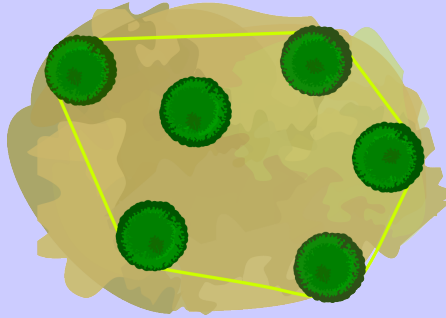# 2018 Beaver Computing Challenge (Grade 7 & 8)

Questions

Part A

Roped Trees

Story

Joni Beaver uses rope to mark groups of trees. The rope forms a very tight loop so that each tree either touches the rope or is entirely inside the loop. Below is an example where the rope touches exactly 5 trees when viewed from above.

Question

How many trees will the rope touch if the trees are arranged as follows (when viewed from above)?
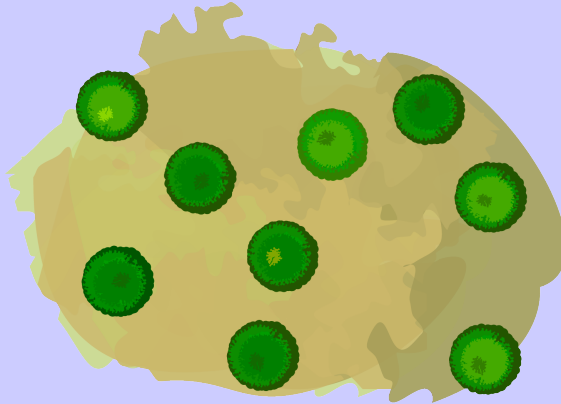
(A) 4

(B) 5

(C) 6

(D) 7

Rotation Game

Story

Beavers play a simple game. The game always begins with this starting position:

From this starting position, rotation instructions are followed. All the rotations are clockwise and one quarter of a complete turn. The possible instructions are:

- 1R – meaning rotate the squares one time,
- 2R – meaning rotate the squares two times,
- 3R – meaning rotate the squares three times.

For example, if the first instruction is 2R, the top-left square will be Yellow as shown below.

Question

From the starting position, what colours will the top-left square be after each of the instructions 1R, 2R, 2R, and 3R are followed in order?

(A) Red Green Blue Green Yellow

(B) Red Blue Green Blue Red

(C) Red Blue Yellow Red Green

(D) Red Red Yellow Red Blue

Beaver Graffiti

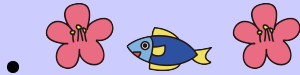**Story**

Beaver graffiti consists of three different symbols: 🐟 , 🌸 , and 🍃 .
Sequences of symbols are built using two steps:

1. One of the symbols is drawn once or twice.

2. One of the symbols is is drawn once to the left of the current sequence and once to the right of the current sequence.

Step 1 happens first and exactly one time. Step 2 may happen any number of times. Here are five examples:

- 🐟

- 🌸

- 🍃 🍃

- 🌸 🐟 🌸

- 🍃 🐟 🐟 🍃
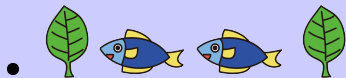
Which of the following is **not** an example of beaver graffiti?

(A)

(B)

(C)

(D)
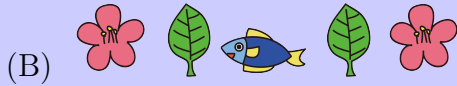
Computer Science Museum

Story

A museum has received statues of five famous computer scientists. However, there is only room to display one statue at a time. They must decide the order in which the statues will be displayed. They come up with the following rules:

- Turing before Berners-Lee
- Turing before Hopper
- Hopper before Lovelace
- Hopper before Gates
- Lovelace before Gates

Question

What is one order in which the statues could be displayed?

