



UNIVERSITY OF
WATERLOO



The CENTRE for EDUCATION in
MATHEMATICS and COMPUTING



2023
*Beaver
Computing
Challenge
(Grades 5 & 6)*

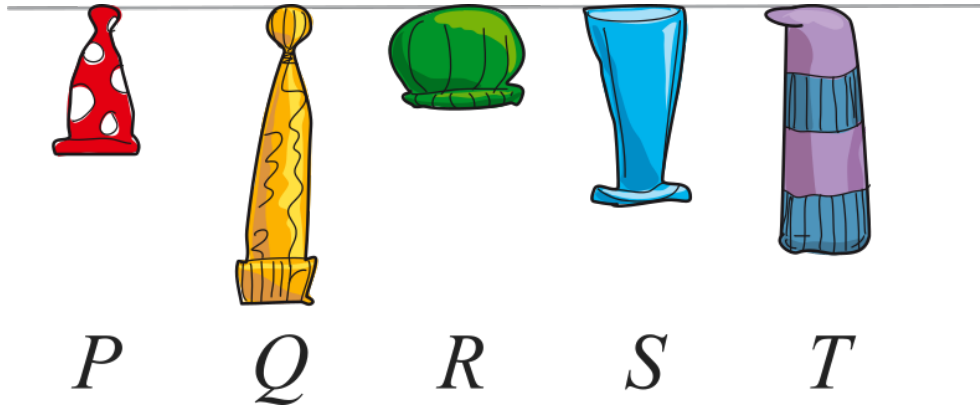
Questions

Part A

Beaver Hats

Story

Five hats are hanging as shown.



Question

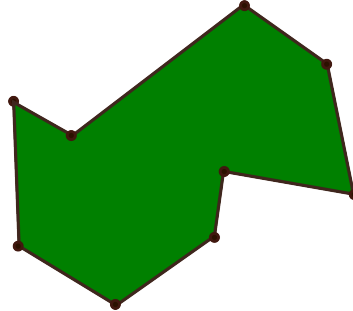
In what order should the hats be rehung so that they get taller as you move left to right?

- (A) R, P, S, T, Q
- (B) Q, S, T, P, R
- (C) R, P, T, S, Q
- (D) T, Q, S, P, R

Flower Garden

Story

Beaver Bai has a garden with 9 fence posts around the edge, as shown.

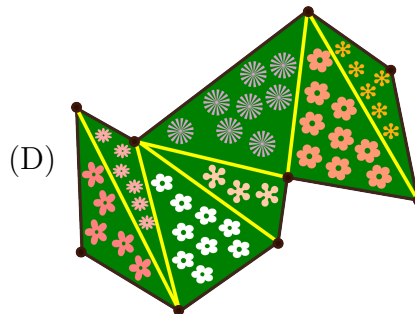
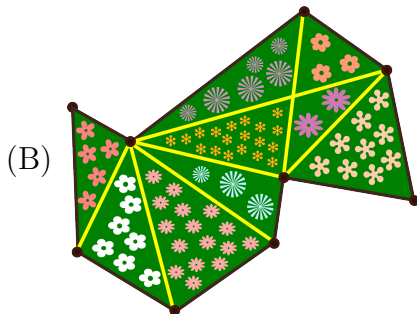
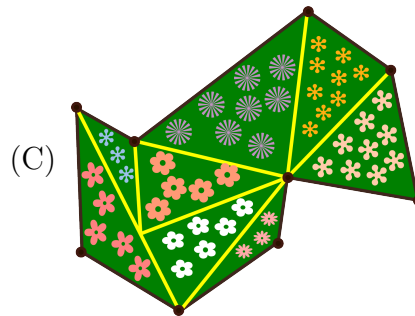
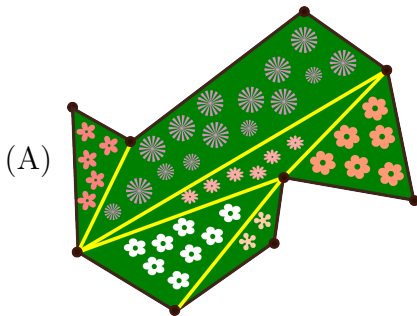


He uses yellow ropes to divide the garden into smaller sections, according to the following rules:

- Each section must be in the shape of a triangle.
- One rope cannot cross another rope.
- Each end of a rope must be attached to a fence post.




