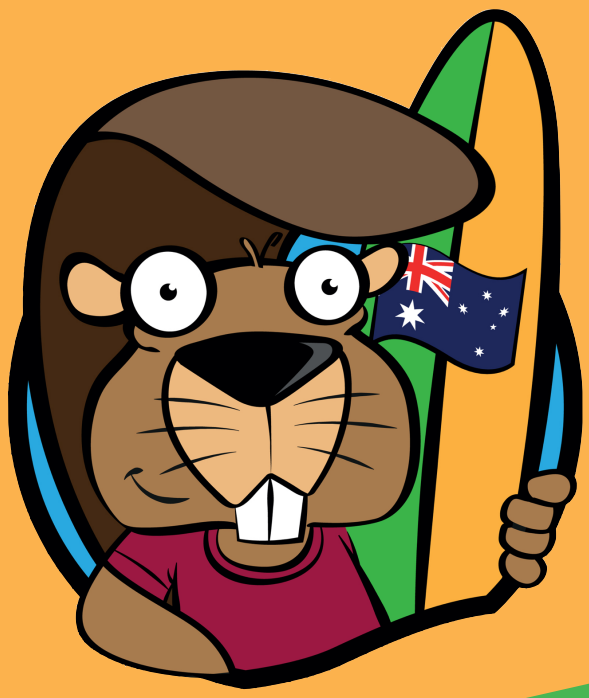


# Bebras Australia Computational Thinking Challenge

## Tasks and Solutions 2017

Editor:

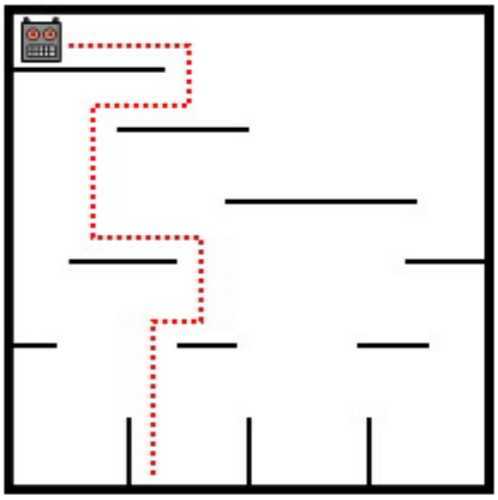
Sarah Hobson

# Falling Robot

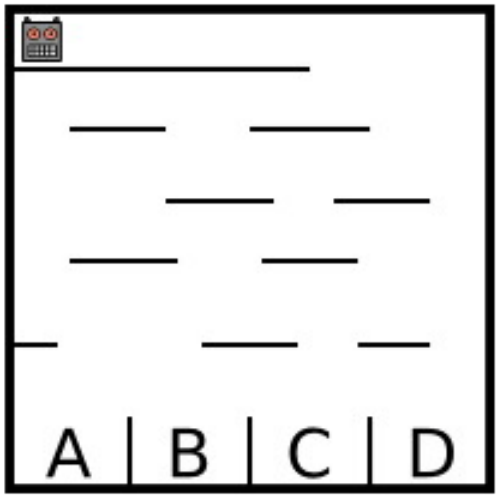
Years 3+4 Years 5+ 6 | A | Years 7+8 Years 9+10 Years 11+12

A robot moves through a vertical maze. The maze consists of various platforms. The robot begins in the upper left corner and then moves to the right.
When it reaches the end of a platform, it falls down onto the platform below.
As soon as the robot lands it changes direction. Eventually the robot reaches one of the buckets at the bottom of the maze.

The following image gives an example of how the robot will move down.



Which bucket will the robot reach in the maze below?



**Answers:**

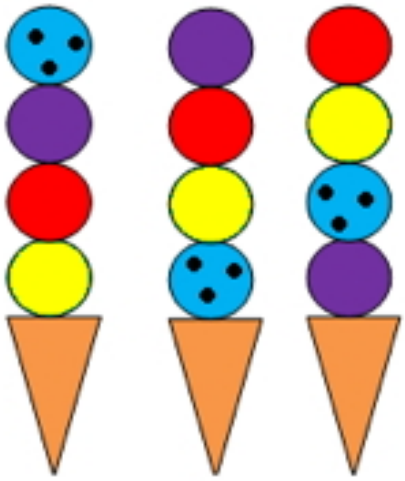
| | |
|---|---|
| A | Bucket A |
| B | Bucket B |
| C | Bucket C |
| D | Bucket D |

# Ice Cream Machine

Years 3+4 Years 5+ 6 | A | Years 7+8 Years 9+10 Years 11+12

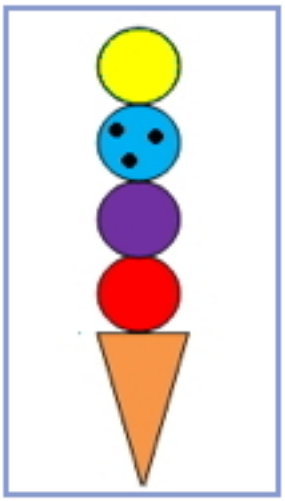
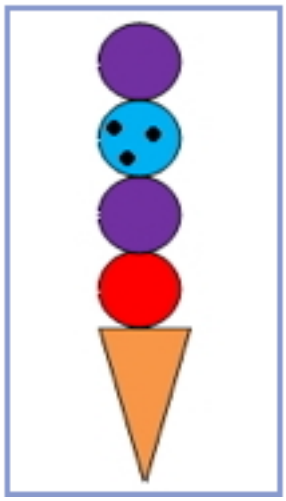
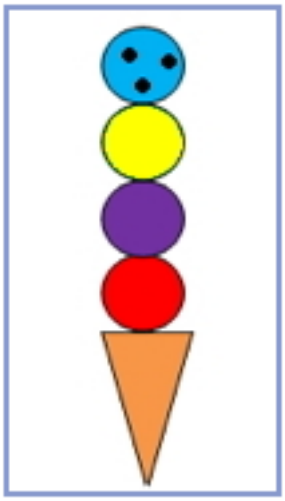
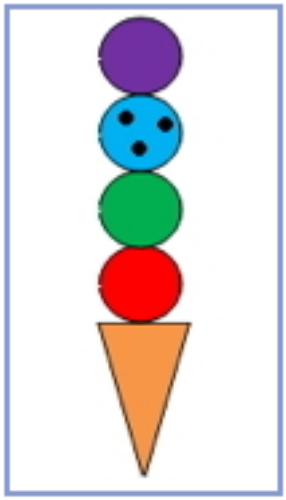
This special ice cream machine creates cones with 4 scoops of ice cream.

It does so in an ordered way. Here you see, from left to right, the last 3 ice creams that the machine has made.



Which ice cream will the machine produce next?

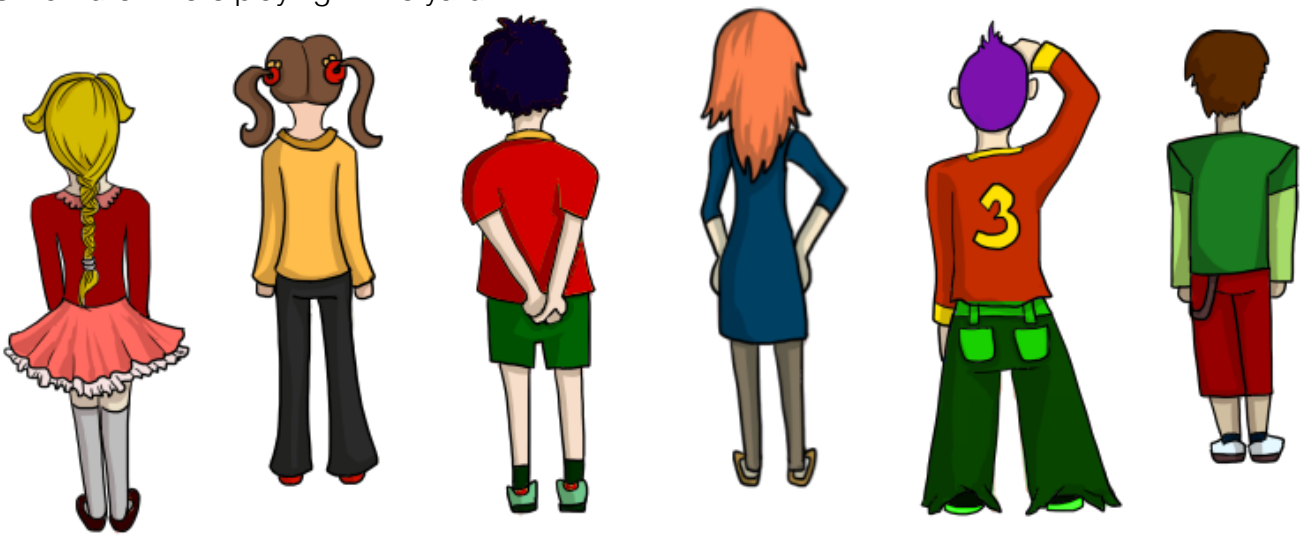
**Answers:**

| A | B | C | D |
|---|---|---|---|
|  |  |  |  |

# Broken Window

Years 3+4 Years 5+ 6 | A | Years 7+8 Years 9+10 Years 11+12

Six children were playing in the yard.

