



UNIVERSITY OF
WATERLOO



The CENTRE for EDUCATION in
MATHEMATICS and COMPUTING























2019
*Beaver
Computing
Challenge
(Grade 7 & 8)*

Questions

Cloud Communication

Story

Smoke signals were used by different groups of ancient peoples to send messages. A very simple code using small and large smoke clouds is given below.

			
			
			
			
			
north	east	south	west

Messages are read from top to bottom. The following message contains an error. Either one small cloud should be a large cloud or one large cloud should be a small cloud.



Question

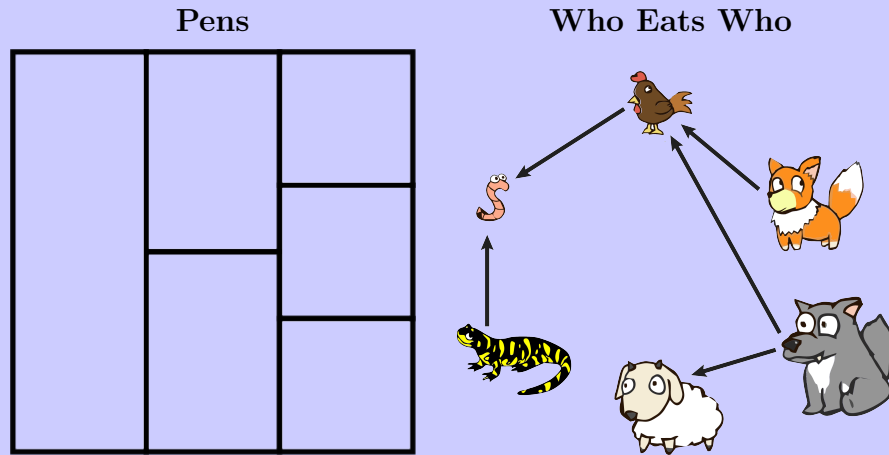
What is the correct message?

- (A) north
- (B) east
- (C) south
- (D) west

Koko's Animals

Story

Koko has six animals and needs to place each one in its own pen. Two animals cannot be placed in touching pens if one animal will eat the other. In the diagram shown, arrows point from an animal to all the other animals that it will eat.



For example, the wolf will eat the chicken, but the wolf will not eat the worm.

Question

Which of the following choices is **not** a good placement?

(A)

(B)

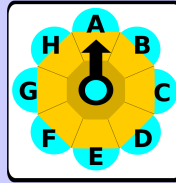
(C)

(D)

Safe

Story

A chef keeps secret recipes in a safe. It is unlocked using a circular knob with a pointer.



With the pointer at A to start, the chef unlocks the safe by turning the knob clockwise and counter-clockwise alternately as the password is spelled. For example, to enter the password BH, the chef:

turns one position clockwise	then turns two positions counter-clockwise

We represent passwords using numbers to indicate how far to turn and arrows to show the direction. For example, BH is represented by $1\curvearrowright 2\curvearrowleft$ which means turn one position clockwise and then two positions counter-clockwise.

To retrieve the secret recipes, the chef must enter the password CHEFDG.

Question

With the pointer starting at A, which of the following will unlock the safe?

- (A) $2\curvearrowright 3\curvearrowleft 4\curvearrowright 3\curvearrowleft 3\curvearrowright 3\curvearrowleft$
- (B) $2\curvearrowright 5\curvearrowleft 5\curvearrowright 1\curvearrowright 3\curvearrowright 3\curvearrowleft$
- (C) $2\curvearrowright 3\curvearrowleft 5\curvearrowright 7\curvearrowleft 6\curvearrowright 5\curvearrowleft$
- (D) $2\curvearrowright 1\curvearrowleft 4\curvearrowright 3\curvearrowleft 3\curvearrowright 2\curvearrowleft$

Mystery Beaver

Story

Beavers named NICOLE, KEVIN, KRISTINA, EDGAR, and KATEY play a game with their teacher. The teacher must discover the mystery beaver among them whose name satisfies these rules:

1. The name of the beaver has the letter G or I in it.
2. The name ends with a letter that no other name starts with.
3. The name starts with a letter that at least one other name starts with.