(A) Turing, Hopper, Lovelace, Gates, Berners-Lee

(B) Turing, Berners-Lee, Hopper, Gates, Lovelace

(C) Turing, Gates, Hopper, Lovelace, Berners-Lee

(D) Turing, Berners-Lee, Lovelace, Hopper, Gates

Balloons

Story

Mark goes to a birthday party. A room at the party is decorated with balloons in rows:

Row 1: **C B A E B A F A D**

Row 2: **C B A E A B F A D**

Row 3: **A D C E D A F A B**

Row 4: **A D C E B B F A C**
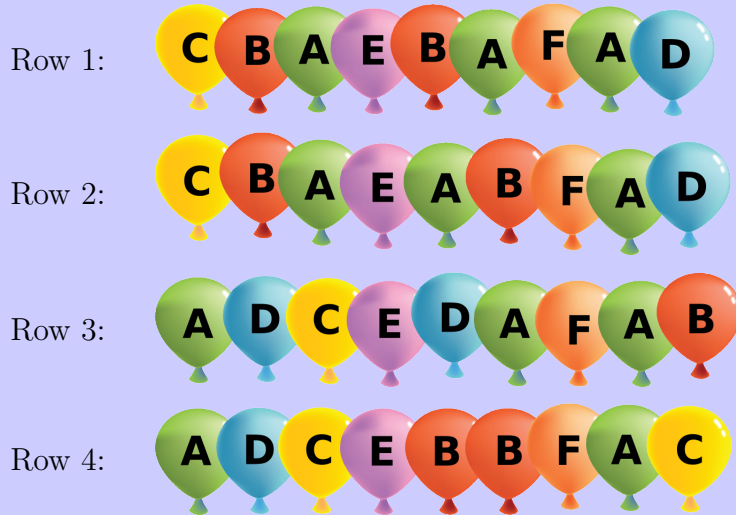
Mark can't see colours clearly. For him, yellow (C) looks the same as green (A), and blue (D) looks the same as red (B).

Question

Which two rows of balloons look the same to Mark?

(A) Row 1 and Row 4

(B) Row 2 and Row 4

(C) Row 1 and Row 2

(D) Row 1 and Row 3
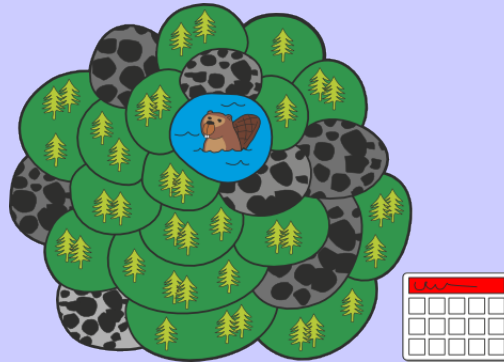
Part B

Beaver Lake

Beavers live in a valley surrounded by mountains. In the valley, there is a lake. The lake is surrounded by fields with either trees or stones.

Every day, beavers flood all those fields with trees that are next to the lake or flooded fields. Fields with stones are not flooded.

For example, after one day, three fields will be flooded, as shown above.

Question

After how many days in total will all the fields with trees be flooded?

