UNIVERSITY OF WATERLOO

The CENTRE for EDUCATION in MATHEMATICS and COMPUTING

2025 Beaver Computing Challenge (Grades 7 & 8)

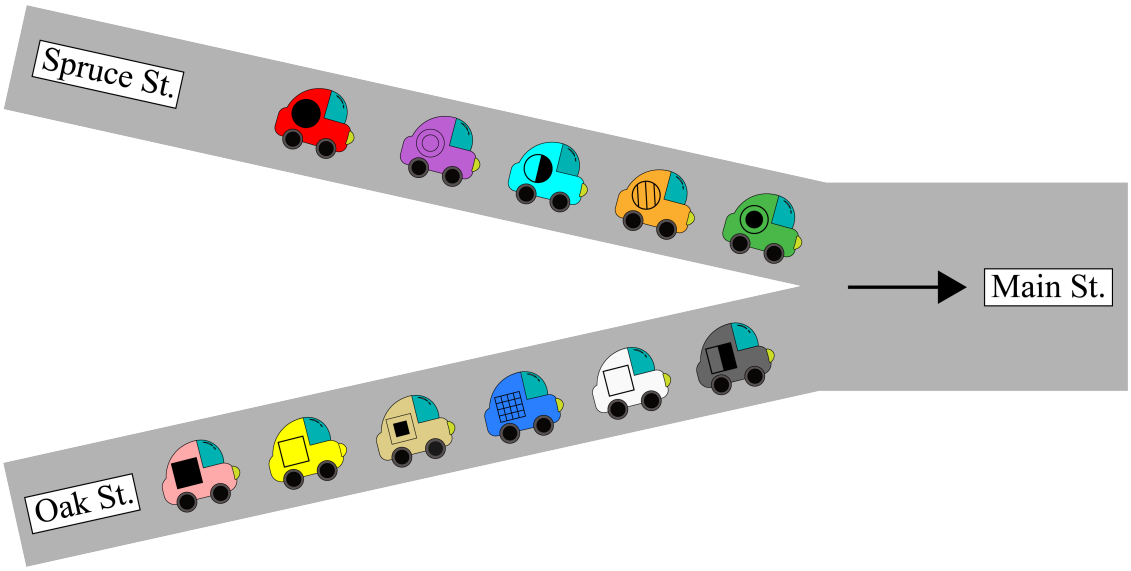
Questions, Answers, and Explanations

Part A

Merging Cars

Story

Cars waiting to enter Main Street are shown. The cars take turns coming from Spruce Street and Oak Street.



Question

If the first car comes from Spruce Street, which car will enter Main Street immediately after  ?

(A) 

(B) 

(C) 

(D) 

Answer

(D) 

Explanation of Answer

Assuming no more cars arrive, the cars shown will enter Main Street from right to left as shown:

We can see that  enters Main Street immediately after  .

Country of Original Author

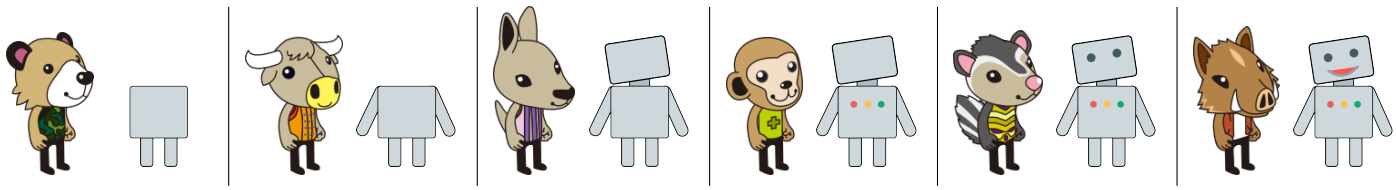
Montenegro

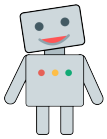
Robot Assembly

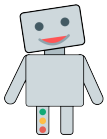
Story

Six animals work on a robot assembly line in order to make toy robots. Each animal has a job attaching certain pieces to certain locations of the robot.

The following image shows what a robot is supposed to look like after each animal does its job.



At the end of the assembly line the toy robots are supposed to look like this: 

However, the toy robots actually look like this: 

Question

Which animal is not doing their job correctly?

(A) 

(B) 

(C) 

(D) 

Answer

(C) 

Explanation of Answer

A toy robot is supposed to have three buttons across its body, but instead it has three buttons down its leg. This means the buttons have not been attached correctly which is the job assigned to the animal in Option C.

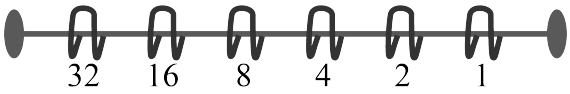
Country of Original Author

Canada 

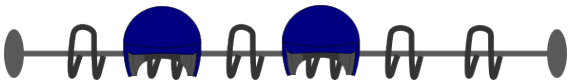
Scoreboard

Story

Two teams are playing baseball. To keep track of their score, each team uses helmets and a row of hooks. The rightmost hook represents a score of 1 and each other hook represents twice the value of the hook to its right, as shown.

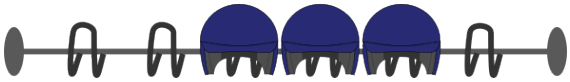


Each hook can have at most one helmet, and the total score for a team is the sum of all the scores on the hooks with helmets. For example, the following row of hooks would represent a score of $16 + 4 = 20$.



