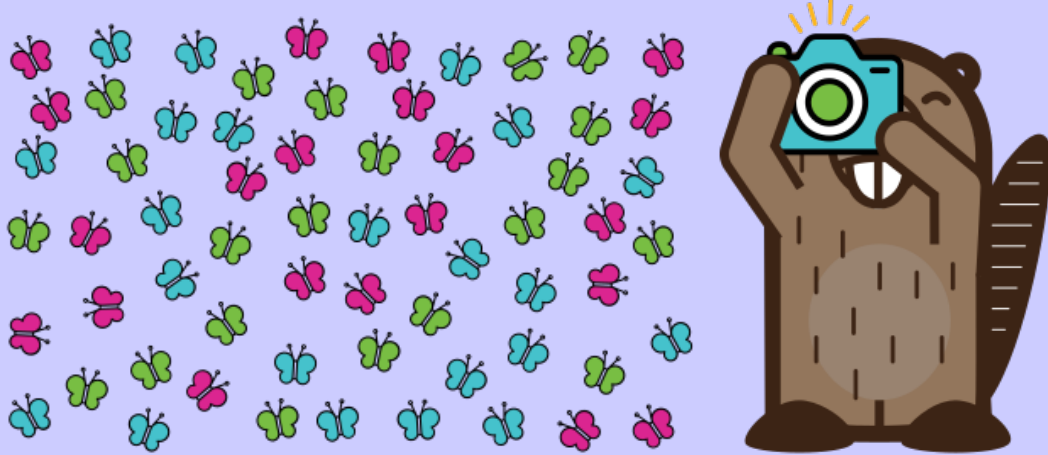# 2021 Beaver Computing Challenge (Grades 7 & 8)

Questions

Part A

Butterflies

A beaver is photographing butterflies, but after each photo is taken, half the butterflies fly away.

The first photo has 64 butterflies in it and the last photo has 2 butterflies in it.

Question

How many photos did the beaver take?

(A) 6

(B) 63

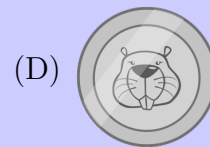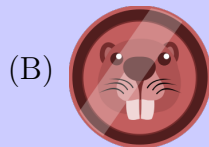(C) 4

(D) 32

Overlapping Coins

Emil has six different coins.

Emil placed the six coins on a table, one at a time. Some coins were placed on top of other coins so that they overlap as shown.
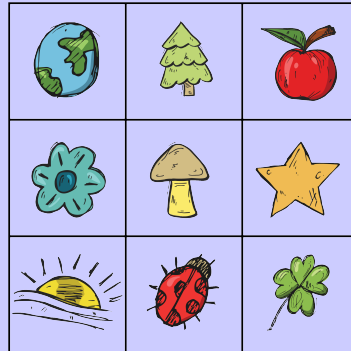
Which coin was the fourth coin that Emil placed on the table?

(A)　　　　　(B)　　　　　(C)　　　　　(D)

4

Arranging Objects

Story

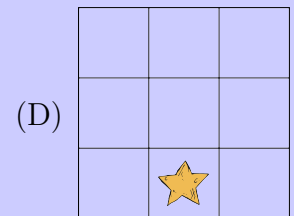A board is divided into squares and a different object is placed in each square as shown.
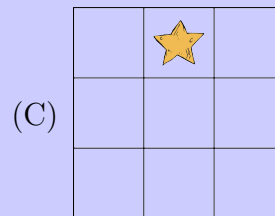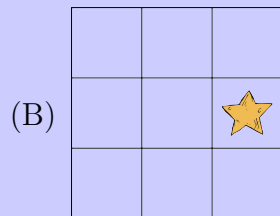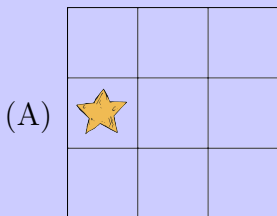

A *swap* exchanges the locations of two objects. Three swaps occur in this order:

1.

2.

3.

Question

What is the location of after the last swap?

