UNIVERSITY OF WATERLOO

The CENTRE for EDUCATION in MATHEMATICS and COMPUTING

2024 Beaver Computing Challenge (Grades 7 & 8)

Questions

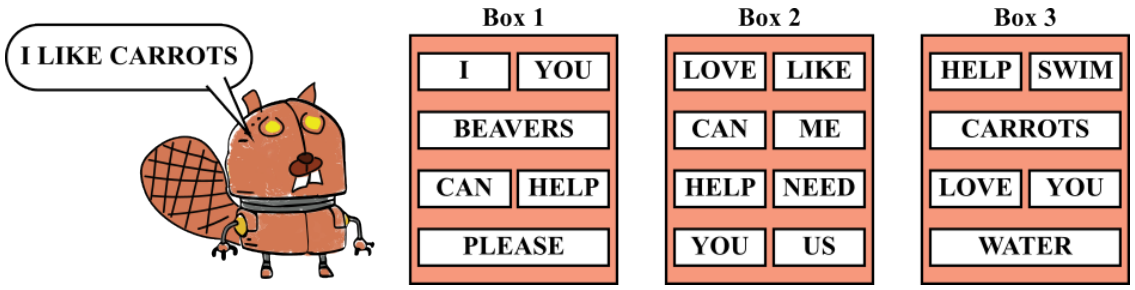
Part A

Beaver Robot

Story

Beaver Robot can say sentences containing exactly 3 words.

- The first word must be chosen from Box 1.
- The second word must be chosen from Box 2.
- The third word must be chosen from Box 3.



Question

Which sentence below **cannot** be said by Beaver Robot?

(A) CAN YOU HELP

(B) BEAVERS CAN SWIM

(C) I LOVE YOU

(D) YOU NEED ME

Digital Image

Story

Ana created the following digital image.

She did her work in stages. For the last three stages, she added the following parts of the image as shown in order from left to right.

Now Ana has decided to undo some of her work, removing the parts added in the last three stages.

Question

Which of the following options shows the resulting picture?

(A) 

(B) 

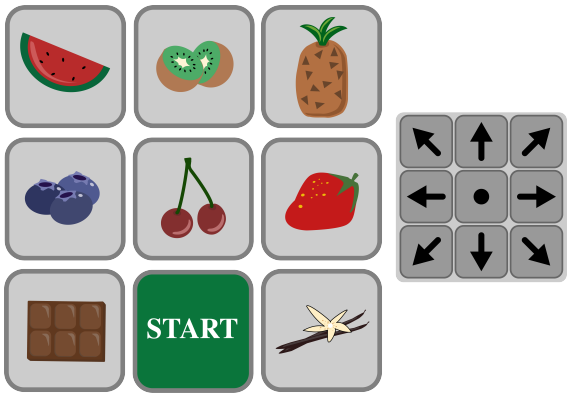
(C) 

(D) 

Ice Cream Shop

Story

A cool new ice cream shop with a self-service machine has opened! To place an order, you push the arrow buttons to move the robot to the square with the flavour you want and then press • to add a scoop to the cone. After you have chosen three scoops, your order is prepared.



The robot always starts an order from the START square. For example, from left to right the sequence

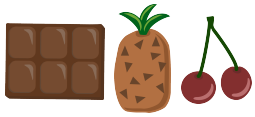
makes a cone where the flavours from bottom to top are  .

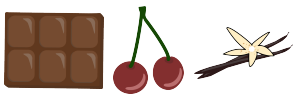
Question

What flavours will be on the ice cream cone, from bottom to top, if the order uses the following sequence, from left to right?

(A) 

(C) 

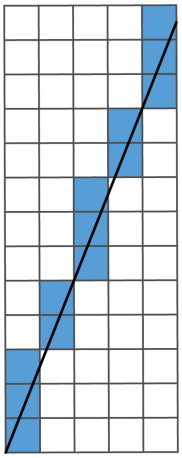
(B) 

(D) 

Line Drawing

Story

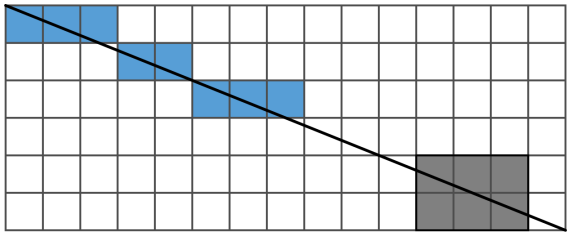
When Pixel tries to draw lines on graph paper, she does this by colouring in blocks of tiny squares. Each of these squares intersects the line she is trying to draw. This means she cannot always draw perfectly straight lines. An example is shown where the blocks of squares Pixel coloured do not look exactly the same as the straight diagonal line that she is trying to draw.