Question

The final scores for the two teams are shown.



What is the difference between the two scores?

(A) 11 (B) 9 (C) 13 (D) 7

Answer

(A) 11

Explanation of Answer

In this way of counting, each row of hooks from right to left stands for a number: 1, 2, 4, 8, 16, and 32.

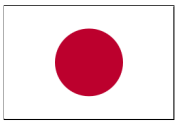
To determine the final scores, we add up the numbers where helmets are placed. One team has a score of $8 + 4 + 2 = 14$ and the other team has a score of $2 + 1 = 3$.

Therefore, the difference is $14 - 3 = 11$.

Alternatively, notice that both teams have a helmet on the second hook from the right. We can ignore these helmets as the scores will cancel each other out when we subtract. Then the difference is $(8+4)-1 = 12 - 1 = 11$, as before.

Country of Original Author

Japan



Snack Time

Story

Every afternoon, Lala eats one of four snacks: apple  , pear  , cookie  , or cheese  .
She follows two nutritional guidelines:

1. She never eats cookies two days in a row.
2. If she eats cheese one day, then the next day she eats either an apple or a pear.

Lala is planning the snacks that she will eat on five consecutive days.

Question

Which of the following plans matches Lala's guidelines?

(A)

Day	1	2	3	4	5
Snack					

(B)

Day	1	2	3	4	5
Snack					

(C)

Day	1	2	3	4	5
Snack					

(D)

Day	1	2	3	4	5
Snack					

Answer

(C)

Day	1	2	3	4	5
Snack					

Explanation of Answer

The plan in Option C follows the nutritional guidelines. For this plan, Lala does not eat cookies on any two consecutive days, and she eats an apple on the third day after having had cheese on the second day.

The plans in Options A and B do not follow the guidelines because for these options, after eating cheese on the first day, Lala should eat an apple or a pear the next day.

The plan in Option D does not follow the guidelines because Lala eats a cookie on the third and fourth days which means she eats cookies on two consecutive days.

Country of Original Author

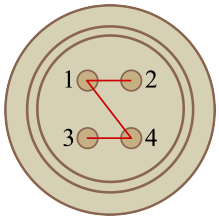
Indonesia

Sewing Buttons

Story

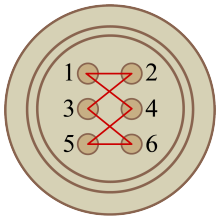
A programmable machine is used to sew decorative buttons on a blanket. Each hole in the button is assigned a number, and when the machine is sent a sequence of numbers, it sews thread along the holes in the order given in the sequence.

For example, if the machine receives the sequence 2 1 4 3, the thread will start at hole 2, then move to 1, then 4, and finish at 3, as shown.



Question

Which of the following sequences of numbers can be sent to the machine so that it sews thread as shown?



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

Answer

(B) 5 4 1 2 3 6 5

Explanation of Answer

Following the sequence of numbers in Option B, we start at hole 5, then move to 4, then 1, then 2, then 3, then 6, and finally back to 5. If we trace this path on the given button, we will follow the line of thread. Thus, this sequence of numbers could produce the given button.

Following the sequence of numbers in Option A, we start at hole 3 and move directly to hole 4, however these holes are not connected by thread in the given button. Thus, this sequence of numbers could not produce the given button.

Following the sequence of numbers in Option C, we need to move directly from hole 5 to hole 1, however these holes are not connected by thread in the given button. Thus, this sequence of numbers could not produce the given button.

Looking at the sequence of numbers in Option D, we notice that 5 only appears at the end of the sequence. This means hole 5 should not have thread coming both in and out of it and yet it does. Thus, this sequence of numbers could not produce the given button.

Therefore, only the sequence of numbers in Option B would produce the given button.

Country of Original Author

Slovakia

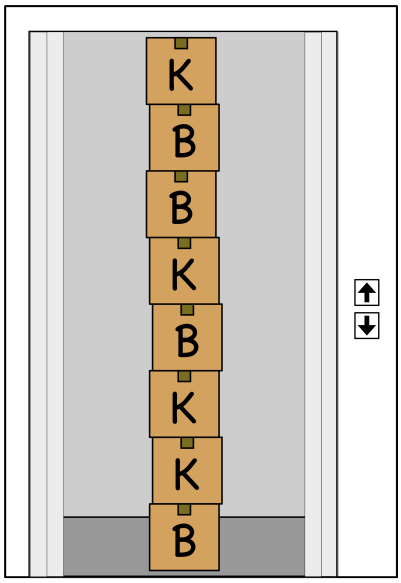
Part B

Elevator

Story

Biwako and Kai live on different floors of the same apartment building.

They each have several boxes being delivered. Biwako's boxes are labeled B, and Kai's boxes are labeled K. However the boxes were mixed up and stacked in the elevator as shown.



Biwako and Kai each stay on their own floor. When the elevator arrives on their floor, they take all of their boxes that are on the top of the stack. Then the elevator moves directly to the other person's floor. The elevator continues to move back and forth between Biwako and Kai's floors until all the boxes have been taken.

The elevator first stops on Kai's floor.

Question

In total, how many times does the elevator stop before all the boxes have been taken?