Question

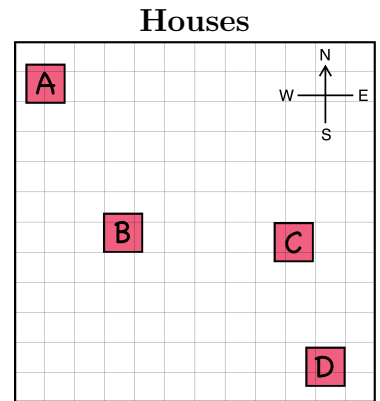
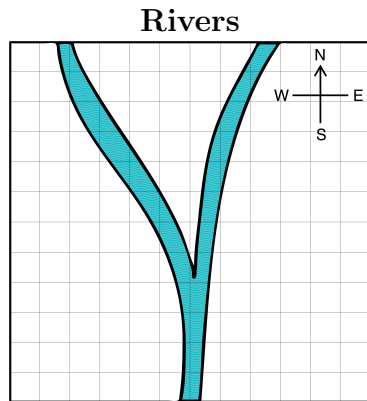
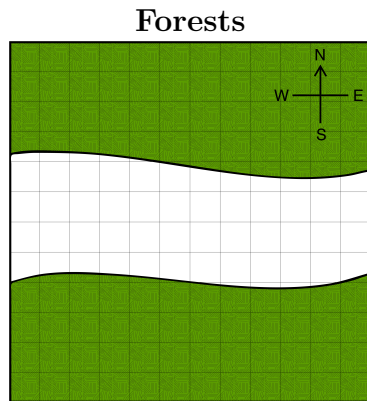
Which of the following gardens below could Bai have made?



Karla's House

Story

Karla has three maps that all show exactly the same region. One map shows the forests , one shows the rivers , and one shows the houses . Karla's house is in the forest, touches the bank of the river, and is House A, B, C, or D.



Question

Which house is Karla's house?

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

Umbrella

Story

This is a view of Andrew's umbrella from above. The umbrella has 10 sections, each with a different design.



Question

Which of the following images shows a possible side view of Andrew's umbrella?



Part B

Hamburger Shop

Story

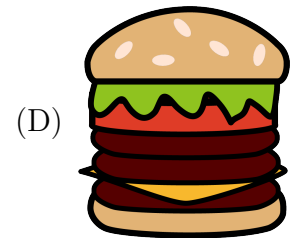
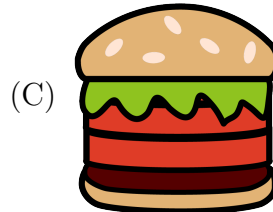
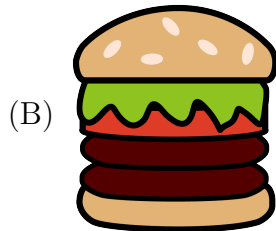
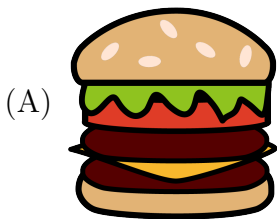
Masahiro made a hamburger for a customer, but the customer changed their mind several times while giving their order.

Masahiro built the hamburger in the order shown from left to right, always putting new items on top. The **X** symbol means that the customer changed their mind about the most recently added item, so Masahiro removed the item on top.



Question

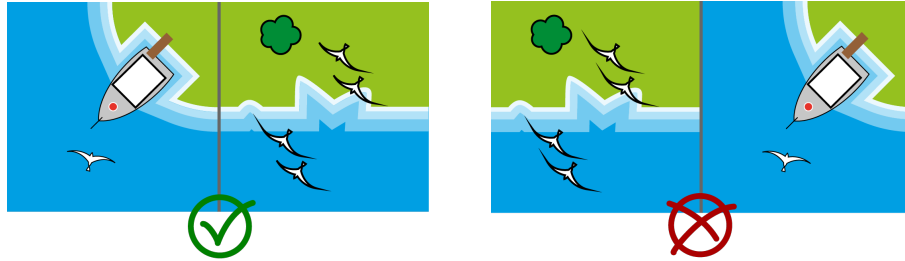
Which of the following hamburgers did Masahiro make?