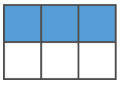


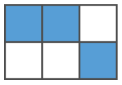
A pattern is formed by the shapes and sizes of blocks of squares that Pixel colours. This pattern repeats every time the line she is trying to draw passes through a corner of a square. In the example, it is always 3 vertical blocks followed by 2 vertical blocks.

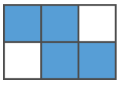
Question

Pixel has started to draw the diagonal line shown and coloured in the first 8 squares as shown. If she continues drawing the line, then how will she colour the 2×3 block of squares shown in grey?



(A) 

(B) 

(C) 

(D) 

Magic Garden

Story

In a magic garden, flowers can change during the night. If there is a group of at least two flowers of the same type directly beside each other, then that group of flowers transforms into a group of different flowers as follows:

- Groups of  transform to  .
- Groups of  transform to  .
- Groups of  transform to  .

A flower never changes more than once per night.

This is what the magic garden looks like one morning.

Question

What will the magic garden look like after four nights have passed?

(A) 

(B) 

(C) 

(D) 

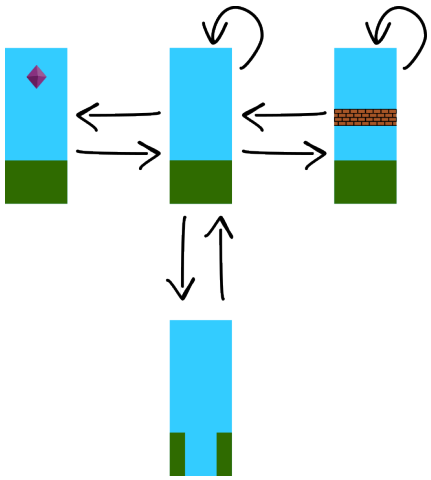
Part B

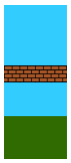
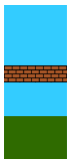
Superbebras

Story

In the computer game Superbebras, the background and the illusion of motion is created using a sequence of tiles.

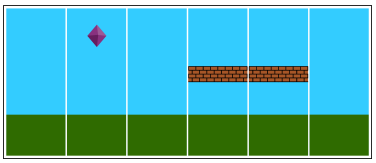
Tiles added to the right end of the sequence are chosen according to the rules in the diagram below. Arrows point directly from each tile to the only tile(s) that can be added immediately to the right of it.

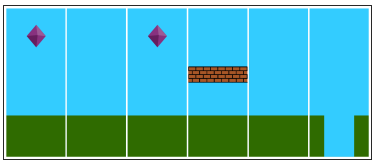


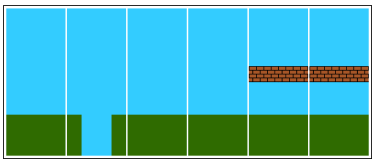
For example, a tile immediately to the right of the tile  can only be tile  or  .

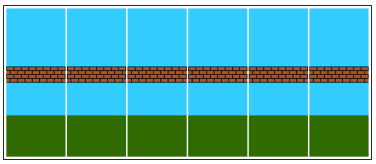
Question

Which of the following images is **not** a possible Superbebras background?

(A) 

(B) 

(C) 

(D) 

Logs and Branches

Story

Sequences of logs and branches are represented by codes, using the following two steps.

1. Moving from left to right in a sequence, each log or branch is represented by the number of branches to the right of it in the sequence. This gives a sequence of numbers.
2. Then each even number in this sequence is replaced with a 0 and each odd number with a 1, to obtain its code.

Let's look at the following sequence as an example.

- The leftmost log has 3 branches to the right of it, so will be represented with a 3.
- The next branch has 2 branches to the right of it, so will be represented with a 2.
- The next branch has 1 branch to the right of it, so will be represented with a 1.