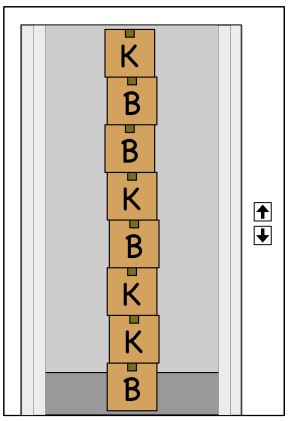
(A) 2 (B) 3 (C) 5 (D) 6

Answer

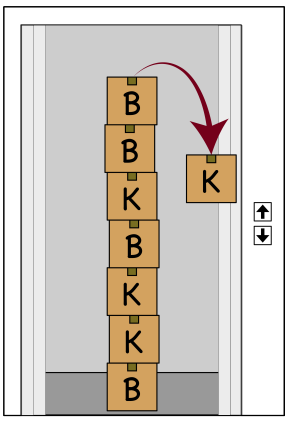
(D) 6

Explanation of Answer

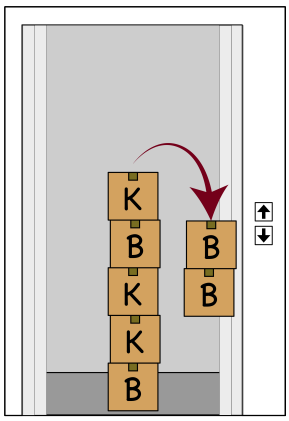
We show the boxes in the elevator after each stop.



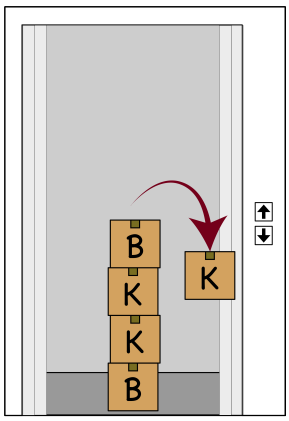
Start



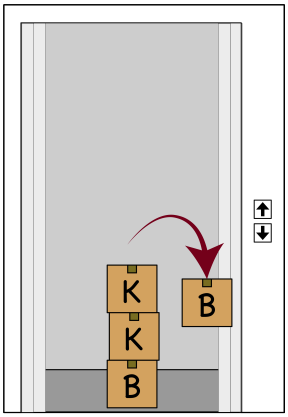
Stop 1: Kai takes 1 box.



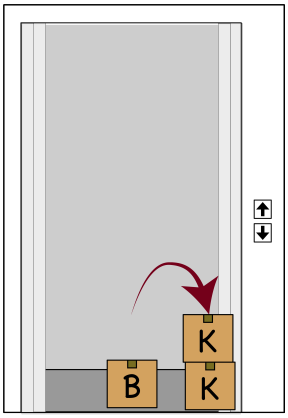
Stop 2: Biwako takes 2 boxes.



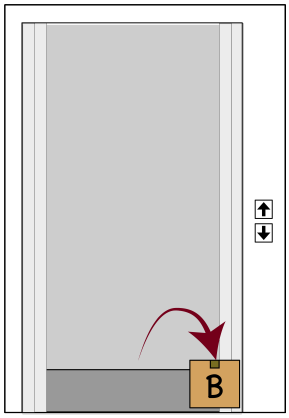
Stop 3: Kai takes 1 box.



Stop 4: Biwako takes 1 box.



Stop 5: Kai takes 2 boxes.

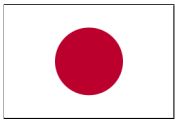


Stop 6: Biwako takes 1 box.

Therefore, the elevator stops a total of 6 times before all the boxes are taken.

Country of Original Author

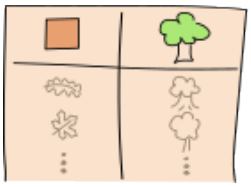
Japan



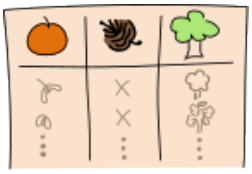
Beaver Timber

Story

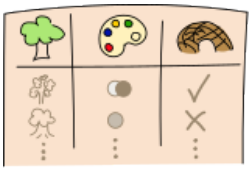
Emil's friends have each recorded different data about all the tree species in a forest. When Emil has a question while hiking in the forest, he knows he can call these friends to find the answer to his question.



Severin records the shape of the leaf for each tree species.



Quirina records the fruit as well as whether or not the tree has cones for each tree species.



Ladina records each tree species along with the colour of its bark and whether or not its wood is suitable for building a beaver lodge.

Question

Emil has found a leaf. He wants to know if it belongs to a tree species whose wood is suitable for building a beaver lodge. Which of his friends must he call?

(A) Only Ladina

(B) Only Severin and Quirina

(C) Only Severin and Ladina

(D) Severin, Quirina and Ladina

Answer

(C) Only Severin and Ladina

Explanation of Answer

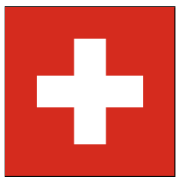
The only friend who recorded data about the shape of the leaf is Severin, so to learn anything new, Emil must call Severin to ask a question. From Severin, he can learn what tree species the leaf corresponds to.

After doing this, Emil can call Ladina to ask whether the wood of that tree species is suitable for building a beaver lodge. Ladina is the only friend who recorded information about whether or not the wood is suitable for building a beaver lodge, so Emil has to call Ladina to ask a question.