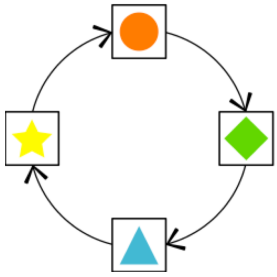



Jane Eve John Anne Dan Tom

One of them threw a ball and broke Mr. Beaver's window.
Mr. Beaver only saw the back of the child running away.
The child had a red shirt and short dark hair.

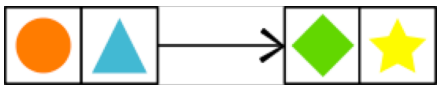
**Question:**
Who broke the window?

The Beaver children have found a magic roller.
The roller replaces a shape in a painting with the next shape shown by the arrows below.



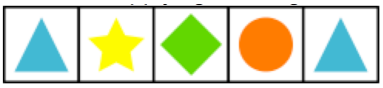
**Example:**

When Ben uses the magic roller to paint over the painting on the left,
he gets the painting on the right.



**Question:**

What will the painting below look like after using the magic roller?



A

B

C

D

# Shelf Sort

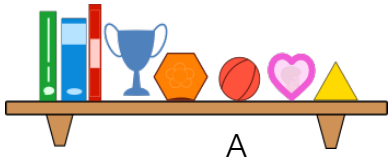
Years 3+4 Years 5+ 6 | A | Years 7+8 Years 9+10 Years 11+12

Beatrix is trying to rearrange her shelf. She has two rules:

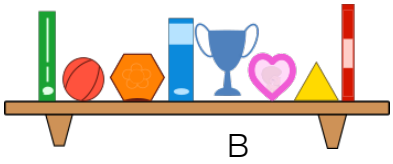
1. Rectangular items must not be next to each other.
2. Circular items must not be next to rectangular items.

**Question:**

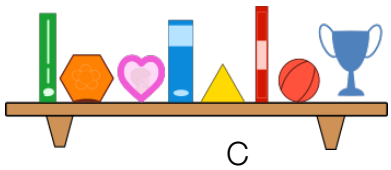
Which one of these shelves has followed her rules correctly?



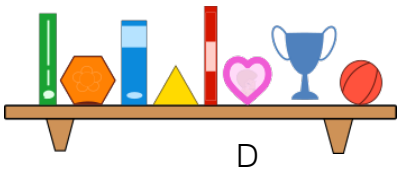
A



B



C

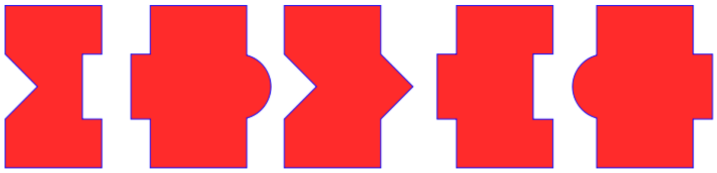


D

The beavers have a new puzzle. They want to make pairs!

Drag two pieces that snap together into the space below to make a pair.
Then try and make another.

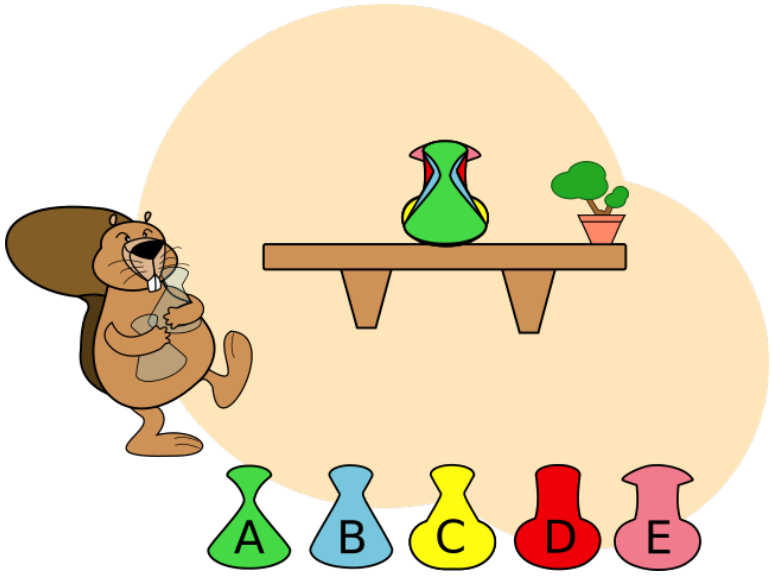
**Question:**
Try and make two pairs then click on 'Save'.



# Bottles

Years 3+4 B Years 7+8
Years 5+ 6 A Years 9+10
Years 11+12

A Beaver puts five bottles on a table.
He places them so that every bottle has a bit showing.
He places the first bottle at the back of the table and puts each new bottle in front of those already placed.




**Question:**
In what order are the bottles placed when they appear as shown in the picture?

E D C B A
D B C A E
E C D A B
D C E B A

# Party Guests

Years 3+4 C Years 7+8 A
Years 5+ 6 B Years 9+10
Years 11+12

To arrange a dinner party Sara the beaver needs to talk to five friends:

Alicia, Beat, Caroline, David and Emil.

Sara can talk to Emil right away. However, to talk to her other friends, there are a few points to consider:

1- Before she talks to David, she must first talk to Alicia.
2- Before she talks to Beat, she must first talk to Emil.
3- Before she talks to Caroline, she must first talk to Beat and David.
4- Before she talks to Alicia, she must first talk to Beat and Emil.

**Question:**

In what order should Sara talk to all of her friends if she wants to talk to all of them?
Drag the names into the right order.

**Alicia** **Beat** **Caroline** **David** **Emil**

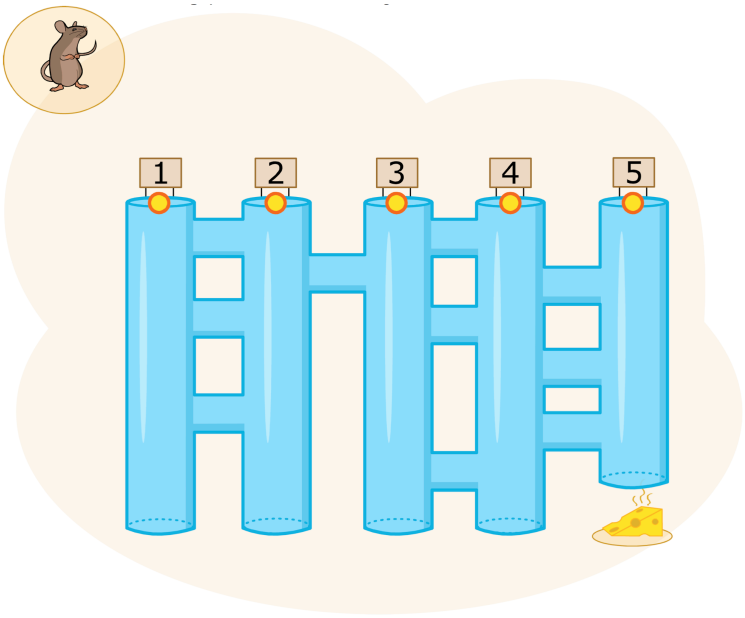
⇒ ⇒ ⇒ ⇒

# Tube System

Years 3+4 B
Years 5+ 6 A
Years 7+8 A
Years 9+10
Years 11+12

A mouse is at the entrance of a tube system. It wants to reach the cheese at the end of tube 5.
The mouse always follows these commands:

1. Go downwards until a crossing
2. At the crossing, move through to the next vertical tube
3. Go to command 1



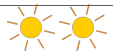

**Question:**
In which tube should the mouse start so that it reaches the cheese?

1 2 3 4 or 5

Barbara has been given two stamps.

With one she can produce a little flower, with the other a little sun.

Being a clever girl, she thinks of a way to write her own name by using the code below:

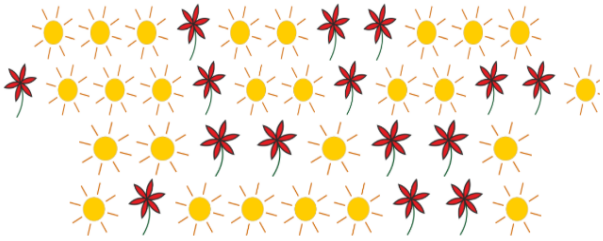
| Letter | B | A | R | E | Y |
|---|---|---|---|---|---|
| Code |  |  |  |  |  |

So Barbara" becomes:

She then writes the names of her friends. Unfortunately, they all got mixed up.

**Question:**
Drag the sun-flower-codes to the names of her four friends.

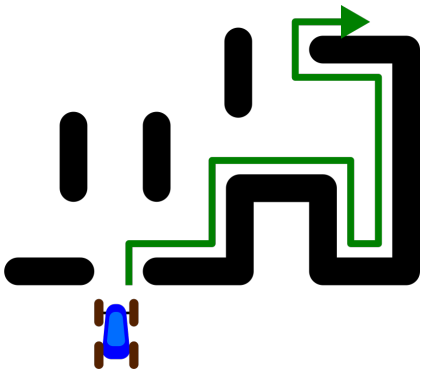
| | |
|---|---|
| **Abby** | |
| **Arya** | |
| **Barry** | |
| **Ray** | |



A robotic car uses a simple rule to drive through a maze:

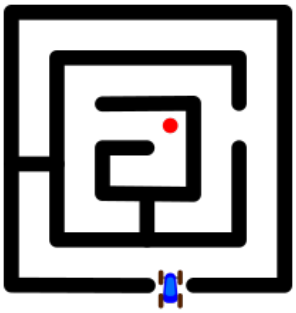
Turn right whenever possible.