Continuing this process gives the sequence 3, 2, 1, 1, 1, 0. Its code is **101110**.

Question

Which of the following sequences of logs and branches is represented by the code **11101000**?

(A) 

(B) 

(C) 

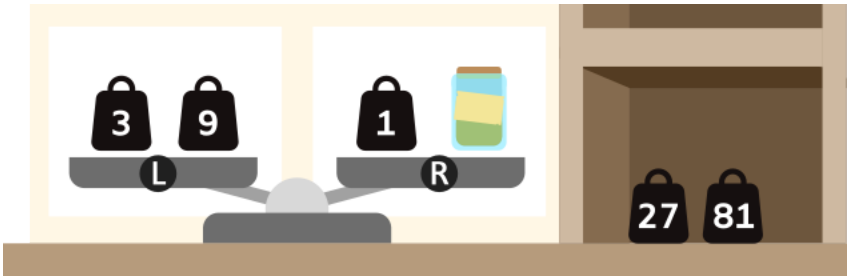
(D) 

Spices

Story

Genaro uses his balance scale to weigh the spices he sells. He uses only the following 5 weights on his scale: 1 gram, 3 grams, 9 grams, 27 grams, and 81 grams.

Genaro always puts the spices on the right side of the scale. To measure 11 grams of spices, he places his weights as shown.



To help train new employees, Genaro creates codes for different amounts of spices. In his code, L means the weight is placed on the left side, R means the weight is placed on the right side, and O means the weight is placed off the scale. Genaro writes each code in order from the smallest weight to the largest weight. For example, the code for 11 grams of spices is $RLLOO$, as shown.

Weight (grams)	1	3	9	27	81
Position	R	L	L	O	O

Question

Among the following four codes, which measures the heaviest amount of spices?

(A) $LORLO$

(B) $RRRRL$

(C) $LRLLO$

(D) $OLRLO$

Online Class

Story

Nine students are sitting side by side in one row in the library while their teacher conducts an online lesson from her home. The teacher sees the class from her laptop screen as shown.

Each student is using a different computer, but the teacher's screen shows who each student is sitting next to.

Question

Which student is sitting in the middle (5th position) of the row in the library?

(A) Raul

(B) Lee

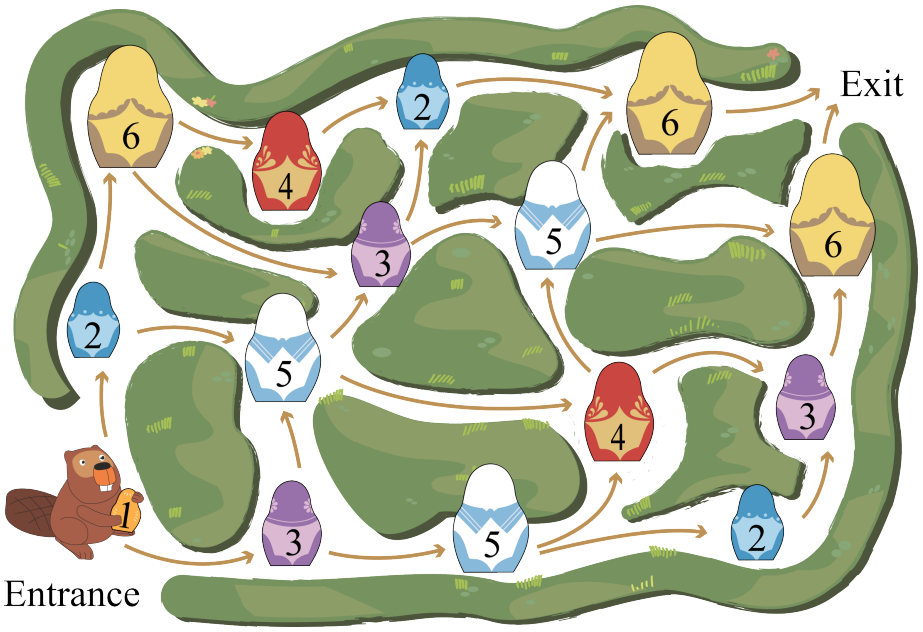
(C) Busara

(D) Hannah

Collecting Dolls

Story

Beaver Deana enters the maze below carrying a doll of size 1. She then goes through the maze and collects dolls of different sizes, placing smaller dolls inside larger dolls.