Notice that Emil did not need to call Quirina to ask any questions.

Country of Original Author

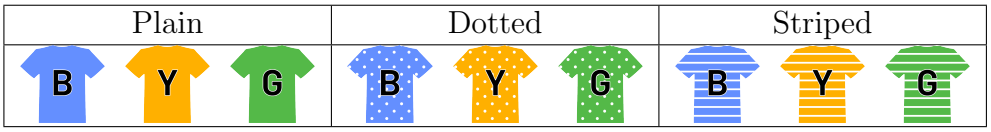
Switzerland



T-shirt Sorting

Story

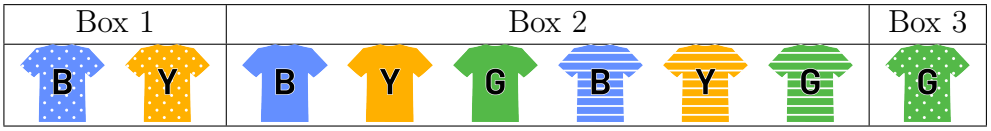
Baasu works at a t-shirt factory. The t-shirts come in three different patterns: plain, dotted, or striped. For each pattern, there are three different colours: blue, yellow, or green. In total, there are nine different t-shirt choices, as shown:



Baasu has a machine that sorts t-shirts into three different boxes based on his daily instructions. For example, on Monday, he gave the following instructions:

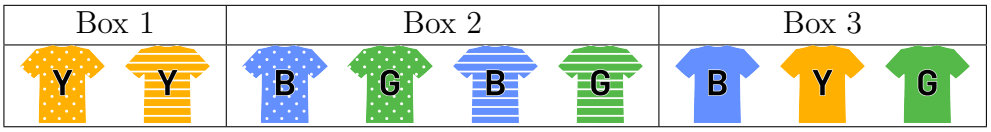
```
If the pattern is plain or striped put it in Box 2.  Otherwise, if the colour is
green, put it in Box 3.  Put any other t-shirts in Box 1.
```

The machine put the t-shirts into boxes as shown:



Question

On Tuesday, Baasu wanted the t-shirts to be sorted as follows:



Which of the following instructions would give Baasu the desired result?

(A) `If the colour is yellow, put it in Box 1.  Otherwise, if the pattern is plain, put it in Box 3.  Put any other t-shirts in Box 2.`

(B) `If the pattern is plain, put it in Box 3.  Otherwise, if the colour is yellow, put it in Box 1.  Put any other t-shirts in Box 2.`

(C) `If the colour is blue or green, put it in Box 2.  Otherwise, if the pattern is plain, put it in Box 3.  Put any other t-shirts in Box 1.`

(D) `If the pattern is not plain and the colour is yellow, put it in Box 1. Otherwise, if the colour is not yellow, put it in Box 2.  Put any other t-shirts in Box 3.`

Answer

(B) `If the pattern is plain, put it in Box 3. Otherwise, if the colour is yellow, put it in Box 1. Put any other t-shirts in Box 2.`

Explanation of Answer

To determine which instructions give the desired result, we will go through each of the instructions.

In Option A, the first instruction says to put all yellow t-shirts in Box 1. However, Baasu wants the plain yellow t-shirt in Box 3. Thus, these instructions would not give the desired result.

In Option B, the first instruction says to put all plain t-shirts in Box 3. This matches the desired result. The second instruction says to put all remaining yellow t-shirts in Box 1. This also matches the desired result, as only the dotted and striped yellow t-shirts are in Box 1. The remaining four t-shirts would then be placed in Box 2, matching the desired result. Thus, these instructions give the desired result.

In Option C, the first instruction says to put all blue or green t-shirts in Box 2. However Baasu wants the plain blue and plain green t-shirts in Box 3. Thus, these instructions would not give the desired result.

In Option D, the first instruction says to put all dotted and striped (not plain) yellow t-shirts in Box 1. This matches the desired output. The second instruction says to put all blue or green (not yellow) t-shirts in Box 2. However Baasu wants the plain blue and plain green t-shirts in Box 3. Thus, these instructions would not give the desired result.

Therefore, only the instructions in Option B give the desired result.

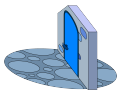
Country of Original Author

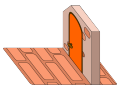
India

Beaver Gates

Story

Gates are placed on two types of platforms.

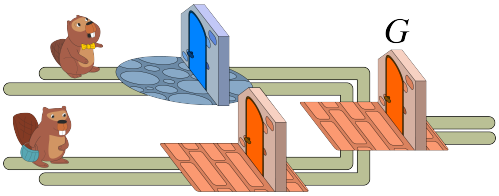
A gate on a circle platform  will only open if there are at least two beavers standing on the circle platform.

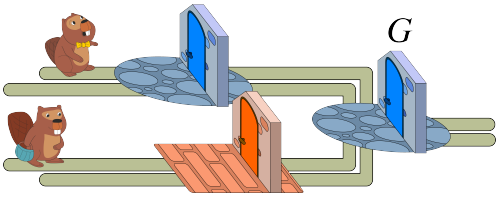
A gate on a square platform  will only open if there is at least one beaver standing on the square platform.