The picture on the right gives an example of how the robot would drive through a maze.

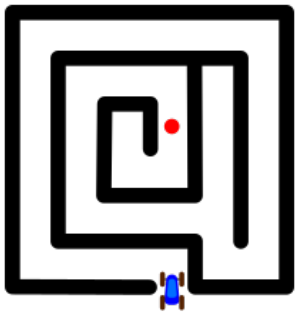


**Question:**

In how many of the following mazes will the car reach the red dot if it uses this system?

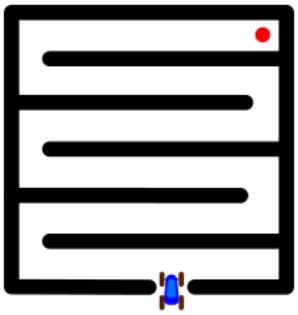


Maze A



Maze B

Maze C



Maze D

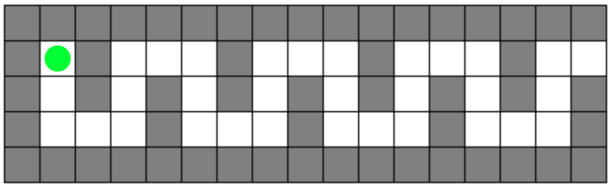
Choose from: 0 1 2 3 or 4

# Robot Exit

Years 3+4 A Years 7+8
Years 5+ 6 A Years 9+10
Years 11+12

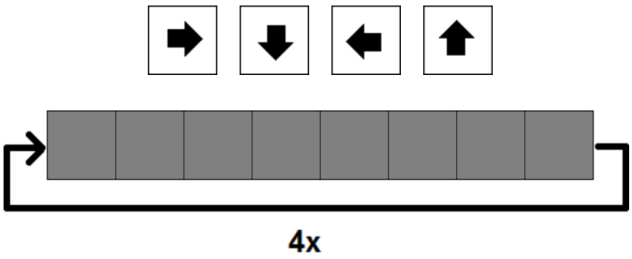
Help the green robot to exit the maze.

The robot will repeat your instructions 4 times.



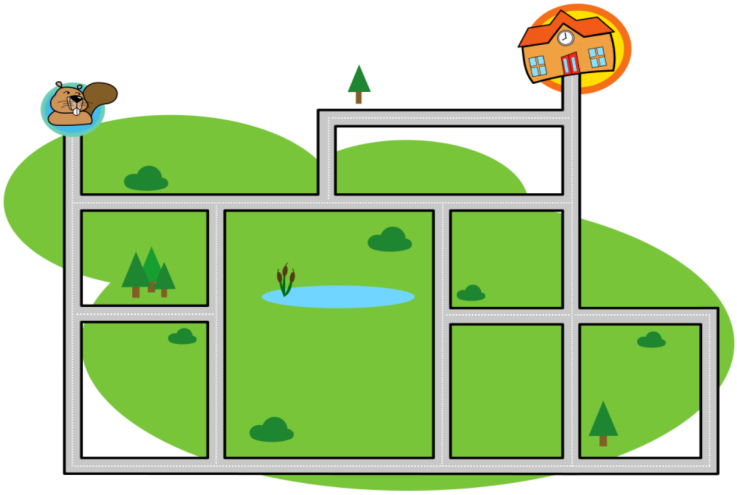
**Question:**

Drag the arrows to form a set of instructions.



# Car Trip

Years 3+4 B
Years 5+ 6 A
Years 7+8 A
Years 9+10
Years 11+12



A self-driving car needs to take a student to school.
The car is programmed so that it only uses these 3 instructions:

**Left:** turn 90° left
**Right:** turn 90° right
**Forward:** go forward until you cannot go forward anymore

**Question:**
Write a set of instructions (a program) that will get the beaver to his school. You can do this by dragging the three instruction blocks next to the car.

# Party Banner

Years 3+4
Years 5+ 6

Years 7+8
Years 9+10
Years 11+12

B

Beaver Bert has a long strip of coloured paper for a party.
The strip has three different colours (yellow, red, blue) in a regularly repeating pattern.
Bert's friend, James, has cut out a section of the paper, as shown in the diagram below.


James says that he will give back the missing piece of paper if Bert can correctly guess the size of the piece cut out.

**Question:**

How many coloured squares does the missing piece of paper have?

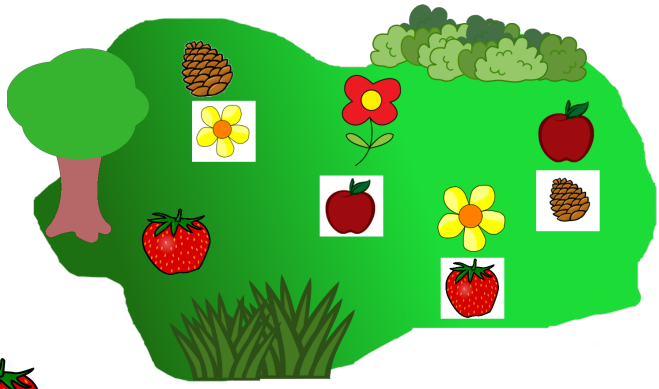
31 32 33 or 34

# Secret Recipe

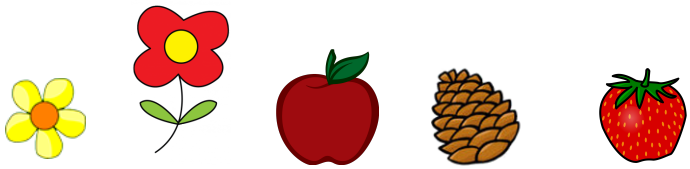
Years 3+4 C Years 7+8
Years 5+ 6 B Years 9+10
Years 11+12

Esther has asked Ivan to cook a special cake made of five ingredients.
She has put labels next to the ingredients in the garden. One ingredient has no label.
The labels tell Ivan in which ingredient must be added next in the sequence.

The garden looks like this:



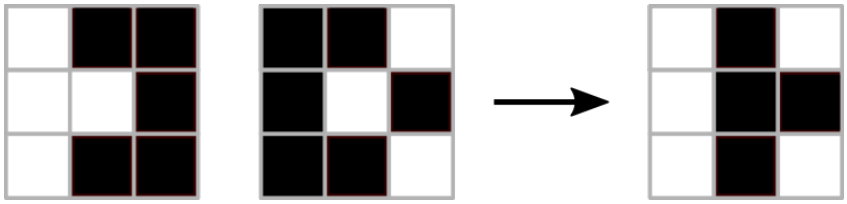
**Question:**
Which ingredient should be added first?



# Paint it Black

Years 3+4 Years 5+ 6 B | Years 7+8 Years 9+10 Years 11+12 A B C

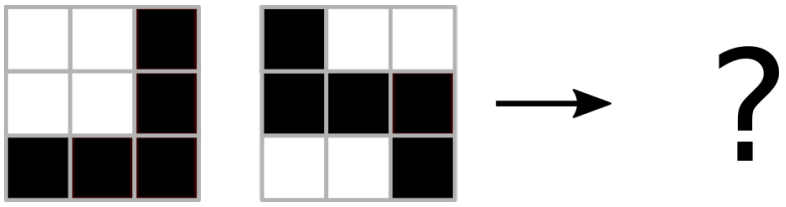
Combining Card A and Card B, you get Card C:



Card A Card B Card C

**Question:**

How many black cells will Card F have after combining Card D and Card E?

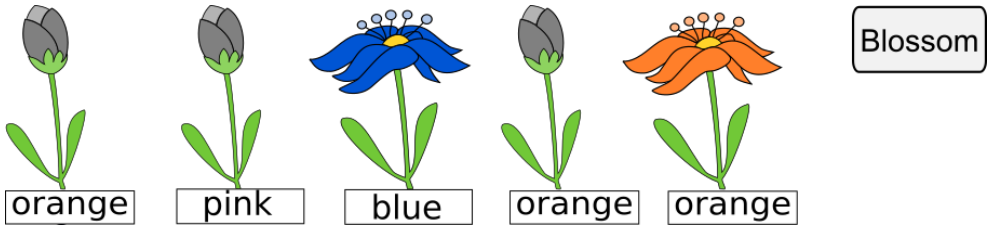


Jane is playing a computer game.

First the computer secretly chooses colours for five buds. The available colours for each flower are **blue**, **orange**, and **pink**. Jane has to guess which flower has which colour. She makes her first five guesses and presses the Blossom button.

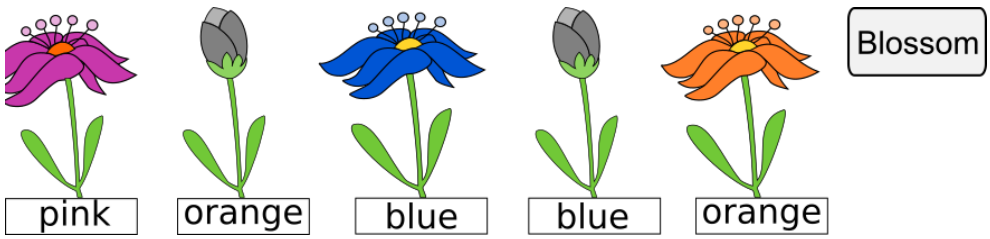
The buds, whose colours she guessed correctly, break into flowers. The others remain as buds.