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

5

Genetic Data

Story

A genetic scientist is conducting experiments. Each experiment involves a condition followed by a sequence of letters. The condition includes two numbers and a target letter. An experiment is flagged if the number of times the target letter appears in the sequence is between the two numbers (inclusive).

{1,2} A: ATGC

This experiment is flagged because the number of times the target letter A appears in the sequence ATGC is 1 which is between 1 and 2 (inclusive).

{3,8} T: ATGT

This experiment is not flagged because the number of times the target letter T appears in the sequence ATGT is 2 which is not between 3 and 8 (inclusive).

Question

How many of the following four experiments will be flagged?

{2,8} T: TTTTTTT
{1,2} C: AGCTACTAC
{0,2} A: TCGCTGC
{1,3} G: GATGTAGCT
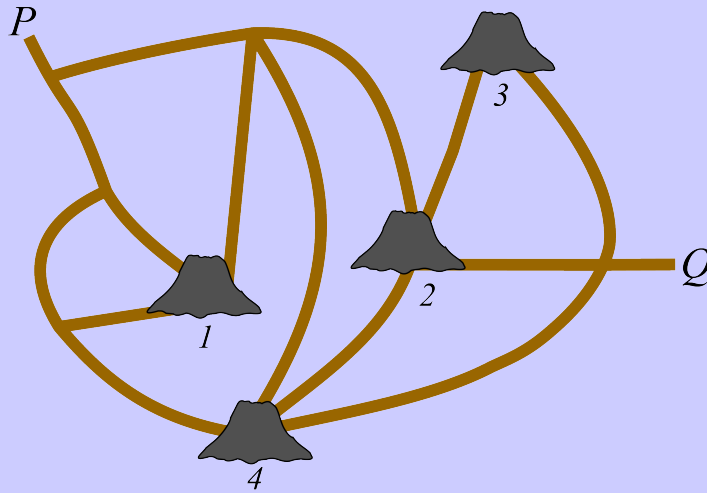
(A) 1

(B) 2

(C) 3

(D) 4

Volcanoes

In the map shown, Dino can follow roads and can climb up and over volcanoes unless they are erupting.

Because two volcanoes are erupting, Dino cannot get from point P to point Q.

Question

Which two volcanoes are erupting?

(A) Volcanoes 1 and 2

(B) Volcanoes 3 and 4

(C) Volcanoes 1 and 4

(D) Volcanoes 2 and 4

Part B

Forest Towers

Story

In a forest, there are seven towers and eight paths. Each path connects two towers as shown.
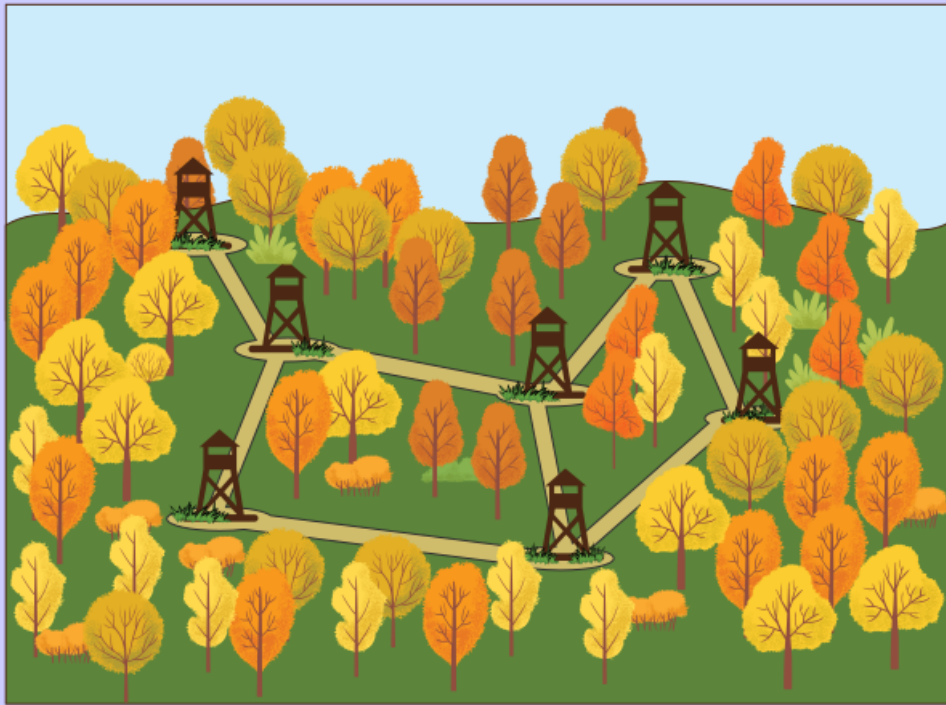
A forest ranger in a tower is able to see all paths that touch that tower, but cannot see any of the other paths. For example, a ranger in the top left tower can only see one path.