Tile Land

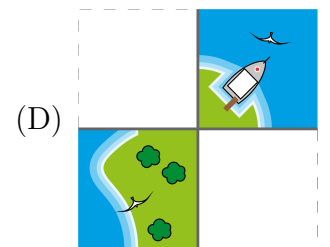
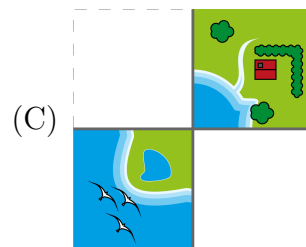
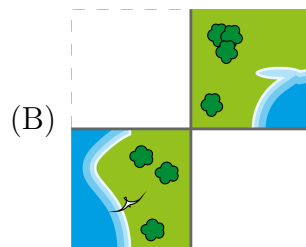
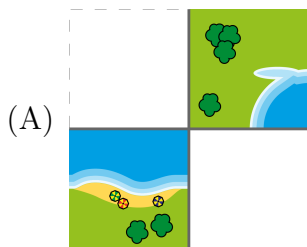
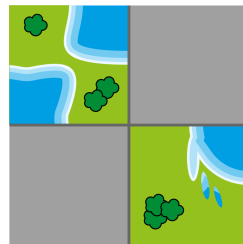
Story

Tiles that show blue areas of water and green areas of land are placed together to create landscapes. Tiles must be placed so that when tiles share an edge, land always touches land and water always touches water. For example, two tiles may be placed as shown on the left, but not as shown on the right:



Question

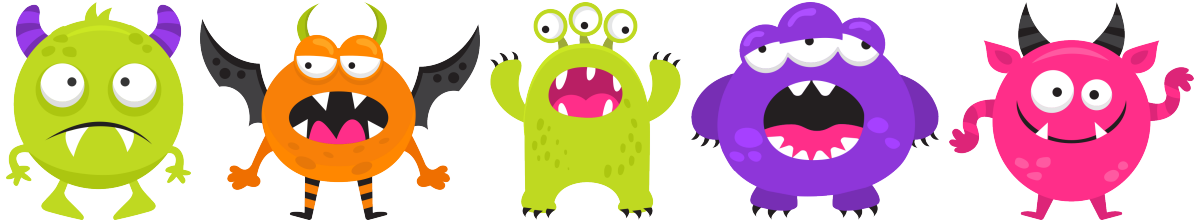
If the following two tiles have been placed as shown, which tiles can be placed in the grey areas?



Riccas

Story

Evren is trying to learn what a Ricca looks like. Evren studies photos of the following five Riccas and makes some notes that **accurately** describe what she sees.



Evren is then shown this sixth photo of a Ricca and realizes one of her notes is **definitely wrong**:



Question

Which one of Evren's notes about Riccas is **definitely wrong**?

- (A) Riccas always have teeth.
- (B) Riccas sometimes have wings.
- (C) Riccas have either horns or three eyes, but not both.
- (D) Riccas have the same number of arms as legs.