Jane's first go:




Jane then has another go at guessing and presses the Blossom button again.

Jane's second go:




**Question:**

What colours did the computer choose for the flowers?

A. blue pink blue orange orange
B. pink blue blue blue orange
C. pink blue blue pink orange
D. pink pink blue pink orange

# Magic Potions

| | | | |
|---|---|---|---|
| Years 3+4 | | Years 7+8 | B |
| Years 5+ 6 | C | Years 9+10 | A |
| | | Years 11+12 | A |

Betaro Beaver has discovered five new magic potions:

one makes ears longer
another makes teeth longer
another makes whiskers curly
another turns the nose white
the last one turns eyes white.

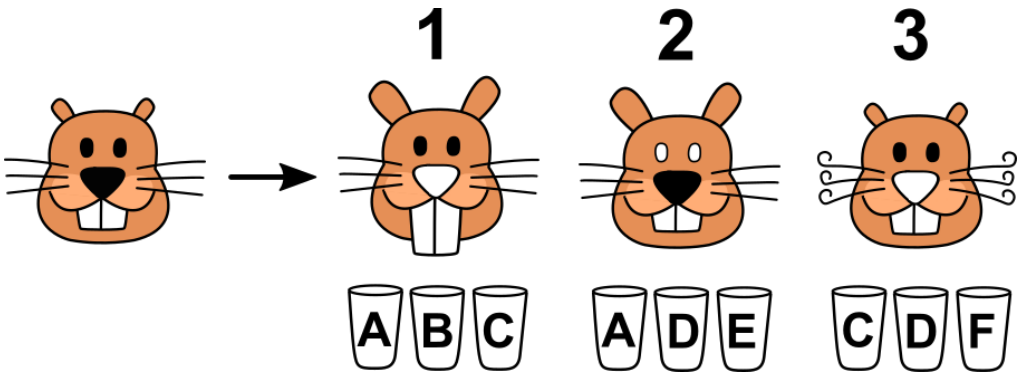
Betaro put each magic potion into a separate beaker. He put pure water into another beaker, so there are six beakers in total. The beakers are labeled A to F. The problem is, he forgot to record which beaker contains which magic potion!


To find out which potion is in each beaker, Betaro set up the following experiments:

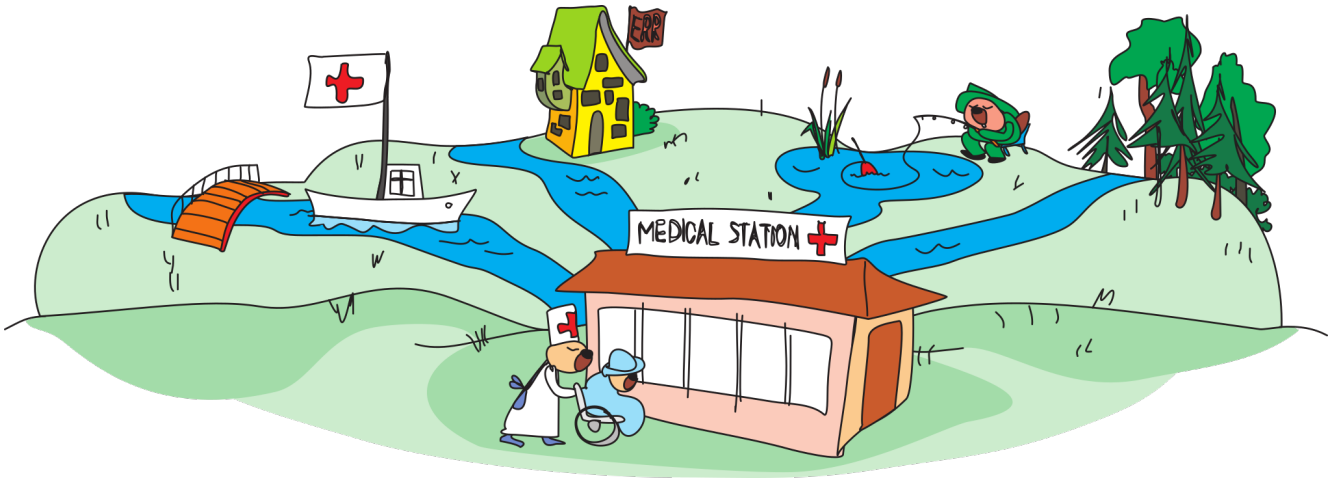
Expt 1: A beaver drinks from beakers A, B and C together - the effects are shown in Figure 1.

Expt 2: A beaver drinks from beakers A, D and E together - the effects are shown in Figure 2.

Expt 3: A beaver drinks from beakers C, D and F together - the effects are shown in Figure 3.

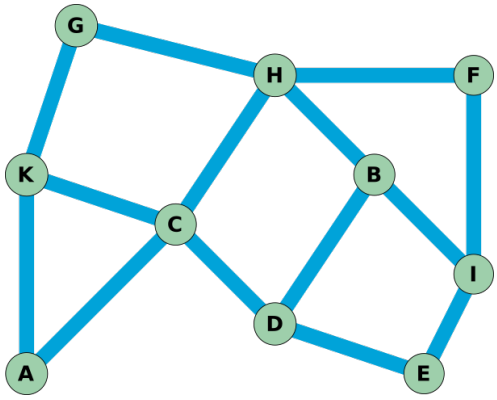



**Question:**
Which beaker contains pure water?




Doctor Hamid wants to build three hospitals for the beavers.
The hospitals can only be built on the places shown on the map below.
To get to a hospital, the beavers should not have to swim through more than one stream from any of these places.

**Question:**
Choose three places to build the hospitals for Doctor Hamid.



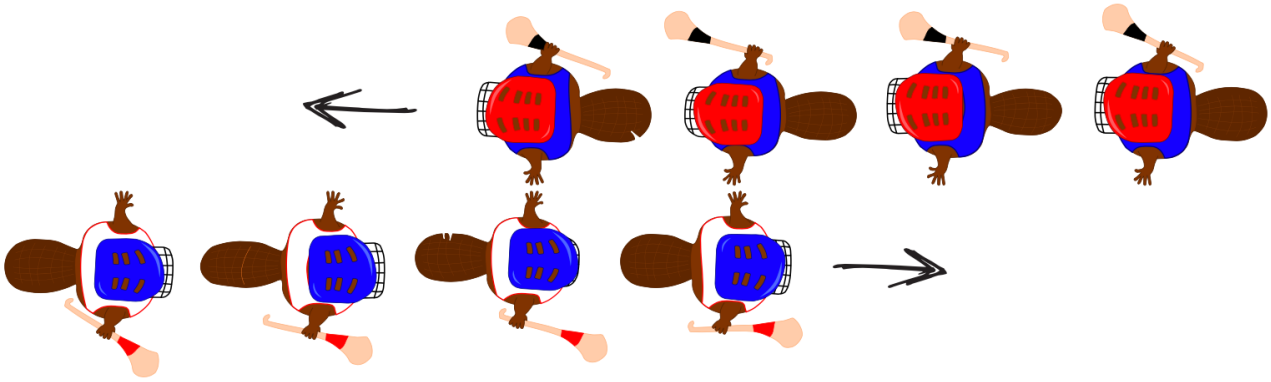
# Hurlers Shake Hands

Years 3+4
Years 5+ 6 C
Years 7+8 B
Years 9+10 A
Years 11+12

Beavers enjoy playing hurling, a popular game similar to hockey.

After the game ends, the beavers in each of the two teams line up in a row and walk past the other team. As they pass each other, they shake hands. At the beginning, only the first player on each team shakes hands. Next, the first two players shake hands (see picture below). This continues until each player has shaken hands with every player on the other team.

There are 15 players on each team.



**Question:**

If each player takes one second to shake hands and move to the next player, how many seconds of shaking hands will there be?

# Concurrent Directions

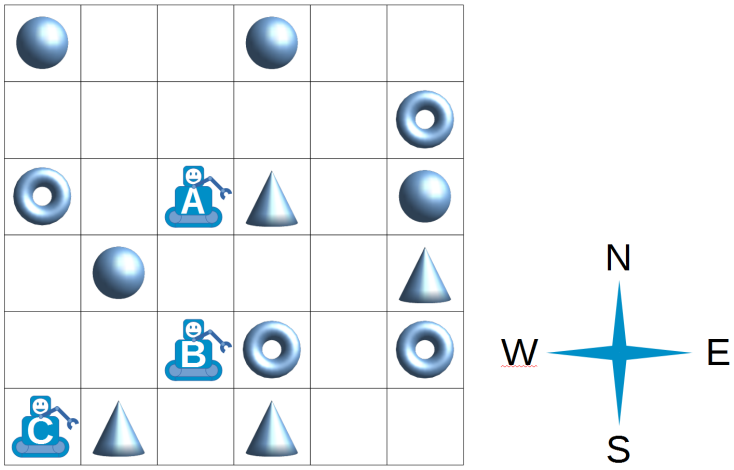
Years 3+4
Years 5+ 6 C
Years 7+8 B
Years 9+10 A
Years 11+12

In a warehouse, three robots always work as a team.

When the team gets a direction instruction (N, S, E, W), all robots in the grid will move one square in that direction at the same time.

After following a list of instructions, the robots all pick up the object found in their final square.

For example, if we give the list N, N, S, S, E to the team, then robot A will pick up a cone, robot B will pick up a ring, and robot C will pick up a cone.