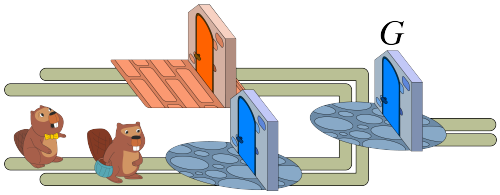
Beavers walk along marked paths until they reach a platform. If the gate doesn't open, they wait on the platform. If the gate opens, then all beavers standing on the platform go through the gate and continue walking along the marked paths.

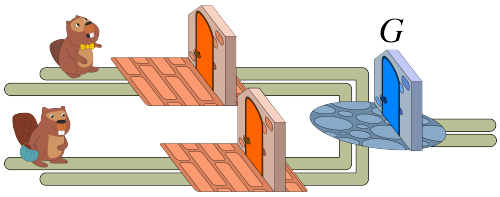
Question

In which situation will the gate labelled G stay closed?

(A) 

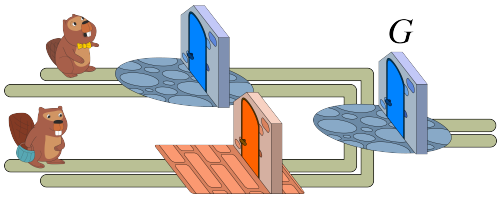
(B) 

(C) 

(D) 

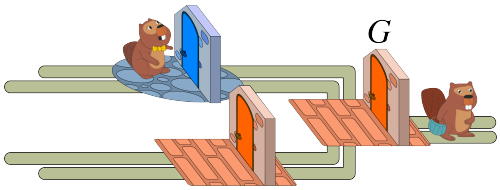
Answer

(B)

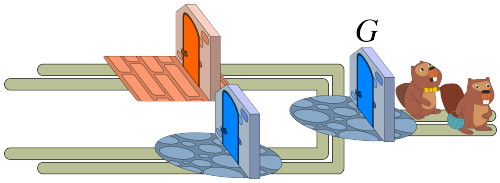


Explanation of Answer

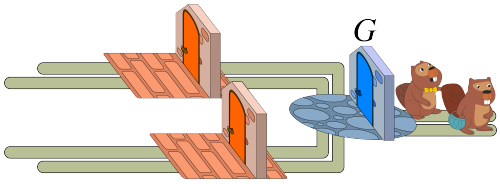
In Option A the top beaver has to wait on the circle platform, but the bottom beaver proceeds to open gate G.



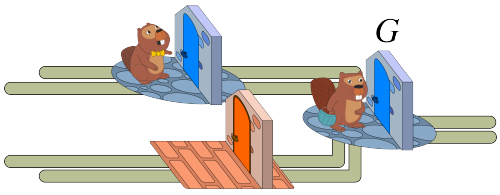
In Option C both beavers go through the gate on the circle platform and proceed together to open gate G.



In Option D both beavers go through the gates on the square platforms and proceed together to open gate G.



However, in Option B one beaver goes through the gate on the square platform, but the other beaver has to wait on the circle platform. Therefore, only one beaver proceeds to the gate G on the circle platform so gate G stays closed.



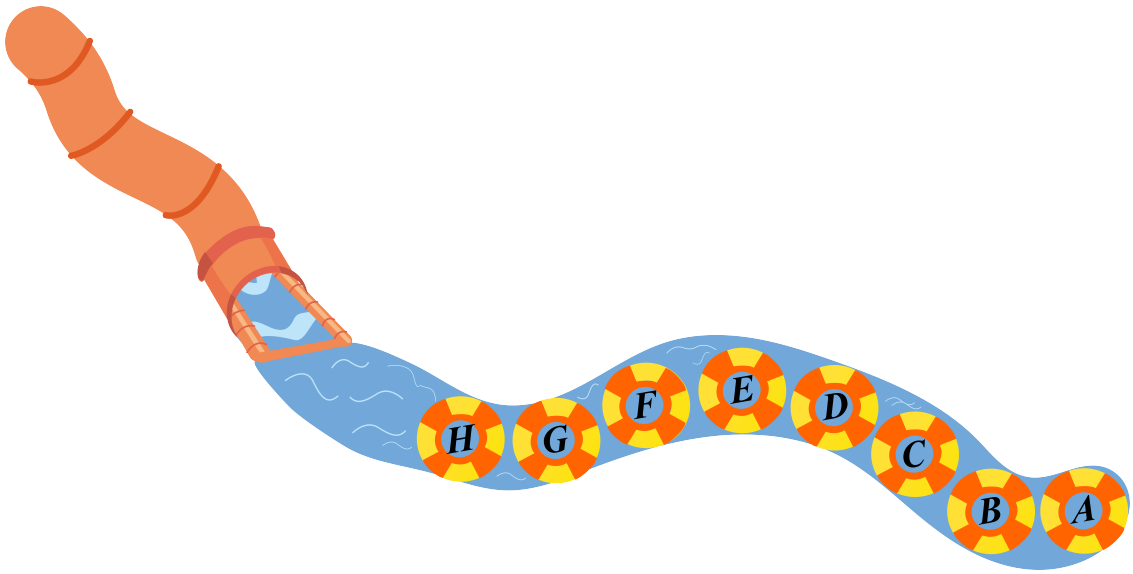
Country of Original Author

Uzbekistan

Inner Tubes

Story

After being used on a water slide, inner tubes float in a lazy river and gather in a line as shown.



When an inner tube is pulled out of the water for someone's next ride, each inner tube behind it floats one position downstream (farther from the slide) to fill the gap.