Question

What is the smallest possible number of forest rangers that need to be assigned to towers so that each path can be seen by at least one forest ranger?

(A) 2

(B) 3

(C) 4

(D) 5

Cuckoo Birds

Story

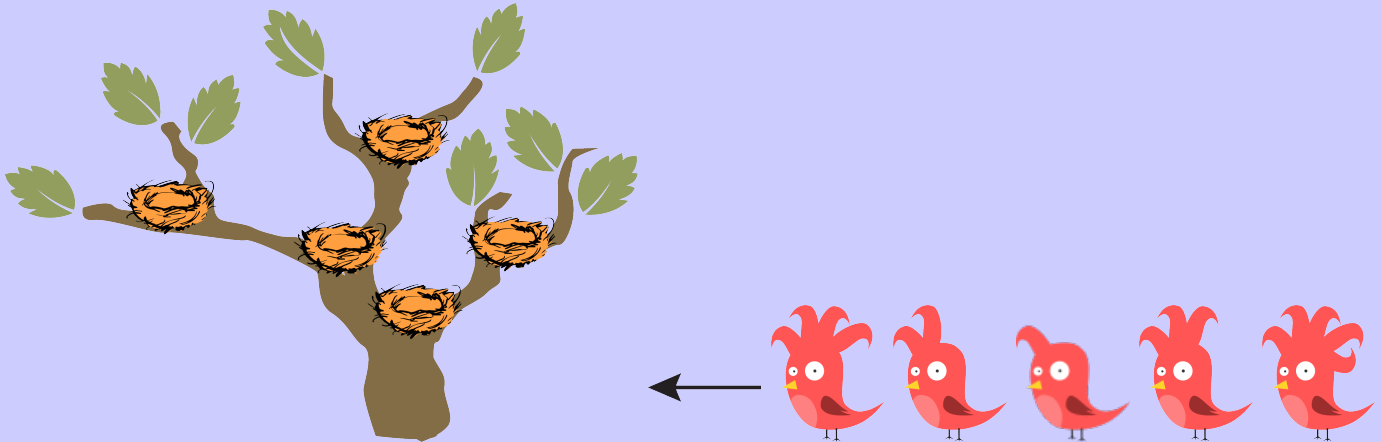Cuckoo birds don't build nests. Instead, they move into empty nests. Below is a tree with five empty nests, and a flock of five cuckoo birds.

The birds, *in order from left to right*, each move into an empty nest in the tree. Each bird does this by first inspecting the lowest nest. Then it repeats the following two steps until it finds a nest to move into:

1. If the inspected nest is empty, the bird moves in!

2. If the inspected nest is full, the bird compares its head feathers to those of the bird nesting there.

   (a) If it has *fewer* head feathers than the nesting bird, the bird inspects the first nest found by travelling along the branch extending to the left in the diagram.

   (b) If it has *more* head feathers than the nesting bird, the bird inspects the first nest found by travelling along the branch extending to the right in the diagram.

Question

Which bird moves into the highest nest?

(A)   (B)   (C)   (D)
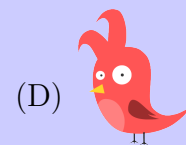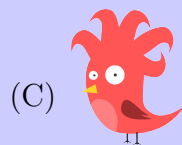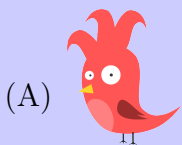
Line of Fish

Story

Fish swim in a line as shown:

Positions are numbered starting from 1 on the left. Occasionally, someone says the positions of two fish. If these positions are A and B where $A < B$, then

- all fish to the left of position A swim away, and
- all fish to the right of position B swim away.