Deana follows the arrows and obeys the following rule whenever she encounters a doll.

- If the doll she encounters is bigger than the biggest doll she already has, she can choose to either take the doll and put her dolls inside of it, or leave it behind.
- Otherwise, if the doll she encounters is the same size or smaller than the biggest doll she already has, she must leave the doll behind.

Question

What is the maximum number of dolls that Deana can collect, including the size 1 doll, by the time she reaches the exit of the maze?

(A) 3

(B) 4

(C) 5

(D) 6

Part C

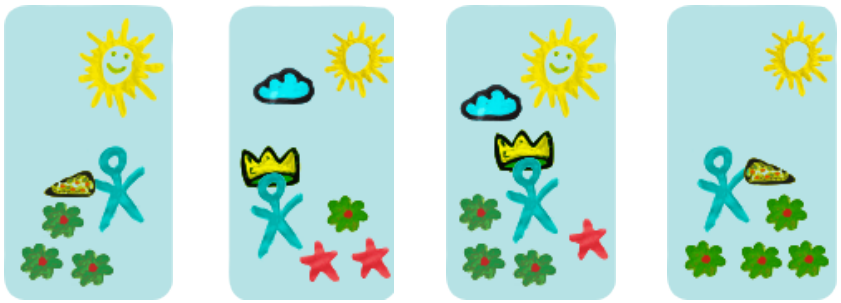
Card Art

Story

Manas creates drawings by combining some of the following images:

cloud crown flower person pizza star sun smiley sun

Manas draws on cards following one, single, secret rule. He has created four cards that obey this rule:



Anil observes the cards and creates a new card, but it does not obey the rule.

Question

Which of the following could be the secret rule?

(A) If there is a cloud on the card, then there are no flowers on the card.

(B) There must either be a star on the card, or there is a person holding pizza on the card.

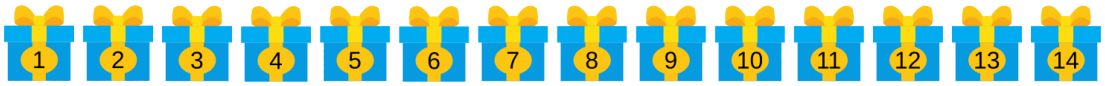
(C) If there is a person holding pizza on the card, then there is no crown on the card.

(D) There must either be a smiley sun on the card, or a cloud on the card.

Gifts

Story

Bernard has wrapped gifts for the 14 students in his class, and numbered the gifts from 1 to 14.



Bernard knows the weight of each gift. After wrapping each gift, Bernard realized that he accidentally dropped his phone in one of the boxes. In order to avoid unwrapping many gifts, he plans to do the following:

1. Divide the 14 gifts into 2 piles, with the smallest 7 gift numbers in the first pile and the largest 7 gift numbers in the second pile.
2. Weigh the first pile. If it is heavier than expected, retain the first pile. Otherwise retain the second pile.
3. Divide the retained pile into 2 piles containing as close to the same number of gifts as possible. If there is an odd number of gifts, the first pile will have one fewer gift than the second pile. The smallest gift numbers are in the first pile.
4. Repeat Steps 2 and 3 until the retained pile has a single gift that contains the phone. Open that gift to retrieve the phone.

Question

In which of the following situations would Bernard weigh the fewest number of piles?

(A) The phone is in gift number 3.

(B) The phone is in gift number 13.

(C) The phone is in gift number 8.

(D) The phone is in gift number 6.

Beaver Travels

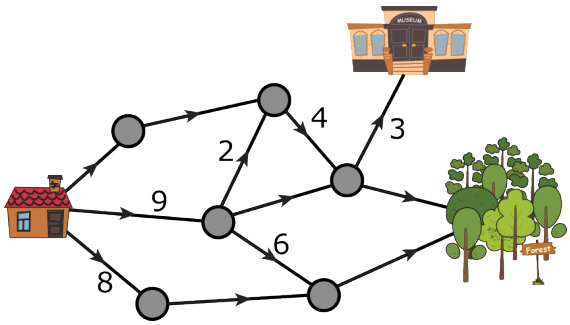
Story

A group of beavers left their house  .

Some of them went to the museum  , and the rest of them went to the forest  .