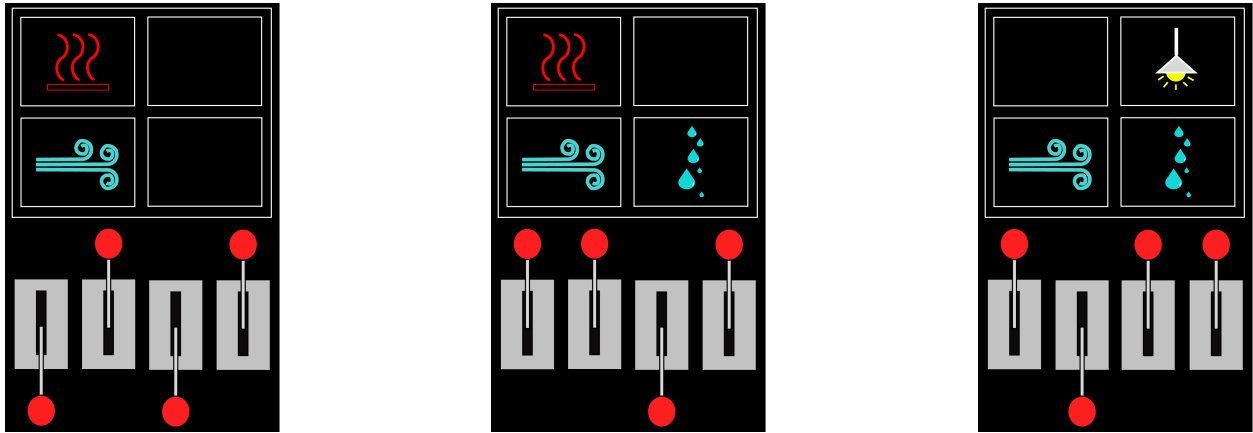
Levers

Story

Jacinta's new helicopter has a control panel with four levers that each control a different system.

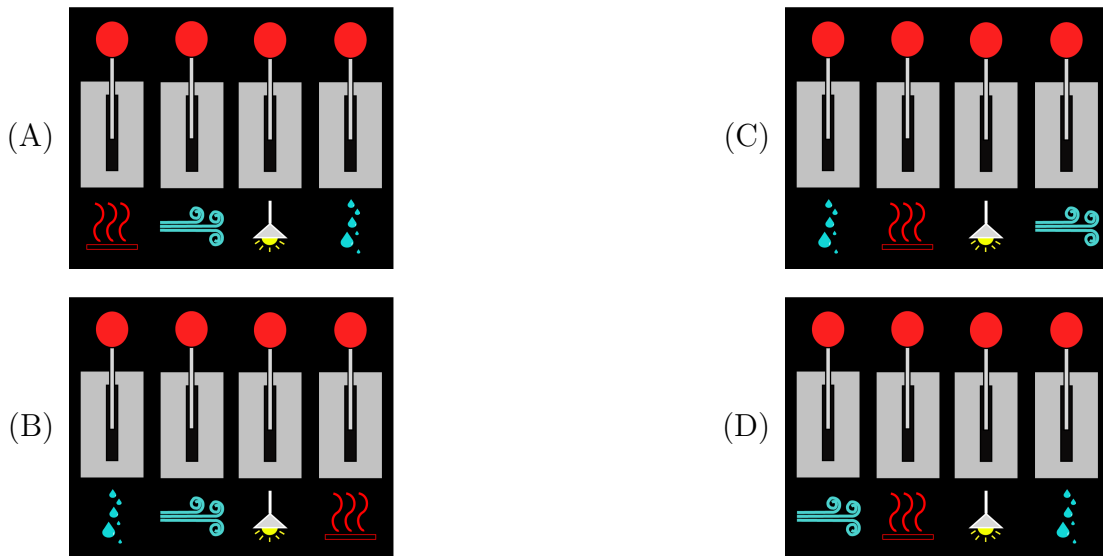
The labels on the levers are missing, and Jacinta was told that the system was wired in a confusing way so she doesn't know which lever controls which system. All she knows is that putting a lever up turns one system and its indicator light on, and putting a lever down turns one system and its indicator light off.

The image shows which indicator lights are on for three different configurations of the levers.



Question

Which of the following correctly matches each lever to the system that it controls?



Part C

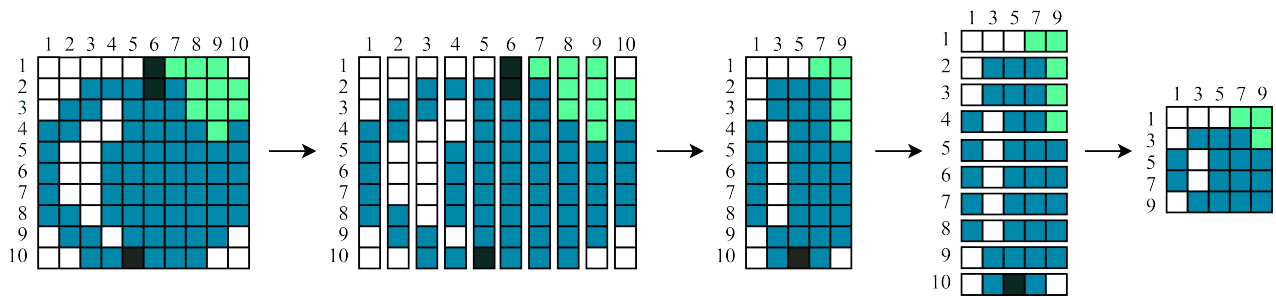
Snail Compress

Story

A beaver has a special technique to shrink images.