Question

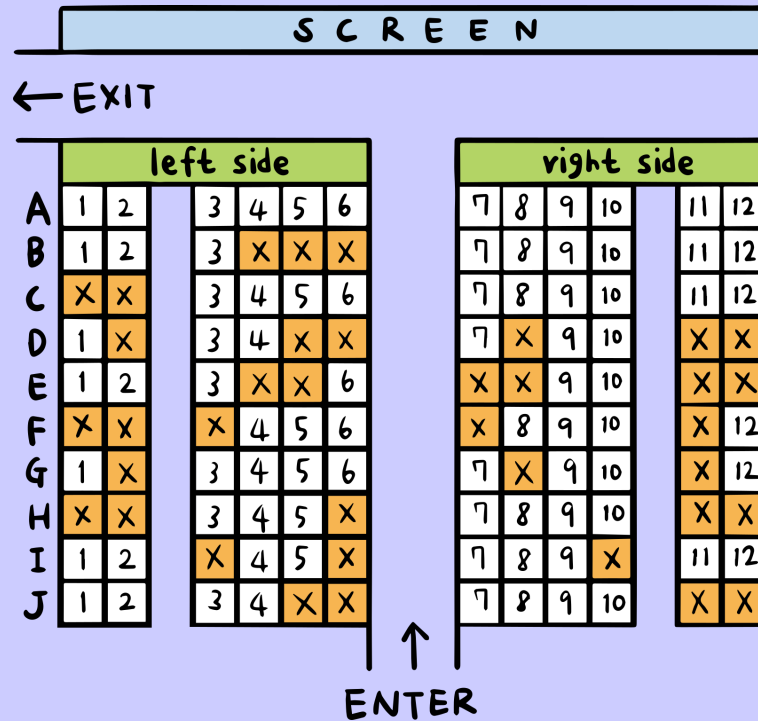
Who is the mystery beaver?

- (A) KEVIN
- (B) EDGAR
- (C) KATEY
- (D) KRISTINA

Movie Theatre Seats

Story

Three friends Alex, Bao, and Chiti are choosing seats in a movie theatre. The seats marked X can't be selected because someone else has already taken them.



Alex, Bao, and Chiti each say what will make them happy:

- Alex: "I want to sit on the right side."
- Bao: "The three of us must sit right beside each other without any seats or aisles between us."
- Chiti: "I don't like when the screen is too close! Let's not sit in the first three rows."

For example, If they choose seats G3, G4, and G5, then Alex will be unhappy. If they choose D7, D9, and D10, then Bao will be unhappy. If they choose A7, A8, and A9, then Chiti will be unhappy.

Question

In how many ways can the three friends choose seats so that they are all happy?

- (A) 3
- (B) 6
- (C) 7
- (D) 9

Cleaning the Lawn

Story

After an outdoor concert, a recycling robot is assigned to pick up the eight items left on the lawn. The robot starts on the left side of the lawn as shown.



The robot starts by identifying the closest item. The robot then moves to this item and picks it up. Then the robot identifies the remaining item that was closest to the item it just picked up, and moves to this new item. The robot continues this process until all of the items have been picked up.

Question

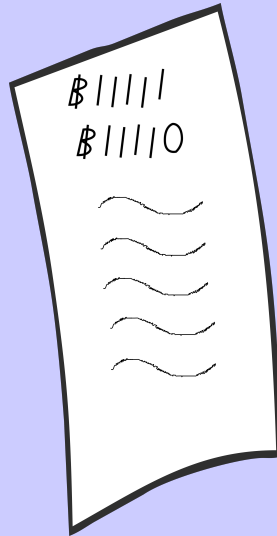
Which type of item will the robot pick up last?

- (A)  (B)  (C)  (D) 

B-taro's Bills

Story

B-taro has exactly five bills worth the following amounts of money: B1, B10, B100, B1000, and B10000. He lists all the possible total amounts of money he can make from greatest to least.



For example, B11110 ranks 2nd on B-taro's list.

Question

Where does B11010 rank on B-taro's list?

- (A) 4th
- (B) 6th
- (C) 8th
- (D) 9th

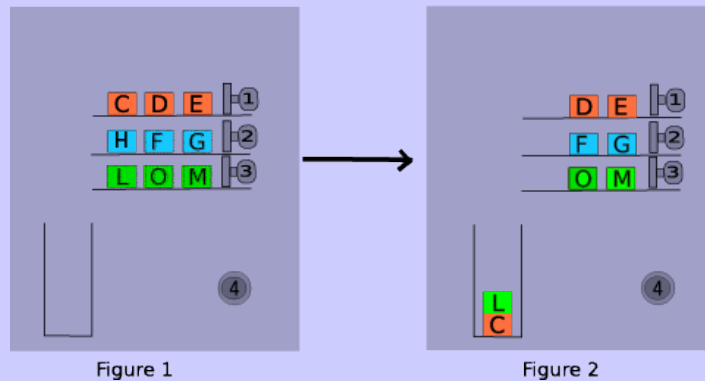
Packing Machine

Story

A machine, controlled by buttons 1, 2, 3, and 4, can drop a block from a shelf into a box or remove a block from the box.