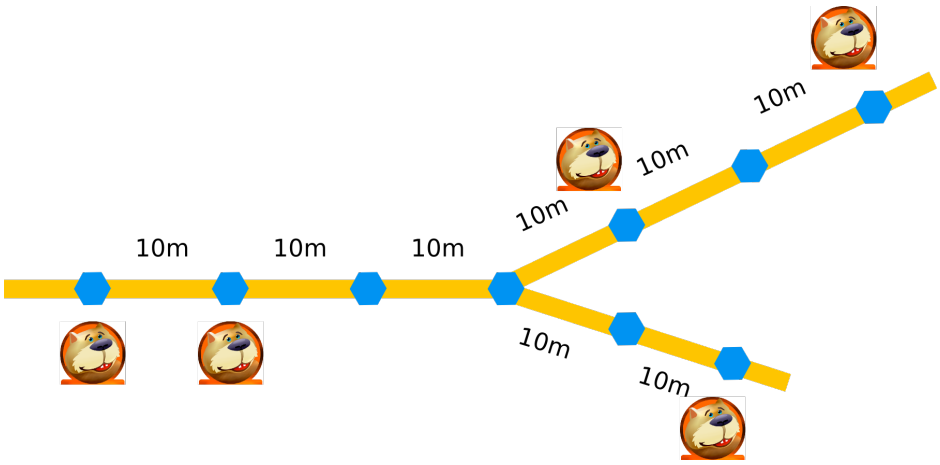

**Question:**
Which list of instructions can be sent to the robots so that the team picks up exactly a sphere, a cone, and a ring?

**A.** N, E, E, E
**B.** N, E, E, S, E
**C.** N, N, S, E, N
**D.** N, E, E, S, W

# Bus Stop

Years 3+4
Years 5+ 6 C
Years 7+8 A
Years 9+10
Years 11+12

The lodges of five beavers are shown on the map below.
The Beavers want to put a bus stop in one of the places marked by blue hexagons.
All the hexagons are 10m apart.
The beavers decide that the sum of the distances from their lodges to the bus stop must be as small as possible.

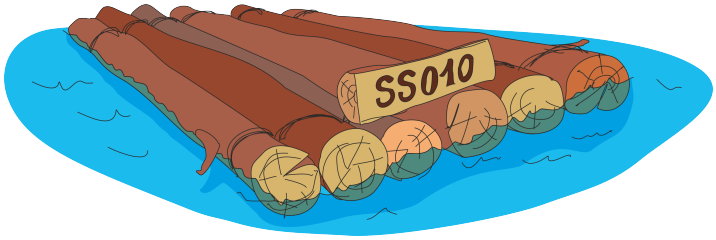


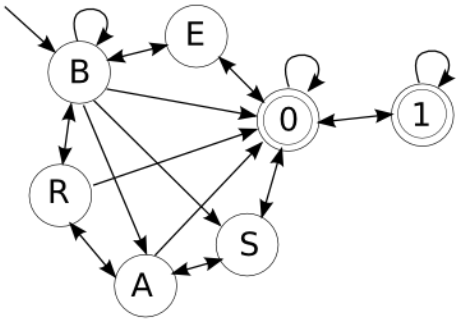

**Question:**
Click on the best place for the bus stop.

# Rafting

| | | | |
|---|---|---|---|
| Years 3+4 | | Years 7+8 | C |
| Years 5+ 6 | | Years 9+10 | A |
| | | Years 11+12 | A |

Beavers build rafts. For river traffic control, all rafts should be registered.
This means that each raft should have a license plate with unique text.
The text is made up of letters and digits as shown in the diagram below.
The licence must start with the letter B and end with the digit 0 or 1.




**Question:**

Which two of these license plates cannot be registered?

BB0001 BBB100 BBB011 BB0100 BR00A0 BSA001 BE0S01

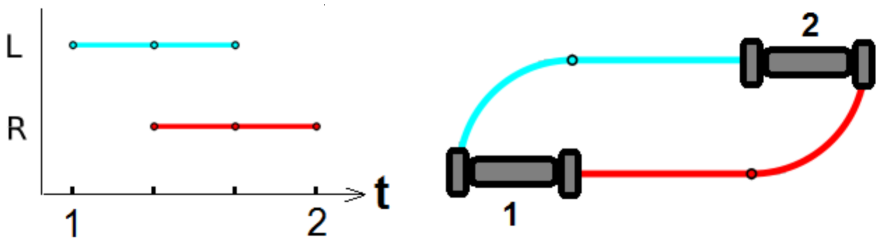
Jan has a special vehicle that looks like a Segway. He moves it by pressing two buttons: a blue (light) button on the left, and a red (dark) button on the right.

When he presses a button, the wheel on that side of the vehicle rotates. If both buttons are pushed at the same time, both wheels rotate and the vehicle moves forward.

If he pushes a single button, only one wheel rotates and the vehicle turns.

**Example:**

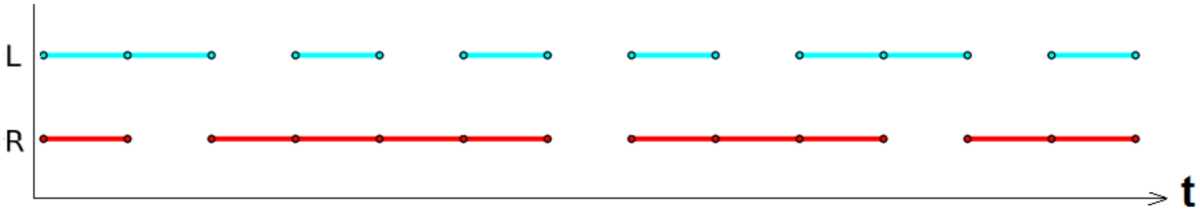
The follow tables shows which button was pushed when, and how the vehicle moved from location 1 to location 2.




First, the blue button was pressed and the vehicle turned to the right. Then both buttons were pressed, and the vehicle moved forward. Finally, the red button was pressed, and the vehicle turned left. The orientation of the vehicle is now the same as in the beginning: facing towards the upper wall.

**Question:**

Here is a record of the button presses from a different journey:




The vehicle kept going until it hit one of the walls. At the start the vehicle was facing towards the upper wall.

Towards which wall was the vehicle facing in the end?

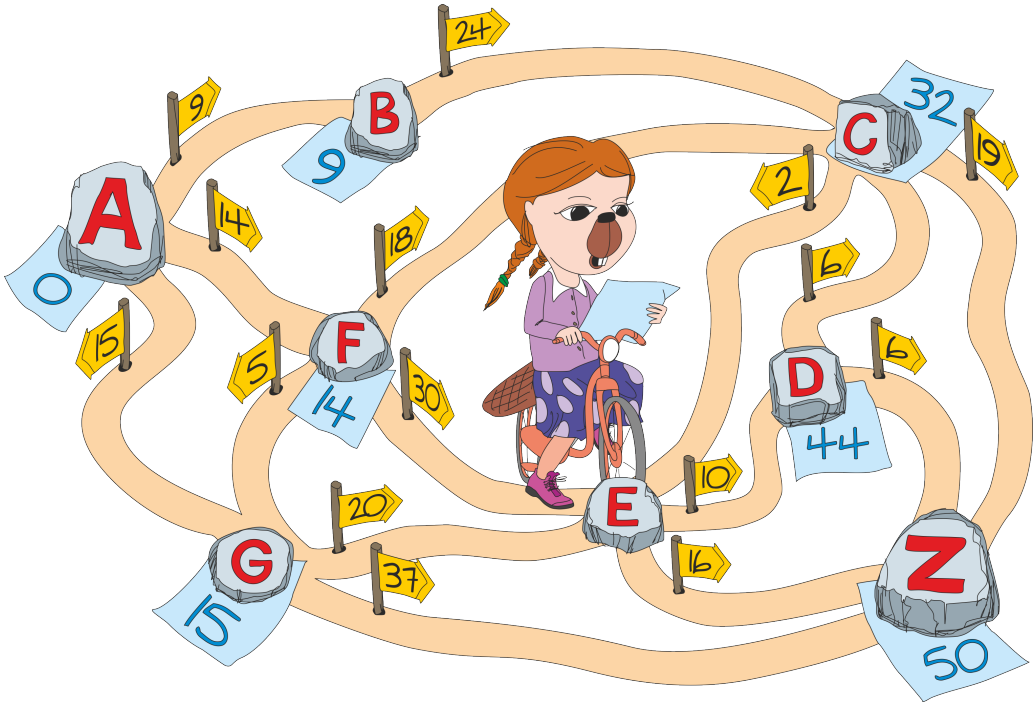
upper lower left or right

# Bike Paths

Years 3+4
Years 5+ 6

Years 7+8 C
Years 9+10 B
Years 11+12 A

Cleveria is a beaver biker. She explores the one-way paths that pass through the villages in her district. Each village has a village stone labeled with a single letter. All the paths have a distance and a direction. The distance and direction are given by the yellow flags.




Over the course of many different trips Cleveria leaves blue notes with a number on under a stone in each village. The notes are about the distance from village A to the village stone with the note under.

**Question:**

What is the meaning of the numbers she has left under the stones?