(A) 4 days

(B) 5 days

(C) 6 days

(D) 7 days

Visiting Friends

Story

Livia wants to visit all of her friends in five villages using public transportation. She visits them in one journey, without visiting a village more than once, and she returns home at the end of her journey. The number of coins it costs to travel on the direct route between each pair of villages is shown below.
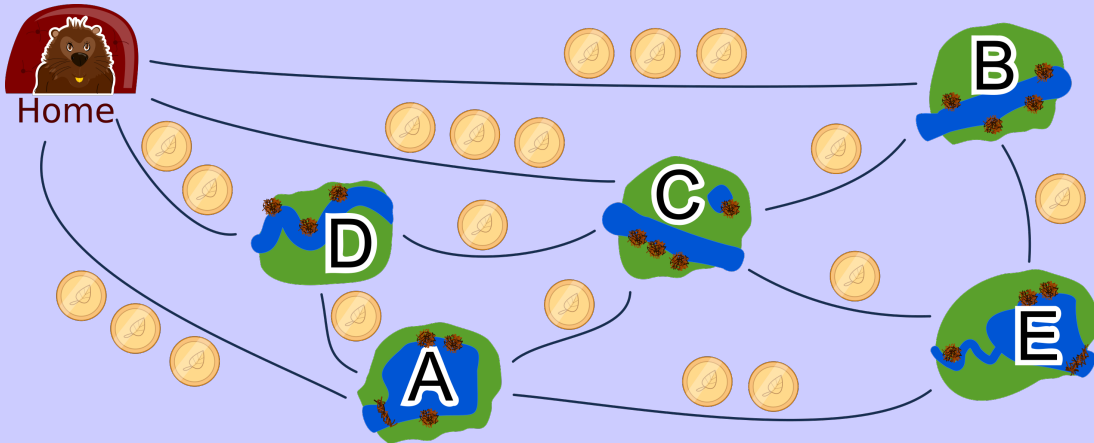
For example, it would cost Livia a total of 11 coins to visit villages in the order:

$$\text{Home} \rightarrow \text{B} \rightarrow \text{E} \rightarrow \text{A} \rightarrow \text{D} \rightarrow \text{C} \rightarrow \text{Home}.$$

Question

What is the least possible total cost for Livia's journey?

(A) 7 coins

(B) 8 coins

(C) 9 coins

(D) 10 coins

Connect the Islands

People of Kastoria use only one rule to decide where bridges are to be built:

> They choose one number called the *bridge number*. If the sum of the populations of two islands is greater than the bridge number, a bridge is built between the islands. Otherwise, a bridge is not built between the two islands.

The six islands of Kastoria and their populations are shown below. The bridges built using the above rule are also shown.
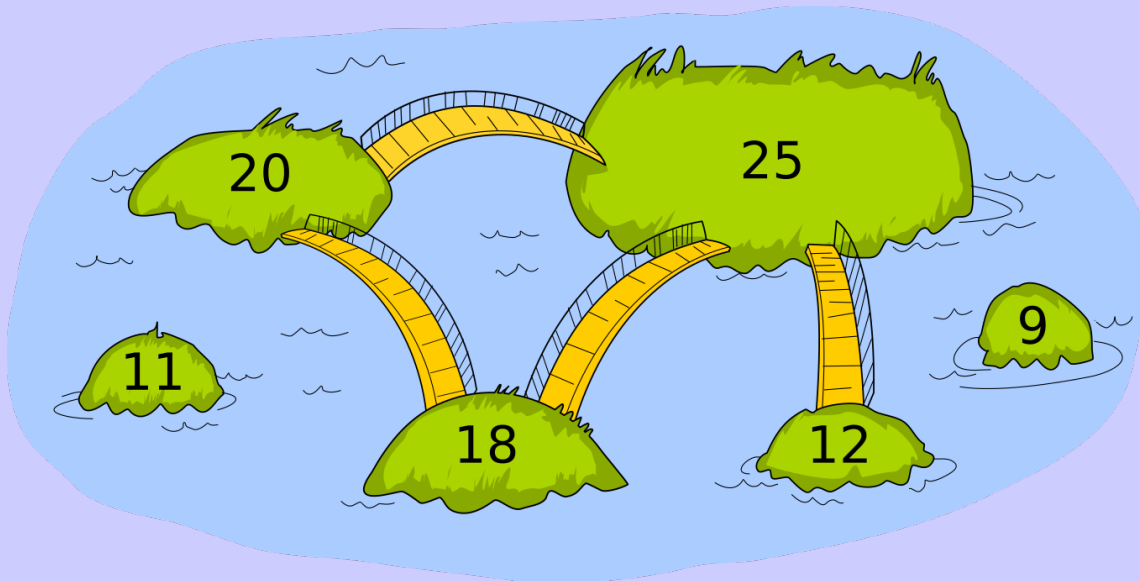
Question

What bridge number was chosen?