Beavers documented their various travels in the map below. Each circle is a place where beavers could pass through, and the lines between them are the paths they could take. Each path is labelled with an arrow indicating the direction the beavers took on that path, and also a number indicating the number of beavers that took that path. For example, three beavers took the path to the museum.

Unfortunately, some documentation is missing, so some paths are missing their label.



Question

How many beavers went to the forest?

(A) 16

(B) 11

(C) 18

(D) 14

Seashell Game

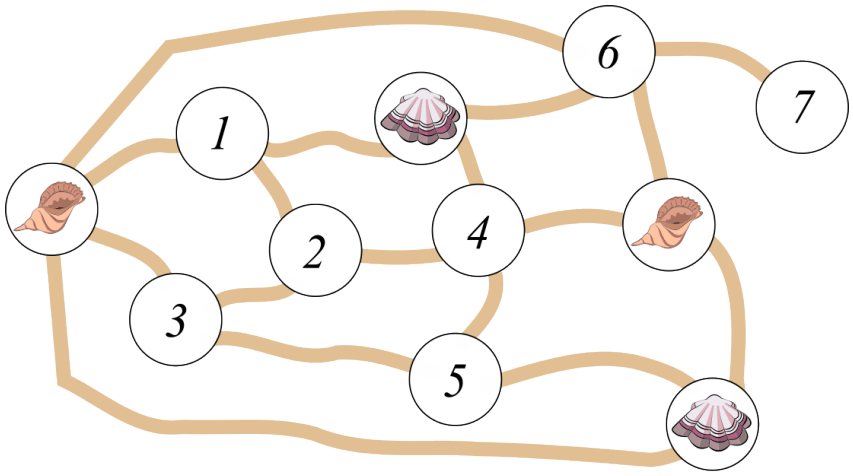
Story

Quinn and Evan are playing a game on the beach involving shells, holes, and lines in the sand.

To play the game, they take turns placing new shells in empty holes, some of which are connected by lines. The first person to have two of their shells placed in holes directly connected by a line loses the game.

Quinn plays with one type of shell:  , and Evan plays with another type of shell:  .

The game has started and each player has completed two turns. The placement of these four shells are as shown, and the remaining empty holes are numbered 1 through 7.



Question

It's now Quinn's turn. In which empty hole should Quinn place her shell if she wants to guarantee a win in the game?

(A) 1

(B) 2

(C) 5

(D) 7

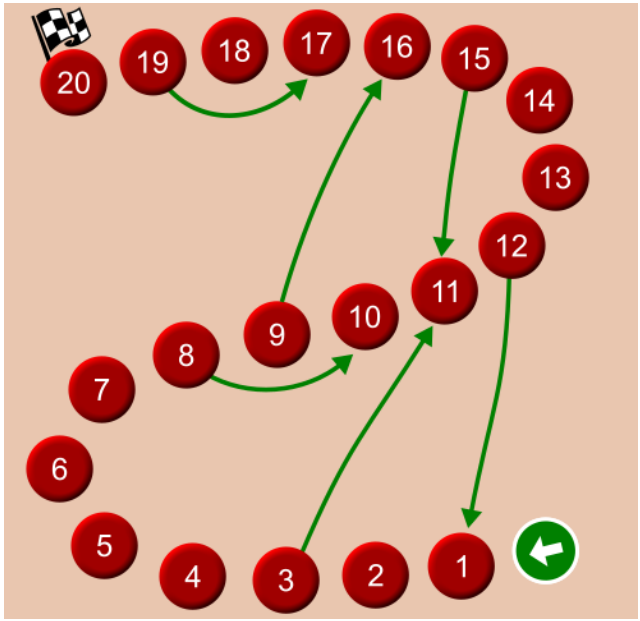
Disappearing Arrows

Story

Fleas A, B, C, and D start a race, in that order, from position 1 in the picture shown. They continue to take turns in this order $(A, B, C, D, A, B, \ldots)$ and follow two rules:

1. On their turn, a flea will jump one position forward.
2. Arrows provide a one time short cut. If a flea jumps to a position that has an arrow leading from it, it immediately jumps to the position the arrow is pointing to. The arrow then disappears so that no other flea can use that arrow.

It is possible for more than one flea to be at the same position at the same time.



Question

Which flea will finish first?

(A) A

(B) B

(C) C

(D) D