A. The shortest distance going through the least number of villages
B. The shortest distance to this village
C. The shortest distance to this village by taking a left turn at crossings if possible
D. The shortest distance to this village by taking a right turn at crossings if possible

# Cave Game

Years 3+4 Years 5+ 6 | Years 7+8 Years 9+10 Years 11+12 | C B A

Hale and Serge are playing a game:

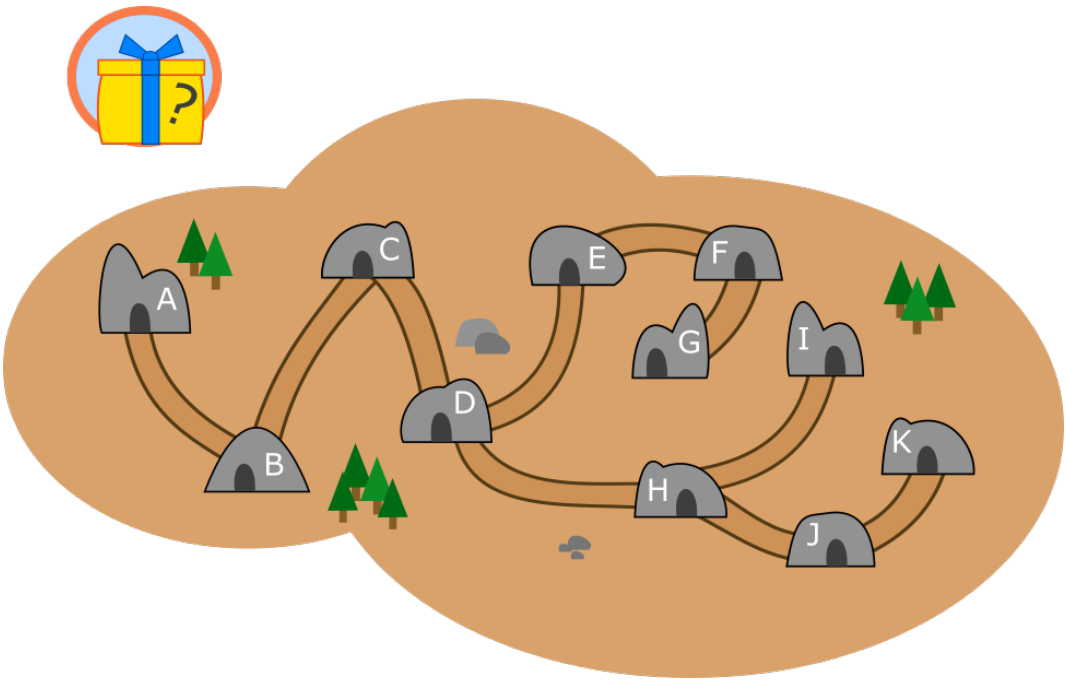
Hale hides a present in one of several caves.
Serge has to find which cave it is in.

To do so, Serge has the map shown below and is only allowed to ask questions like:
“Is the toy in cave X?”

If Serge guesses correctly, Hale will answer “yes”.

Otherwise, she will tell Serge which of the neighbouring caves leads to the hidden toy.

When Serge knows for sure where the toy is, the game is over and he will walk to the cave.




**Question**

Serge wants to ask as few questions as possible to find the present.
In the worst case, how many questions does he have to ask to be sure to have found the present?

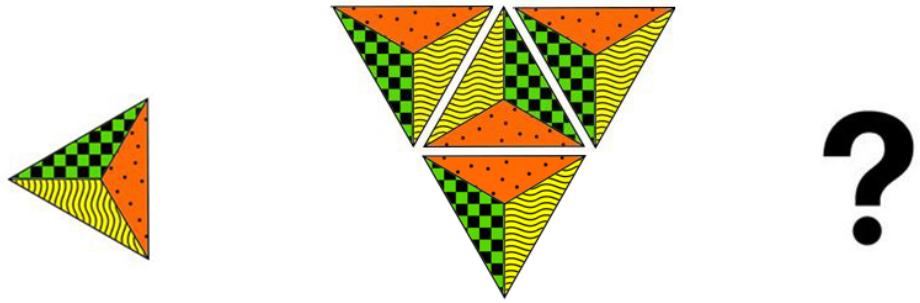
# Triangles

| | | | |
|---|---|---|---|
| Years 3+4 | | Years 7+8 | C |
| Years 5+ 6 | | Years 9+10 | B |
| | | Years 11+12 | B |

A beaver wants to create a mosaic with identical, triangle-shaped tiles.

He starts with one tile. He rotates it 90 degrees clockwise and then adds tiles on each side of the triangle-shaped tile, as shown in the picture below.

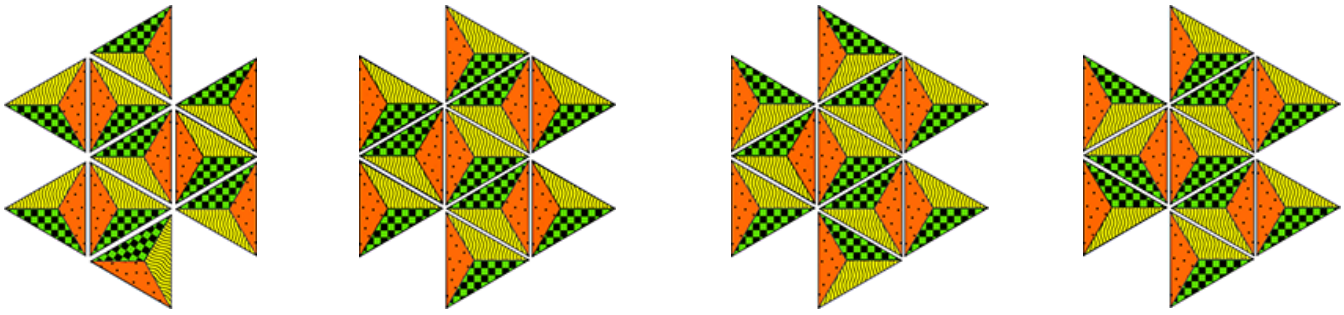
Then he rotates the whole shape 90 degrees clockwise again and adds tiles to the sides as before.




Step = 1 Step = 2 Step = 3

**Question:**

What will be the final shape of the triangles after step 3?



a b c d

# Cards and Cones

Years 3+4
Years 5+ 6

Years 7+8
Years 9+10 B
Years 11+12 A

Inés has a pack of cards; each card has a number written on it from 1 to 9. The pack contains many of the same cards.

She places three coloured cones in front of her:


Inés intends to create stacks under the cones with the numbers facing up.
Each time she puts a new card on the stack it will cover the rest of the stack.

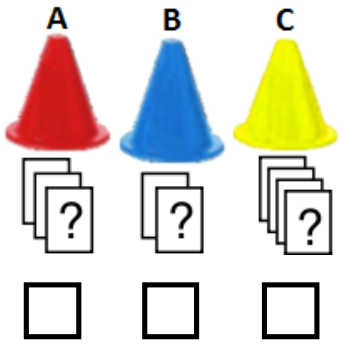
Her friend, Jules, takes notes as Inés puts cards, one at a time, under the cones:

Inés starts by placing a card with the number 5 on it under the red cone. Jules writes: **A <-- 5**
Next Inés places another card under the red cone, on top of the previous one. Jules writes: **A <-- 3**
Then Inés peeps under the red cone and finds a card from the pack that has the same number as she sees. She places it under the blue cone. Jules writes **B <-- A**

Jules' final notes look like this:

A <-- 5
A <-- 3
B <-- A
B <-- 3
A <-- B
B <-- 5
A <-- 6
C <-- B
A <-- B
B <-- 1

**Question:**
What cards are visible when the cones are lifted?
Write the correct numbers in the spaces below the question mark.



# Red & Blue Marbles

Years 3+4
Years 5+ 6

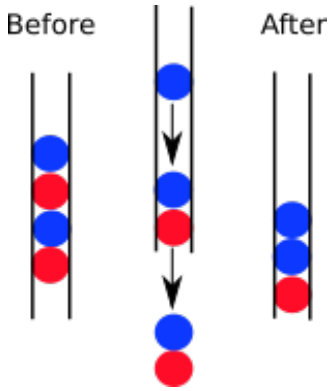
Years 7+8
Years 9+10 C
Years 11+12 B

Beaver Emil is trying a new puzzle on his computer. He has to arrange a stack of marbles in a cylinder.

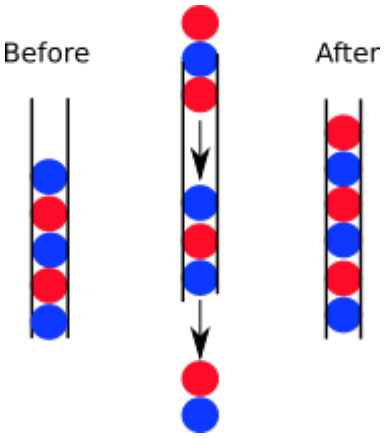
**Rules:**
The marbles must be either red or blue.
There must be at least three marbles in the cylinder at the start.

**Aim:**
To produce a stack that never has less than 3 marbles in the cylinder when the GO button is repeatedly pressed.

**What happens when GO button is pressed once:**
Each click of the GO button lets the two lowest marbles drop out.
Then one of two things happen depending on the colour of the first marble to drop out:

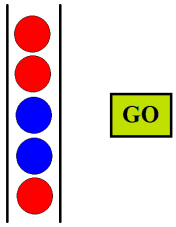



If the first marble that drops is blue: three new marbles drop on the top of the cylinder: one red, one blue, and one red.