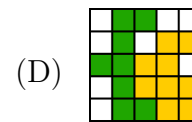
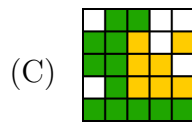
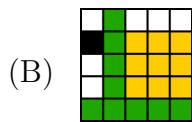
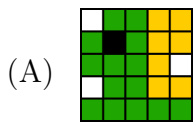
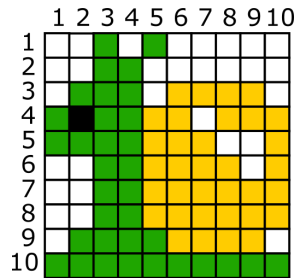
First, they cut the original image into 10 equally-sized vertical strips. Then, they remove the even-numbered strips and assemble the odd-numbered strips to create a new image.

Next, they cut the new image into 10 equally-sized horizontal strips. Then, they remove the even-numbered strips and assemble the odd-numbered strips to create a complete shrunken image. Here is an example:



Question

If the beaver uses this technique to shrink the image below, what is the complete shrunken image?

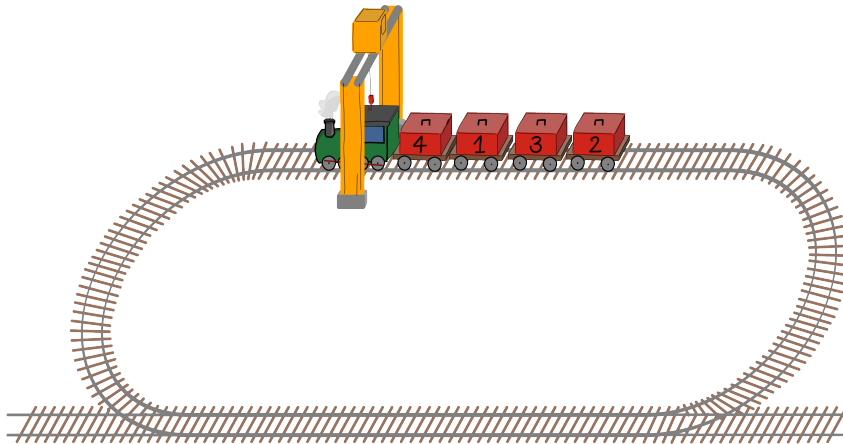


Unloading

Story

Freight trains consist of an engine followed by wagons, each holding a numbered box. The boxes must be unloaded in increasing order, starting from box 1. To unload a box, its wagon must be positioned directly below the crane.

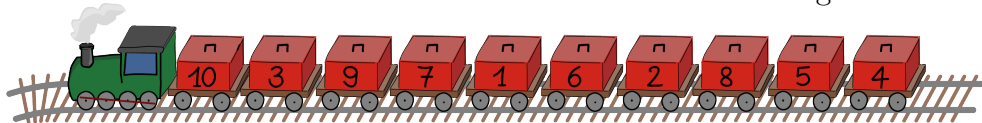
The crane is in a fixed position and trains can only move forward on a loop. Usually, this means that several rounds are needed to unload all the boxes. Each round begins with the engine directly under the crane.



In the example shown, the boxes have to be unloaded in the order 1, 2, 3, 4 and three rounds are needed to do this. In the first round of unloading, the train moves forward to skip box 4, unload box 1, skip box 3, and unload box 2. The train then goes around the track until the engine is under the crane again. In the second round of unloading, the train moves forward to skip box 4, skip the empty wagon, and unload box 3. The train then has to come back for a third round in order to unload box 4.

Question

How many rounds will be needed to unload all the boxes from the following train?