For example, if someone pulls out inner tube F, the two inner tubes G and H float one position downstream. If someone pulls out inner tube A after this, then all six remaining inner tubes will float one position downstream. In this case, the total number of times that an inner tube floats one position downstream is $2 + 6 = 8$.

Question

Eight inner tubes gather as shown above. Then five inner tubes are pulled out of the water in the order B, G, E, D, H. What is the total number of times that an inner tube floats one position downstream?

(A) 10 (B) 11 (C) 12 (D) 13

Answer

(B) 11

Explanation of Answer

To begin, from the end of the river, the line of inner tubes is A, B, C, D, E, F, G, H.

For each inner tube that is then pulled out of the water, the table below lists the inner tubes that float one position downstream. The table also shows what the line of inner tube looks like after each inner tube is pulled out of the water.

Pulled out inner tube	Inner tubes that float downstream	New line from the end of the river
B	C, D, E, F, G, and H (6 inner tubes)	A, C, D, E, F, G, H
G	H (1 inner tube)	A, C, D, E, F, H
E	F and H (2 inner tubes)	A, C, D, F, H
D	F and H (2 inner tubes)	A, C, F, H
H	none	A, C, F

The inner tubes float a total of $6 + 1 + 2 + 2 = 11$ positions downstream.

Country of Original Author

Canada

Part C

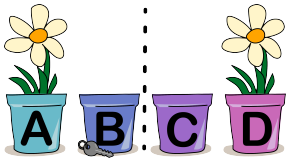
Flower Pots

Story

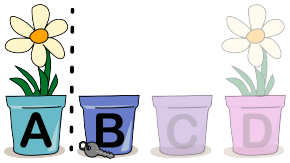
A beaver places a row of flower pots by their front door. They hide a key for their friend under one of the pots and then plant one flower in some of the pots so that their friend can find the key using the following instructions:

> "If the total number of flowers is even, the key is hidden in the left half of the pots; otherwise, it is hidden in the right half of the pots. Now consider only the half of the pots where the key is hidden. Repeat these steps until you look at only one pot. That's where the key is hidden."

For example, if there are four pots as shown and the key is hidden in pot B, this is how a friend can find the key:



Look at pots A, B, C and D. They contain 2 flowers. Since 2 is **even**, the key is hidden in the **left** half: pots A and B.



Look at pots A and B. They contain 1 flower. Since 1 is **odd**, the key is hidden in the **right** half: pot B.

Question

If there are eight pots labelled A to H and the beaver hides the key under pot C, which of the following rows of pots would guide their friend to find the key?

(A) 

(B) 

(C) 

(D) 

Answer

(A) 

Explanation of Answer

For Option A, there are 6 flowers and 6 is even so the friend should look in the left half: pots A, B, C and D. Among these four pots, there are 3 flowers and 3 is odd so the friend should then consider the right half of these pots: pots C and D. Among these two pots, there are 2 flowers and 2 is even so the friend should then consider the left half of these pots: pot C. Therefore, if the key is in pot C, Option A is a possible flower arrangement.

Like Option A, each of the other options also has an even number of flowers in all pots and an odd number of flowers in pots A, B, C and D. Therefore, for these other options, the friend will correctly end up considering pots C and D. However, in Options B, C and D, there is only 1 flower among these two pots which means the friend should then consider pot D which is incorrect if the key is in pot C.

Country of Original Author

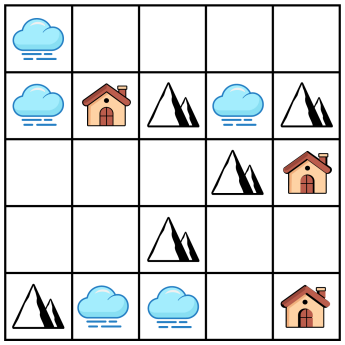
Germany

Foggy Day

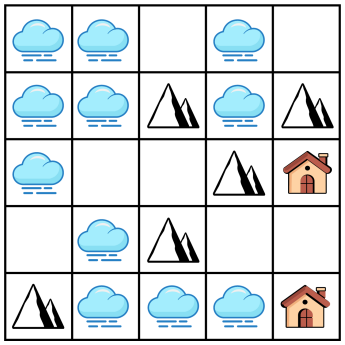
Story

It is a very foggy day on Bebrasland and the fog coverage is expanding. The map of Bebrasland is divided into a grid of squares. Some squares contain mountains or houses. The fog starts in certain squares and each hour the fog expands to cover the four neighbouring squares (to the left, right, above, and below), except for any neighbouring squares that contain mountains. When the fog covers a house it can no longer be seen.

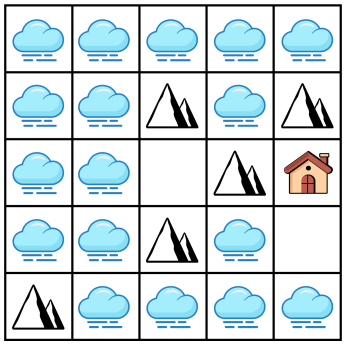
For example, the following maps show how the fog expands in an area of Bebrasland over 2 hours.