If at least three marbles remain in the cylinder after each press of the GO button, Emil will click the button again.
The game ends if two marbles or less remain in the cylinder.

**Example:**
The stack shown on the right produces a game that ends after five clicks.
At this point, only two blue marbles will remain in the cylinder.



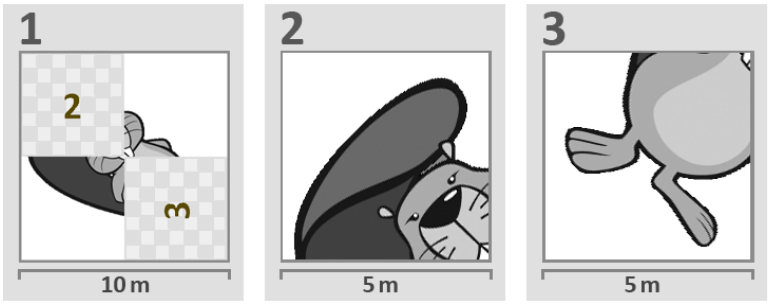

**Question?**
Produce a starting stack that consists of only three marbles which will produce a never-ending game.

# Recursive Painting

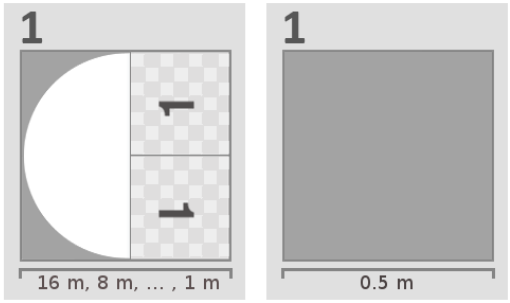
Ingrid and her friends have volunteered to help paint a floor that is 16m long by 16m wide.

The instructions are printed on numbered sheets that refer to the other sheets by their number. Each sheet has a scale printed at the bottom.

Here is an example floor plan from a previous project. It draws a beaver.




Ingrid is given the plan for a new project:




The planning sheet refers to itself and both sheets have the same number!

Ingrid's friend asks how this can be and she answers: "We can do it. The second sheet is important because it tells us when to stop."

**Question:**

What does the painted result look like?

# Scanner Code

Years 3+4
Years 5+ 6

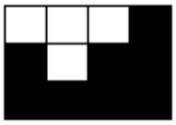
Years 7+8
Years 9+10 B
Years 11+12 B

Two scanners encode an image by translating its pixels into a special code. The code lists the number of all consecutive pixels of the same colour (black or white), followed by the number of all the consecutive pixels of the other colour, and so on. Both scanners start from the top left corner, and go from left to right, and row by row.

The two scanners use different methods at the end of a row:
Scanner A processes the pixels row by row and restarts the encoding on the next row.
Scanner B processes the pixels row by row but does not restart the encoding on the next row.

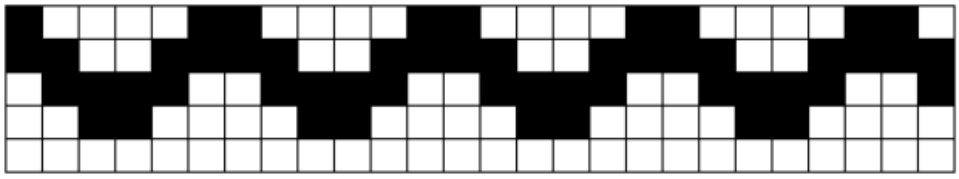
**Example:**
The image on the right would be represented by the following codes:

Scanner A: 3,1,1,1,2,4 (3 white, 1 black, 1 black; 1 white, 2 black, 4 black)
Scanner B: 3,2,1,6. (3 white, 2 black, 1 white, 6 black)

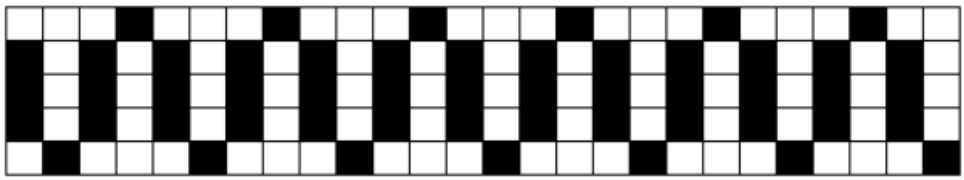


**Question:**
Which of the following pictures will have the same code no matter which scanner is used?

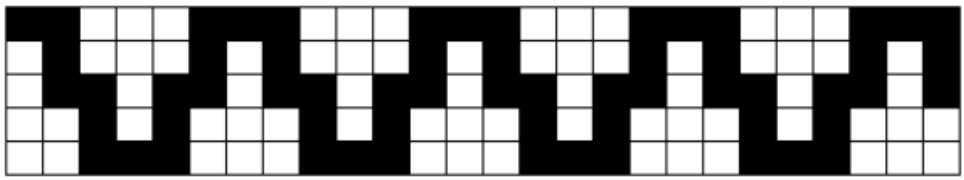
A



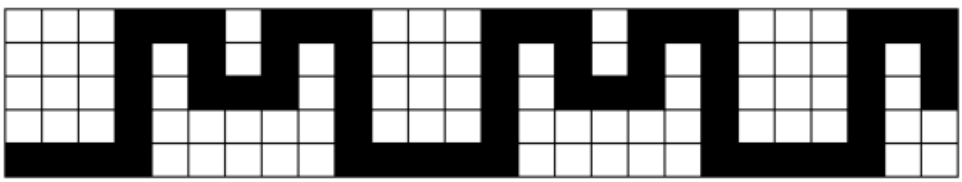
B



C



D



# Kix Code

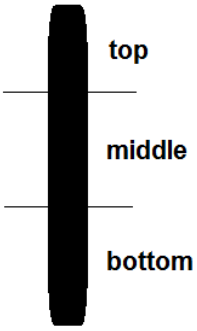
Years 3+4
Years 5+ 6

Years 7+8
Years 9+10 C
Years 11+12 C

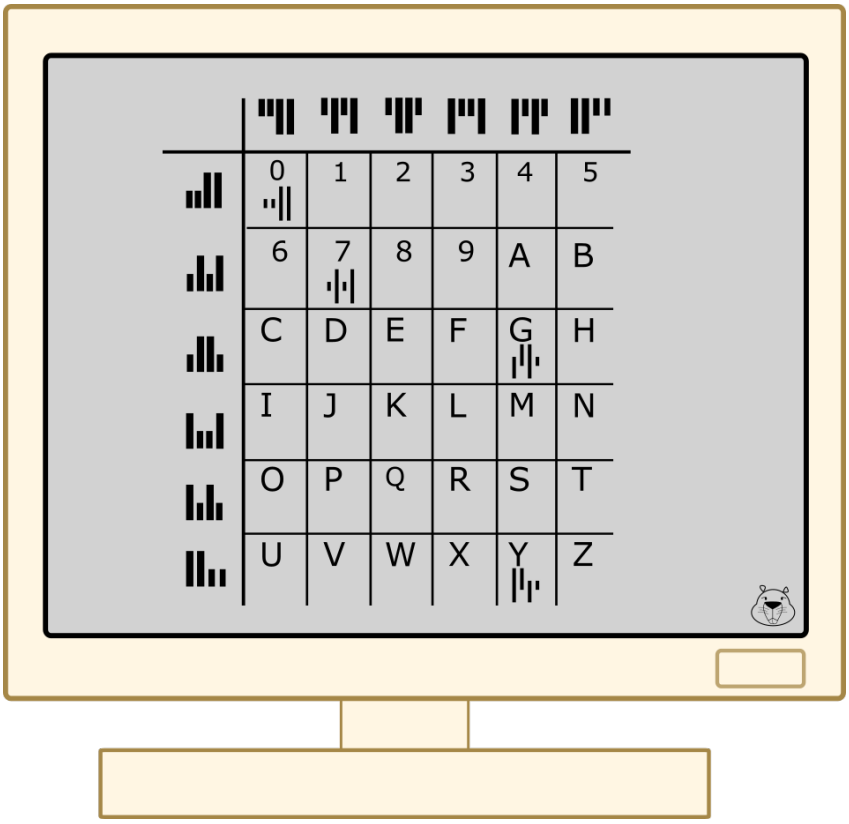
The Bebras Post Office uses postal codes that contain four characters.
To make the postal codes readable by machines, they convert the postal codes into Kix codes.

In a Kix code, each character is represented by 4 vertical bars.

A code has 2 sections: upper and lower.
The upper section contains only the middle and the top bars, while the lower sec
only the middle and the bottom bars.




This table shows the codes for several characters:

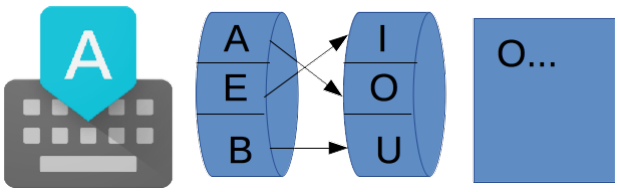



**Example:**
The Kix code for “G7Y0” is

**Question:**
Another postal code has this Kix code.

What is the postal code?