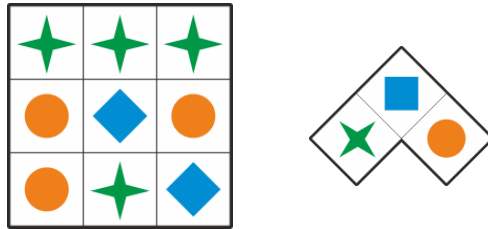


- (A) 5
- (B) 6
- (C) 7
- (D) 8

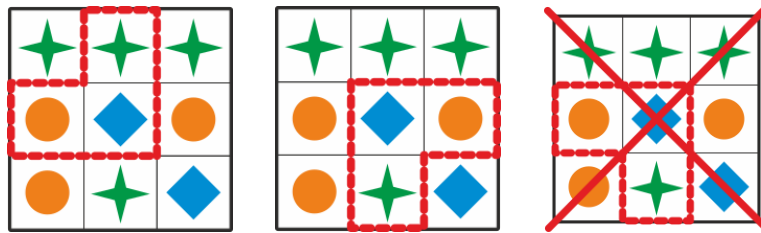
Decorated Mat

Story

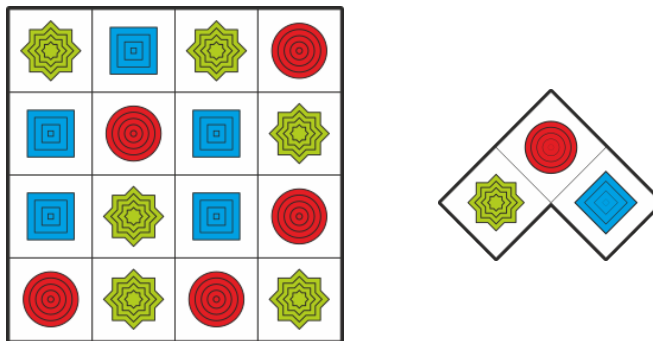
Ángel has the decorated mat shown below on the left and the pattern shown below on the right.



They determine that the pattern appears twice on the mat. Note that they may rotate the pattern but they may not turn it over.



Then Ángel looks at the new mat shown below on the left for the new pattern shown below on the right.



Question

How many times does this new pattern appear on the new mat if Ángel may rotate the pattern but not turn it over?

(A) 3

(B) 4

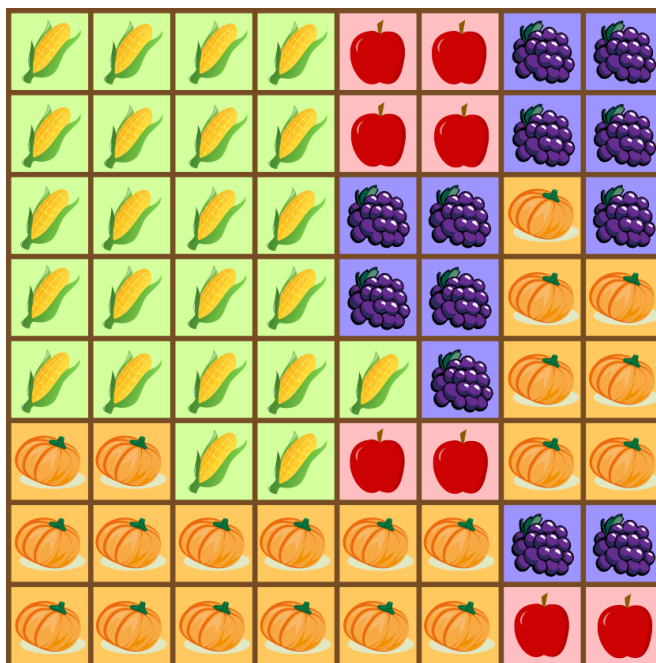
(C) 7

(D) 9

Sprinklers

Story

Plots of land on Qi's farm are arranged in an 8-by-8 grid. The 64 plots contain four types of plants as shown.



Ali wants to install sprinklers so that each plot is watered by exactly one sprinkler. All the plots watered by a single sprinkler must be the same type of plant. There are three types of sprinklers:

- small sprinklers that water the one plot in a 1-by-1 region,
- medium sprinklers that water the four plots in a 2-by-2 region, and
- large sprinklers that water the sixteen plots in a 4-by-4 region.

Question

What is the minimum number of sprinklers that Qi needs?

- (A) 19
- (B) 21
- (C) 23
- (D) 25