Press	Result
1	leftmost block on the top shelf drops into box
2	leftmost block on the middle shelf drops into box
3	leftmost block on the bottom shelf drops into box
4	top block from the box is removed

Blocks that drop into the box always land on top of other blocks already in the box. For example, suppose we start as shown in Figure 1. After buttons 1, 2, 4, and 3 are pressed (in that order), we will end as in Figure 2. Notice that Block H has been removed from the box and is no longer in the picture.



Question

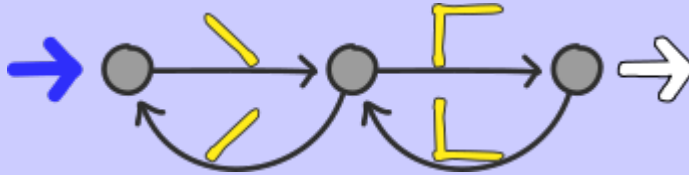
Suppose we start as shown in Figure 1 and then the buttons are pressed in the order: 3, 1, 1, 4, 4, 2, 3, 4. After this happens, which of the following blocks is the second from the top of the box?

- (A) Block H
- (B) Block O
- (C) Block C
- (D) Block L

Making Stitches

Story

A sewing machine can make four different types of stitches. The rules that the machine follows are shown.



The machine starts a new line of stitches by following the thick blue arrow on the left.

Then the machine moves from circle to circle following in the direction of the arrows. Every time an arrow is followed, the machine makes the stitch shown on that arrow. If a circle has more than one arrow leading out of it, the user of the machine can choose to follow either one of the arrows.

The machine finishes by following the outlined arrow on the right.

Question

Which line of stitches **cannot** be made using the above rules?

- (A)
- (B)
- (C)
- (D)

Classifier

Story

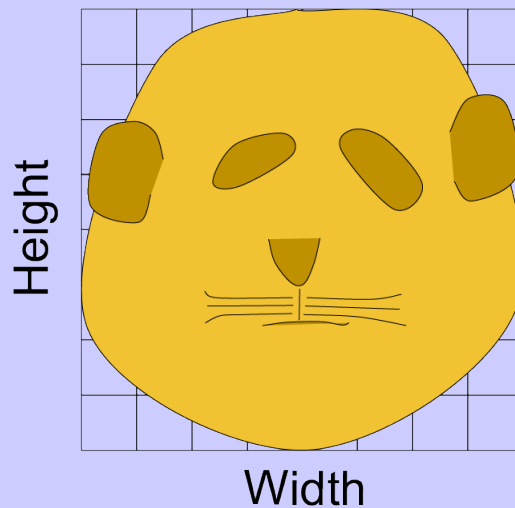
Given an image of an animal, a machine measures various parts of the animal: head, ears, and whiskers. The height of a part is the distance from its lowest point to its highest point. The width of a part is the distance from its leftmost point to its rightmost point.

These measurements are used to identify the animal based on the chart shown.

	Rabbit	Beaver	Bear	Cat
ear height	$\frac{1}{2}$ of head height	$\frac{1}{4}$ of head height	$\frac{1}{4}$ of head height	$\frac{1}{2}$ of head height
whiskers width	head width	$\frac{1}{2}$ of head width	$\frac{1}{2}$ of head width	head width
head width	$\frac{1}{2}$ of head height	$\frac{1}{2}$ of head height	head height	head height

Question

What type of animal does the machine identify the following image as?




















- (A) Rabbit
- (B) Beaver
- (C) Bear
- (D) Cat

Wood Allergies

Story

For some beavers, eating some types of wood will make them sick. Ang is making appetizers out of wood for a party. Each appetizer is made from one type of wood and each appetizer is large enough to feed all the beavers. Ang has a list of the beavers attending the party, and the types of wood that they can eat without getting sick.

Name	Wood They Can Eat			
Ang	 willow	 oak	 ash	 maple
Baadi	 willow	 oak	 poplar	
Chakor	 oak			
Dalma	 ash	 birch		
Edgard	 willow	 maple	 birch	
Filipa	 oak	 ash		
Georgios	 poplar	 maple		

Ang wants to make as few appetizers as possible. However, she wants to make sure that every beaver can eat at least one appetizer without getting sick.

Question

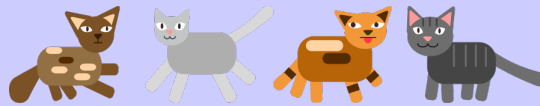
How many appetizers should Ang make?