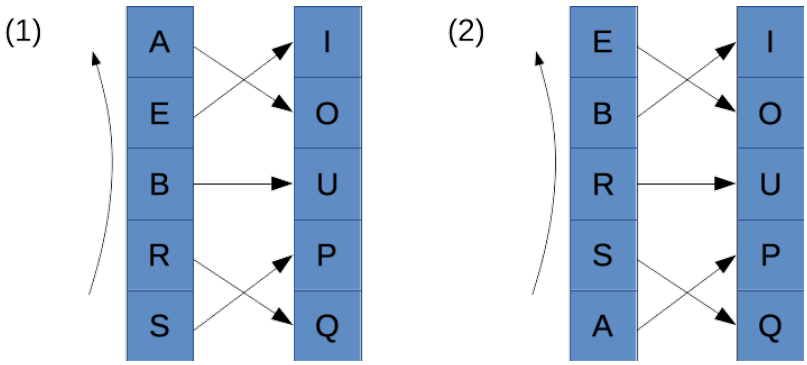
The Beavers need to communicate secretly. They decide to use a mechanism called the B-Enigma machine to hide (encrypt) their messages.




The B-Enigma works as shown above. Each time a letter is typed (e.g. “A”), the left rotor will find a letter on the right rotor according to the arrows (e.g. “O” for “A” in the first step). After typing a letter, the left rotor will move up one position.

This is shown in a different way in the diagram below. After rotating up one position the left rotor will then be in position (2). However, note that the rotor on the right never moves. The links between the two rotors (shown by the straight arrows) also remain the same.

In the diagram below, all the letters available are shown on both rotors.




**Question?**

The Beavers wish to send the message “BEBRAS”.
What will the encrypted message be if we start from position (1)?

**A.** UOSAEB
**B.** UOUQOP
**C.** UOOOIP
**D.** UOOUPQ

# The Game

Beaver Big is playing a game with Beaver Small on the special game board shown.

They start from the leftmost box (Box 5). **Beaver Big goes first.**

She can choose to move Up or Down:
Up will move to Box 4.4; Down will move to Box 5.7.

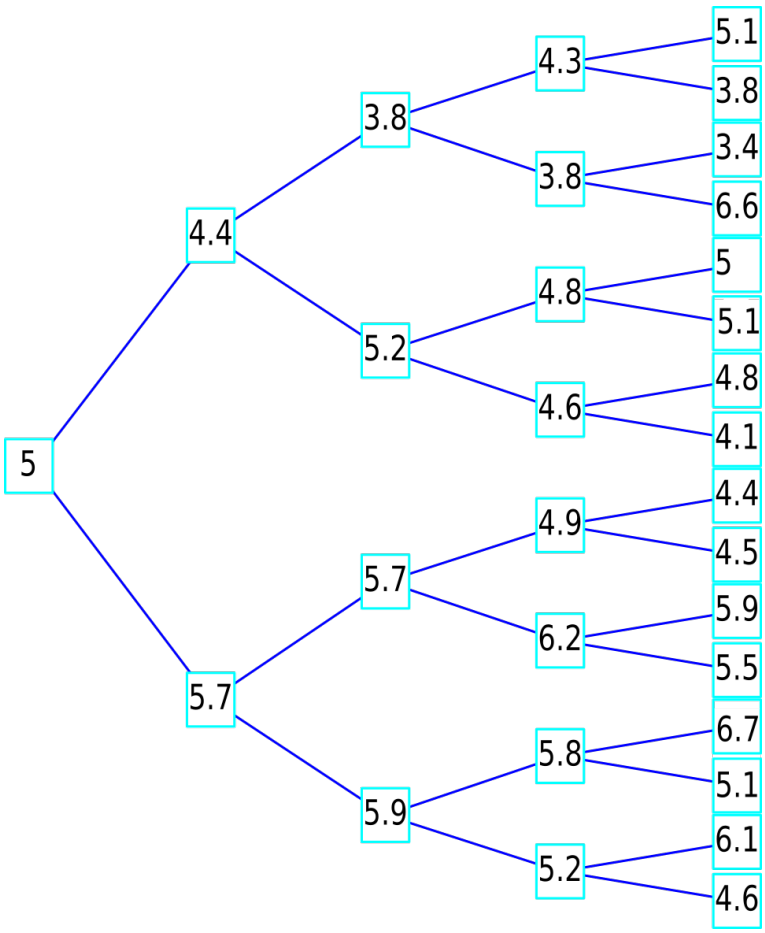
Then, it is Beaver Small's turn to choose Up or Down. From then on they take turns until, finally, Beaver Small chooses a box in the rightmost column.

Because both beavers can see all the numbers on the game board all the time, they are able to plan their moves accordingly.

**Question:**

Beaver Big plays so that the final box will have the biggest possible value and Beaver Small plays to get the smallest possible value.

If both always play as well as they possible can, what will the number in the final box be?



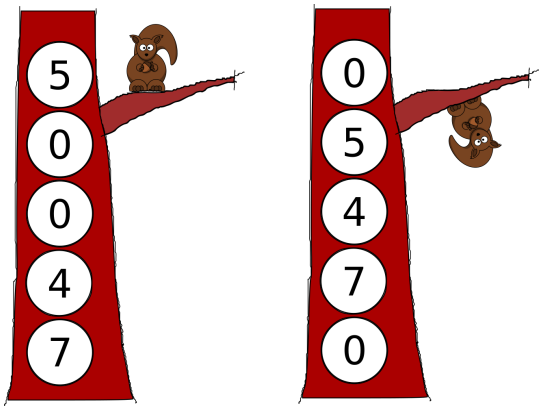
16 squirrels live in a tree with five big holes one above the other.

Each day all of the squirrels find out how many squirrels are in their hole and the neighbouring holes above and below it.

The next night, each squirrel secretly either stays where they are or moves to a hole above or below it, whichever currently has the lowest number of squirrels in. If they are the same, the squirrels prefer their current hole to the hole above. They also prefer a high hole to a low hole.

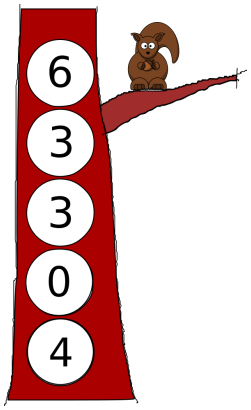
**Example:**

Today there are 5, 0, 0, 4 and 7 squirrels in the holes from top to bottom as shown below. Tomorrow all 5 squirrels in the top hole will move to the hole below (0 neighbours is better that 4). The 7 squirrels from the bottom hole will move up (4 neighbours is better than 6) and the 4 squirrels from the hole next to the bottom will go up (0 neighbours is better than 3)




**Question?**

Here is a different situation that squirrels find themselves in:




After how many days will all the squirrels end up together in the same hole?

2 3 4 or never

A leafy tree  is surrounded by two bare trees  and two palm trees  .

Five types of bananas, say P, Q, R, S, T, are placed on the trees, a different type for each tree. A monkey swings from one tree to another tree to enjoy one banana, and then swings to another tree. It takes the monkey

- three seconds to swing from the leafy tree to any other tree, and to eat one banana (or going in the opposite direction),
- two seconds to swing from a bare tree to a palm tree or vice versa, and to eat one banana,
- seven seconds to swing between two bare trees or two palm trees while avoiding the leafy tree along the way, and to eat one banana.

The monkey swings and eats bananas of type P, Q, S, R, T, R, P.

**Question:**

What type of bananas can possibly be on the leafy tree if the total amount of time the monkey swings and eats is as small as possible?

P or Q or T
P or S or T
Q or S or T
Q or R or S

# L-game

Years 3+4
Years 5+ 6

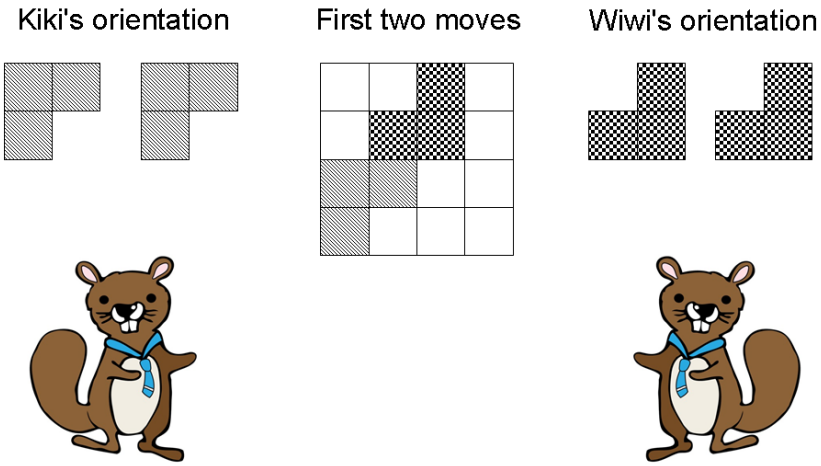
Years 7+8
Years 9+10
Years 11+12 C

Kiki and Wiwi are playing L-Game on a 4x4 board.
They take turns placing L-shaped pieces so that

- every piece placed by Kiki is oriented as shown below,
- every piece placed by Wiwi is oriented as shown below,
- every piece is placed entirely on the board, and
- no two pieces overlap.

Pieces cannot be moved after they are placed. A player loses the game when it is their turn but it is not possible to place a piece according to the rules above.

An example where Kiki goes first is shown below. In this example, Kiki can win the game by placing a piece in the bottom-right corner.




**Question:**
Kiki has nine possible first moves. In how many of them is she guaranteed to win no matter how pieces are placed in following turns?

0 1 2 or 3

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