(A) 34

(B) 35

(C) 36

(D) 37

Outdoor Soccer

Story

Mr. Castor is planning for his class to play soccer outside in the schoolyard. Several issues must be considered:

- The students can only play soccer on a sunny day.

- An outdoor activity is only allowed when the wind speed is lower than 20 km/h.

- The schoolyard cannot be used if another class has already reserved it on that day.

Mr. Castor has the following related information:

Weather Forecast

	Monday	Tuesday	Wednesday	Thursday	Friday
Weather Condition	☀	☂	☂	☀	☀
Wind Speed	5 km/h	24 km/h	13 km/h	7 km/h	40 km/h

Schoolyard Reservations

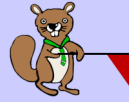|		Monday	Tuesday	Wednesday	Thursday	Friday
Class		Ms. Garcia	-	-	-	-

Question

What day should Mr. Castor plan to play soccer on?

(A) Tuesday

(B) Wednesday

(C) Thursday

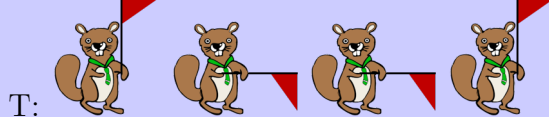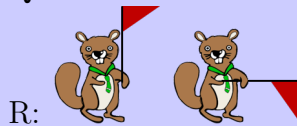(D) Friday

Flag Codes

Story
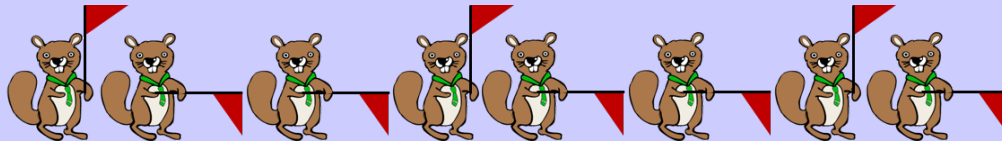
Beavers communicate by holding flags held horizontally or vertically .

Five different letters (P, Q, R, S, and T) can be sent by using the following codes:

P:

Q:

R:

S:

T:

Sequences of letters are sent using the codes for each letter in the sequence in order. Beaver Adanma sends this:

Question

What sequence of letters could Adanma be sending?

(A) QPPTP

(B) TSQ

(C) RPQSR

(D) RPSP

14

Part C

Longest Word Chain

Story

Beavers play a word chain game. One beaver starts by saying a word. The other beaver must say a different word which begins with the last letter of the previous word. Then the first beaver says another word (which was not said yet) using this same rule, and so on. If a beaver is unable to say a new word, that beaver loses the game. These beavers do not know many words. In fact, they can draw their entire vocabulary like this:
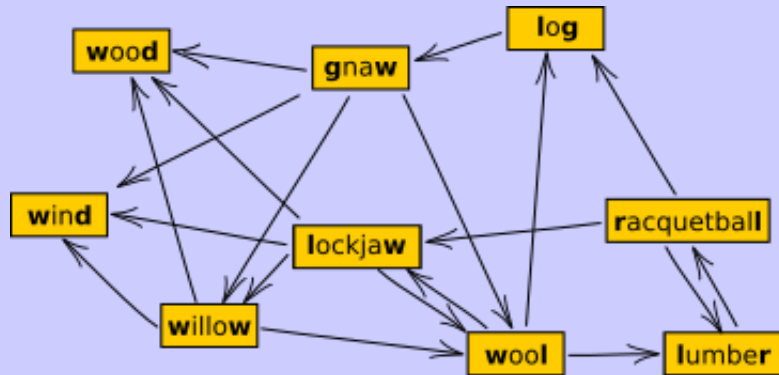
Notice that an arrow out of a word points at the next possible word(s) that can be said.