Start



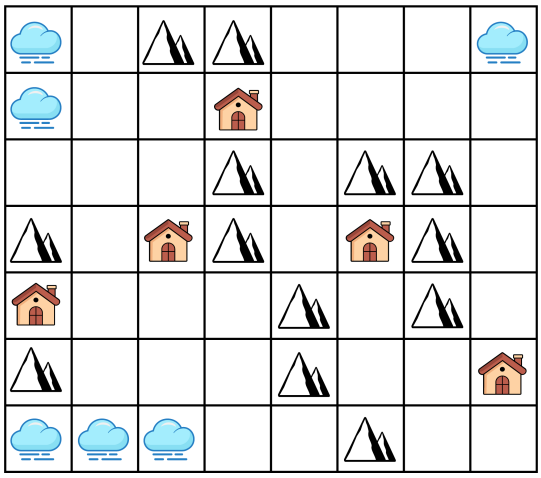
After 1 hour



After 2 hours

Question

The following area of Bebrasland shows the starting positions of the fog. How many hours will it take for the fog to cover all of the houses in the area?



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

Answer

(B) 7

Explanation of Answer

We label each square of the map of Bebrasland with a number representing the number of hours until that square is covered by fog, as shown.

fog	1	mountain	mountain	3	2	1	fog
fog	1	2	3 house	4	3	2	1
1	2	3	mountain	5	mountain	mountain	2
mountain	3	3 house	mountain	6	7 house	mountain	3
3 house	2	2	3	mountain	8	mountain	4
mountain	1	1	2	mountain	7	6	5 house
fog	fog	fog	1	2	mountain	7	6

From the map, the last house will be covered after 7 hours.

Country of Original Author

Portugal

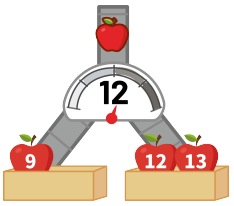
Apple Classification

Story

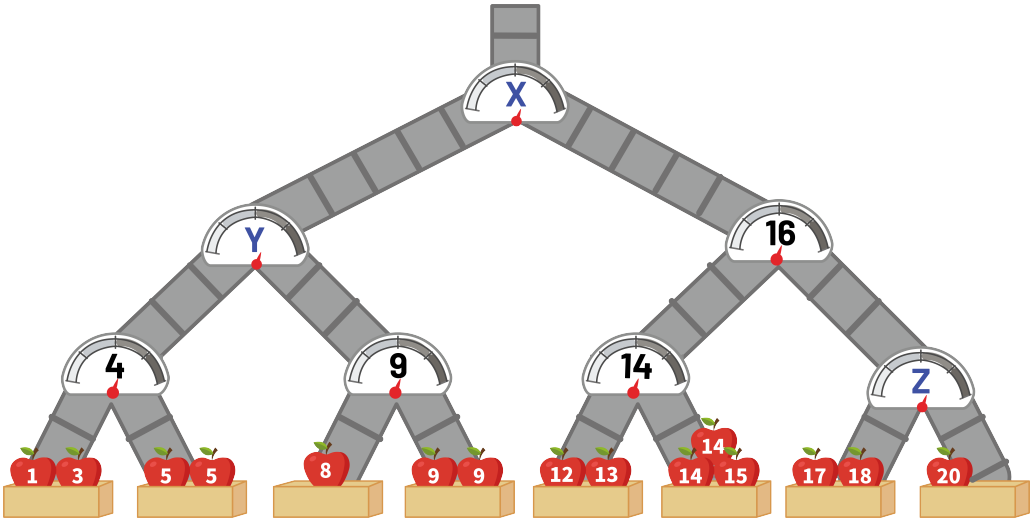
At Beaver Orchard, a machine sorts apples into eight weight-based grades, with apples of the same grade sent to the same packaging area.

Apples are fed into the top of the machine, move through different chutes, and land in one of eight bins at the bottom of the machine. As each apple moves through the machine, it passes weight sensors that determine its path through the chutes. If the weight of an apple is greater than or equal to the sensor's value, then the apple will drop through the right chute; otherwise, it will drop through the left chute.

For example, the given diagram shows the result when apples of weights 9, 12, and 13 pass through a sensor of value 12. The apple of weight 9 will drop through the left chute, while the apples of weights 12 and 13 will drop through the right chute.



The machine has already sorted some apples and the results are shown in the following diagram. The displays on the weight sensors labelled X, Y, and Z are broken and so do not show these sensors' values.



Question

Which of the following are possible values for the weight sensors labelled X, Y, and Z?

(A) 

(B) 

(C) 

(D) 

Answer

(C) 

Explanation of Answer

First we look at the sensor labelled X. Of the apples that dropped through the left chute at this sensor, the heaviest weight was 9. Of the apples that dropped through the right chute, the lightest weight was 12. Thus, X can be 10, 11, or 12. From this, we can exclude Option D.

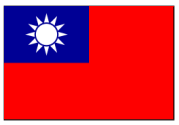
Next we look at the sensor labelled Y. Of the apples that dropped through the left chute at this sensor, the heaviest weight was 5. Of the apples that dropped through the right chute, the lightest weight was 8. Thus, Y can be 6, 7, or 8. From this, we can exclude Option A.

Finally we look at the sensor labelled Z. Of the apples that dropped through the left chute at this sensor, the heaviest weight was 18. The only apple that that dropped through the right chute had a weight of 20. Thus, Z can be 19 or 20. From this, we can exclude Option B.

Thus, the only option that shows possible values for all three sensors is Option C, as it satisfies all the conditions.