Positions are renumbered after any fish swim away.

For example, after someone says positions 4 and 9, there would be 6 fish remaining in the line (now in positions 1, 2, ... 6) as shown:

Starting with the original line of 12 fish, suppose that

- someone says positions 2 and 10, then
- someone says positions 3 and 8, and then
- someone says positions 2 and 4.

Question

After this, which of the following is the new line of fish?

(A)

(B)

(C)

(D)

Colourful Tubes

In science class, Beaver Currie learns that different liquids have different densities. If you pour a liquid into a tube and then carefully pour a different liquid into the same tube, the lower density liquid will stay separate and on top of the higher density liquid.
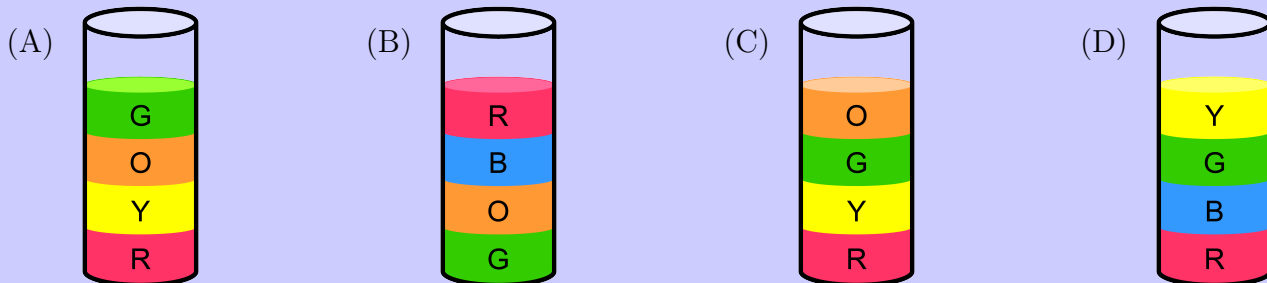
The results of Beaver Currie's three experiments to demonstrate this property are shown.
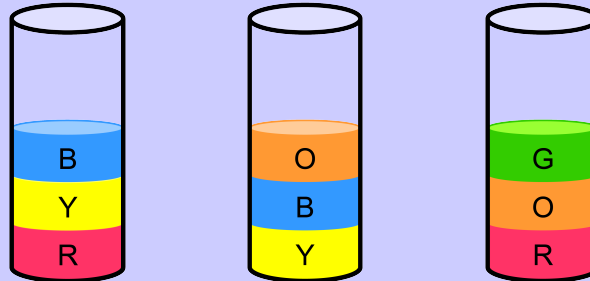
Each different liquid is a different colour and marked with a different letter.
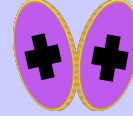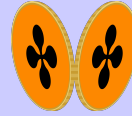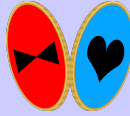
Question

If Beaver Currie used the same liquids in a fourth experiment, which of the following might be the result?
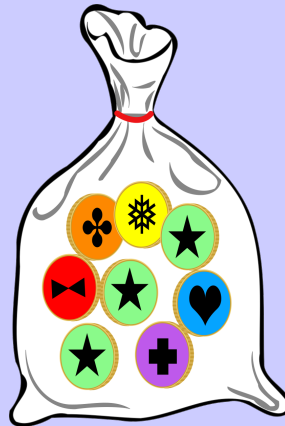
(A)   (B)   (C)   (D)