- (A) 3
- (B) 4
- (C) 5
- (D) 6

Swapping Cats

Story

Four cats stand in a line as shown.



The line-up can be changed by performing a *swap*. A swap is performed by exchanging the positions of any two cats in the line. Two cats do not need to be side-by-side for a swap to occur.

Question

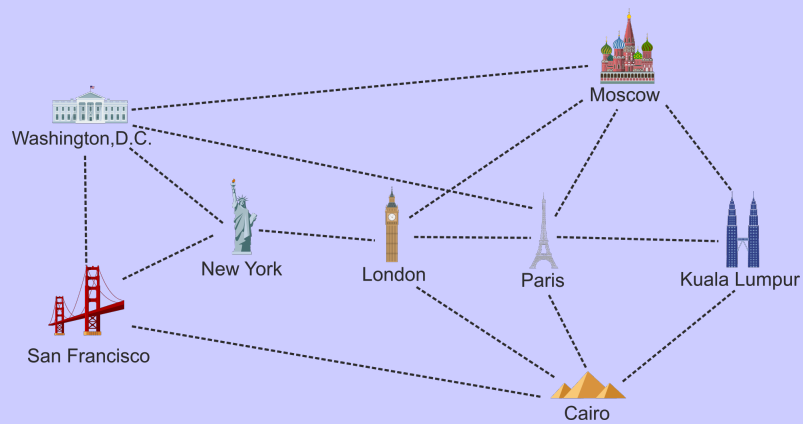
If exactly two swaps occur, one after the other, then which of the following line-ups **cannot** be the result?

- (A) A horizontal line of four cartoon cats. From left to right: an orange tabby cat, a black cat with white vertical stripes, a brown cat with dark brown spots, and a light grey cat.
- (B) A horizontal line of four cartoon cats. From left to right: a brown cat with dark brown spots, an orange tabby cat, a black cat with white vertical stripes, and a light grey cat.
- (C) A horizontal line of four cartoon cats. From left to right: an orange tabby cat, a black cat with white vertical stripes, a light grey cat, and a brown cat with dark brown spots.
- (D) A horizontal line of four cartoon cats. From left to right: a black cat with white vertical stripes, a light grey cat, a brown cat with dark brown spots, and an orange tabby cat.

Cancelled Flights

Story

The dashed lines in the diagram represent all Bebras Air flights. Each flight operates in both directions. The airline is popular because its customers are able to fly between any two cities (possibly stopping in one or more cities in between).



The airline wants to cancel some flights but it still wants its customers to be able to fly between any two cities.

Question

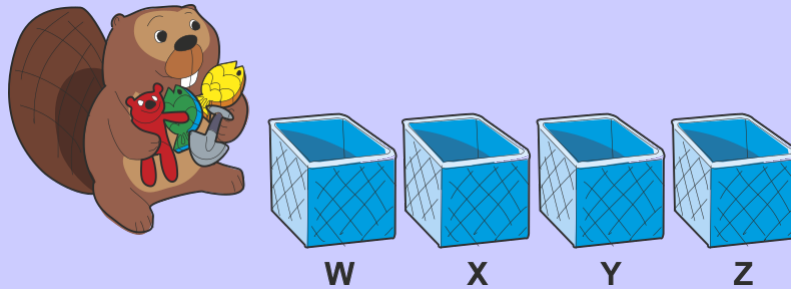
What is the maximum number of flights that Bebras Air can cancel?

- (A) 6
- (B) 7
- (C) 8
- (D) 9

Triple Trouble

Story

A beaver puts each of four toys into boxes labeled W, X, Y, and Z. Each box can hold any number of toys.



At least one of the three conditions in each row of the table shown is satisfied.

a toy is in X	no toy is in Y	no toy is in Z
a toy is in W	a toy is in X	no toy is in Z
no toy is in X	no toy is in Y	a toy is in Z
no toy is in W	no toy is in X	no toy is in Y
no toy is in X	a toy is in Y	no toy is in Z

Question

What is the minimum possible number of empty boxes?

- (A) 3
- (B) 2
- (C) 1
- (D) 0

Farmer's Report

Story

Farms are divided into square fields. There is always a farmhouse in the centre square. Every year, farmers must decide whether a field will grow wheat or grass. They must report the total number of wheat fields in each row and column. An example of a report is shown.



The totals given are accurate because there is one wheat field in each row, one wheat field in the left column, two wheat fields in the middle column, and no wheat fields in the right column.

Question

In each of the following reports, each dark green square, except the centre square containing the farmhouse, represents either a wheat field or a grass field. Which report could contain accurate totals?