Question

What is the largest possible number of words that can be said in one game?

(A) 6

(B) 7

(C) 8

(D) 9

Timetabling

Story

Bebras Tech offers the following evening classes:

- Computing (C),
- Geography (G),
- Language (L),
- Math (M), and
- Science (S).

Three beavers would like to sign up for these courses:

- Xavier wants to take C, L, and M;
- Yvette wants to take C, G, and S;
- Zoey wants to take L, M, and S.

Bebras Tech wants to squeeze these courses into as few evenings as possible such that:

- each course is offered on exactly one evening, and
- beavers can take at most one course per evening.

Question

What is the least number of evenings needed for Bebras Tech to schedule these courses?

(A) 2

(B) 3

(C) 4

(D) 5

Bulbs

An amateur electrician connected 6 bulbs (numbered 1, 2, 3, 4, 5, and 6) to 6 switches (labelled A, B, C, D, E, and F). Each switch operates exactly one bulb but nobody knows which one. Each switch can be either up or down, but we don't know which position corresponds to the bulb being on and which position corresponds to the bulb being off. To make matters worse, this could be different for different switches.

Four experiments were conducted to determine which switch is connected to which bulb. The results of these experiments including the position of the switches and on/off status of the bulbs are shown below.
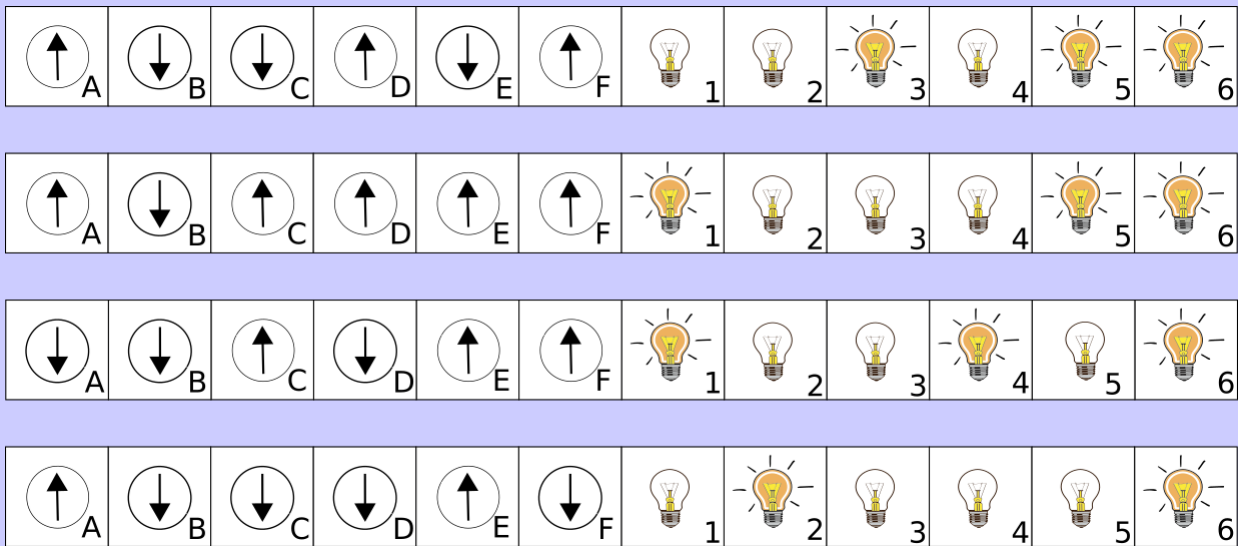
Question

Which switch is connected to which bulb?