Coin Bag

Story

In Saoirse's country there are four different types of coins. Some coins are the same on both sides, and some are not. The images below show both sides of each type of coin.
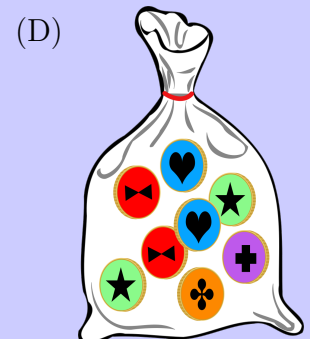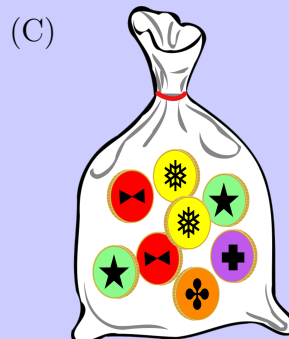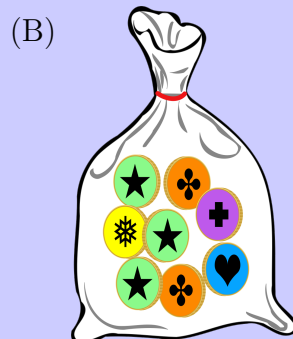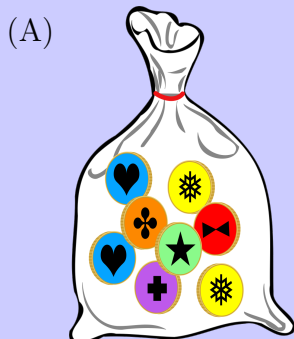

Saoirse has the following bag of coins:

Then the bag is shaken and the coins in the bag move around.

Question

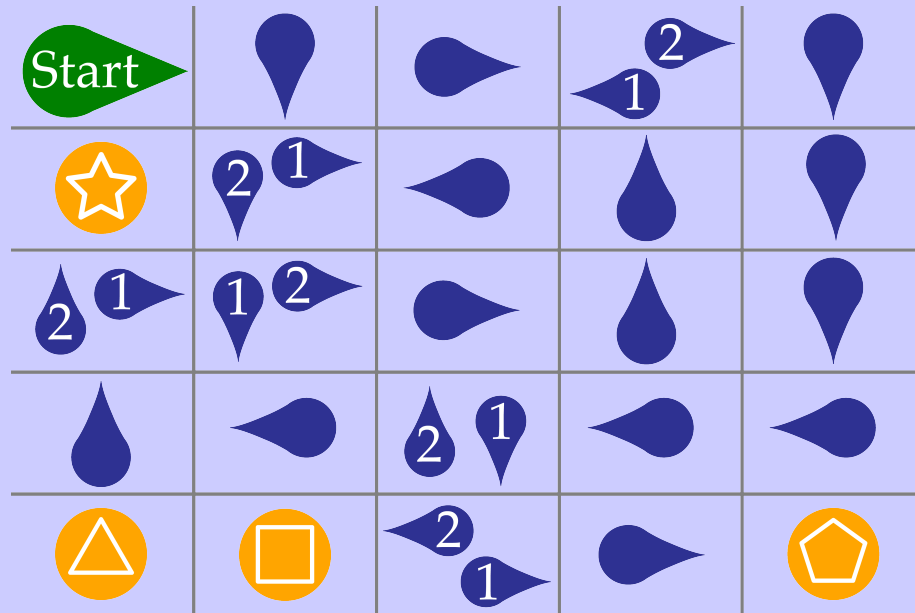Which of the following could be Saoirse's bag of coins after it was shaken?

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

Part C

Treasure Hunt

You find the following 5-by-5 treasure map created by pirates. Treasure is hidden at exactly one of the four locations marked by an orange circle.

To find the treasure, you begin at the top left. Then you continually move either up, down, left or right from location to location. When you reach a raindrop symbol, the pointed end of the symbol indicates which direction to move next. For example, indicates your next move should be to the left.

Some locations contain two raindrop symbols. When this happens, the first time you reach such a location, follow the raindrop labelled with the number 1, and the second time you reach that location, follow the raindrop labelled with the number 2.

The first location you reach marked by an orange circle is where the treasure is hidden.

Question

Which symbol marks where the treasure is hidden?

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

Unlock the Crown

Story

A crown 👑 is locked in one of 15 drawers as shown.

There is a keyhole at the top of each drawer. To open the drawer, you must insert an object with the same shape as the keyhole. For example, for the keyhole ♦ on the top left drawer, you must insert an object shaped like a diamond.