Country of Original Author

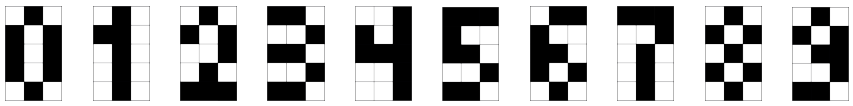
Taiwan



Masked Coordinates

Story

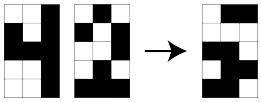
Gemma draws each of the digits 0 through 9 on separate 5×3 grids as shown:



Gemma then invents a way to represent two-digit numbers. She combines the grids for each of the digits in a two-digit number into one new 5×3 grid following this rule:

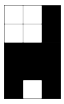
A square in the new grid is black when exactly one of the two corresponding squares in the original grids is black. Otherwise the square is white.

For example, Gemma's representation of her favourite two-digit number, 42, is shown.



Question

Gemma represented a different two-digit number in the same way and produced the following:



Which of the following two-digit numbers could Gemma have represented?

(A) 20 (B) 35 (C) 59 (D) 62

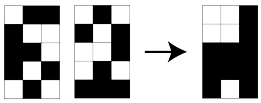
Answer

(D) 62

Explanation of Answer

Notice that every square in the rightmost column of Gemma's representation is black. This means that the corresponding squares of the original digits must all be different.

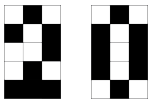
We notice that this is true for the digits 6 and 2. According to Gemma's rule, the number 62 would be represented as follows:



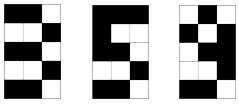
Since this matches Gemma's representation, we can conclude that Gemma could have represented the number 62.

For completeness, we show that Gemma could not have represented the numbers 20, 35, or 59.

For each of the digits 2 and 0, the rightmost square in the top row is white. So Gemma's representation of 20 would have a white square in that position. Thus, Gemma could not have represented the number 20.



For each of the digits 3, 5, and 9, the rightmost square in the bottom row is white. So Gemma's representations of 35 and 59 would each have a white square in that position. Thus, Gemma could not have represented the numbers 35 or 59.



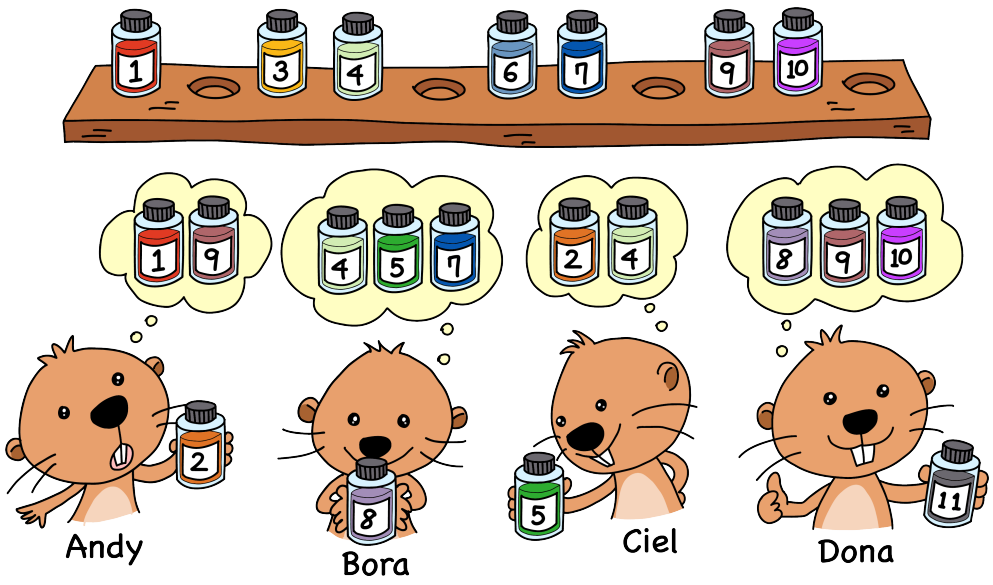
Country of Original Author

Switzerland

Sand Painting

Story

Beavers Andy, Bora, Ciel, and Dona are each making a sand painting. They share eleven numbered jars, each containing a different colour of sand. In the picture, each beaver is holding one of the jars they need for their sand painting, and the clouds above their heads show the other jars they need.



Two beavers cannot use the same jar at the same time. Also a beaver cannot start their sand painting until they have all the jars they need. Each beaver waits until all the jars they need are available, then they take them all and do their sand painting. When they are finished they return all their jars so others can use them.

Question

Which beaver does their sand painting last?

(A) Andy (B) Bora (C) Ciel (D) Dona

Answer

(D) Dona

Explanation of Answer

Andy needs jars 1 and 9, and since they are both available she can start her sand painting immediately.

Ciel needs jar 2, but Andy has jar 2 so Ciel has to wait for Andy to finish her sand painting.

Bora needs jar 5, but Ciel has jar 5 so Bora has to wait for Ciel to finish his sand painting.

Dona needs jar 8, but Bora has jar 8 so Dona has to wait for Bora to finish his sand painting.

Therefore, Andy does her sand painting first, followed by Ciel, then Bora, and finally Dona. That is, Dona does her sand painting last.

Country of Original Author

South Korea