(A) C → 1, E → 2, D → 3, A → 4, F → 5, B → 6

(B) C → 1, F → 2, E → 3, A → 4, D → 5, B → 6

(C) C → 1, F → 2, D → 3, E → 4, A → 5, B → 6

(D) C → 1, F → 2, B → 3, A → 4, D → 5, B → 6

Nesting Dolls

Story

Wooden toy dolls have different widths and heights. They are hollow and can be separated into two parts. This means that a doll can be nested inside any other doll that is both wider and higher.

For example, a doll with width 5 and height 5 fits inside a doll with width 10 and height 10, which in turn fits inside a doll with width 20 and height 20. After this, only one doll is visible.
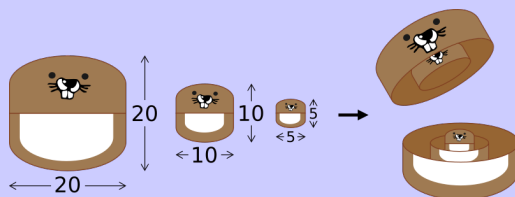
On the other hand, a doll with width 20 and height 20 cannot fit inside a doll with width 25 and height 15. Also, a doll with width 25 and height 15 cannot fit inside a doll with width 20 and height 20. So, if these are the only two dolls, they will both always be visible.
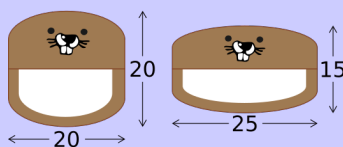
Ian has the following collection of dolls and starts fitting them inside each other.
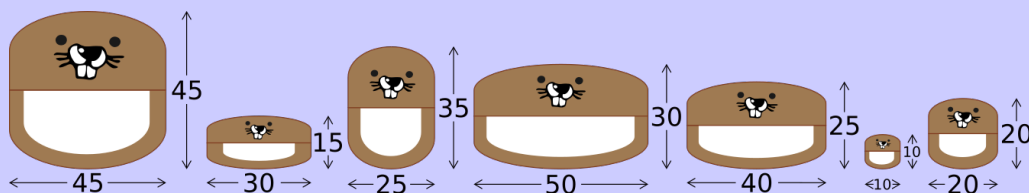
Question

What is the fewest possible number of dolls that are visible after Ian is done?

(A) 1

(B) 2

(C) 3

(D) 4

Park Walk

Story

A map of a park is shown below. Green circles represent trees and brown lines represent paths. Trees are labelled with letters but note that some letters are used to label more than one tree.
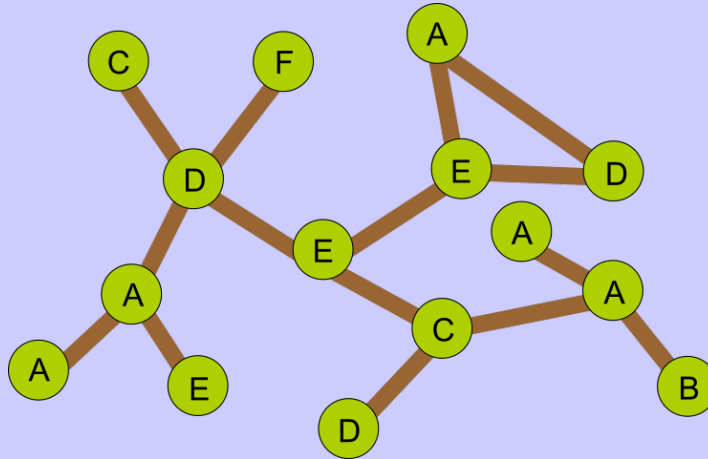
Two families walk in the park along paths from tree to tree. Each time they visit a different tree, they write down the letter of that tree, even if they have visited the tree before.

- The Bea family writes down B A A A C E D E E D A.

- The Ver family writes down F D C D A E A D E D A.

Both families started walking at the same time and the amount of time it took them to walk along any path from one tree to another was constant.

Question

How many times did the two families meet at a tree?

(A) one time

(B) two times

(C) three times

(D) never