Each drawer contains one object as indicated on the front of the drawer below the keyhole. For example, the top left drawer contains an object shaped like a heart ❤.
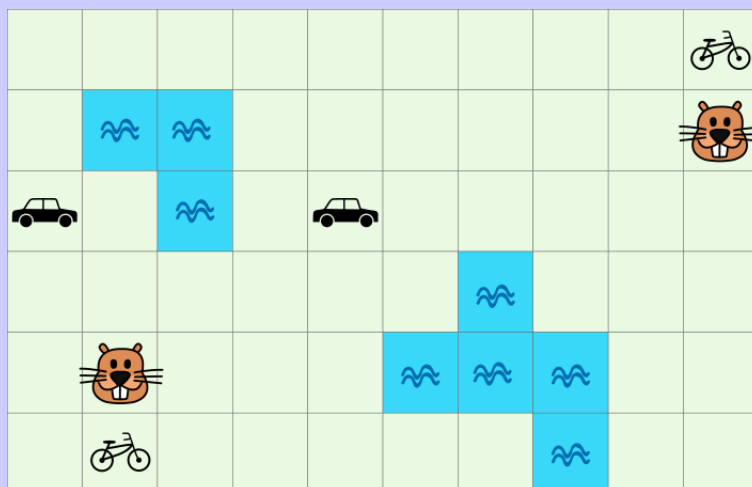
Question

Bella has an object shaped like a circle. What is the minimum number of drawers that Bella needs to open in order to retrieve the crown?

(A) 3

(B) 4

(C) 5

(D) 6

Meet in the City

Story

Two beavers are planning on meeting somewhere in their city. Their current locations are shown on the following map of the city along with the locations of water 〜, two bikes 🚲, and two cars 🚗.

The beavers can only move from one square on the map to another square that is horizontally or vertically adjacent to their square and does not contain water.

They can move 1 square in 1 minute when walking. However, if they reach a square with a bike or a car, then they can use it to travel faster. They can move 1 square in 30 seconds while on a bike, and they can move 1 square in 12 seconds while in a car.

Question

What is the least amount of time needed for the beavers to meet on the same square together?

(A) 3 minutes and 48 seconds

(B) 4 minutes

(C) 4 minutes and 12 seconds

(D) 5 minutes

Missing Erasers

Story

Four students were helping their teacher clean up. While cleaning, one of the students hid the blackboard erasers. When the teacher realized that the erasers were missing, she asked the students, "Which one of you hid the erasers?" Each student answered as follows.

Amélie: "I didn't hide the erasers."

Benin: "Dahila didn't hide the erasers."

Cai: "Amélie hid the erasers."

Dahila: "Either Benin or Cai hid the erasers."
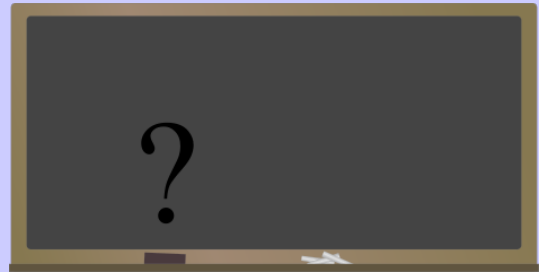
Only one of these answers was true.

Question

Which student hid the erasers?

(A) Amélie

(B) Benin

(C) Cai

(D) Dahila

Shapes

Story

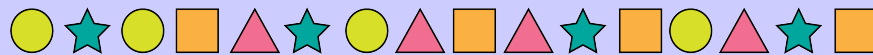Here is a line of shapes.

🔺 🟧 🟡 ⭐ 🟧 ⭐ ⭐ 🟡 🟧

The line has a run of stars of length 2. A *run* is an unbroken chain of identical shapes.

Ali likes to create long runs by changing shapes. For example, if Ali changes the middle square to a star in the line above, then he can create a longer run of length 4.

Question

Suppose Ali chooses and changes exactly 3 of the 16 shapes in the following line:

🟡 ⭐ 🟡 🟧 🔺 ⭐ 🟡 🔺 🟧 🔺 ⭐ 🟧 🟡 🔺 ⭐ 🟧

What is the length of the longest possible run that Ali can create?

(A) 4

(B) 5

(C) 6

(D) 7