

WATERLOO | MATHEMATICS

The CENTRE for EDUCATION in MATHEMATICS and COMPUTING



2016
*Beaver
Computing
Challenge*
(Grade 7 & 8)

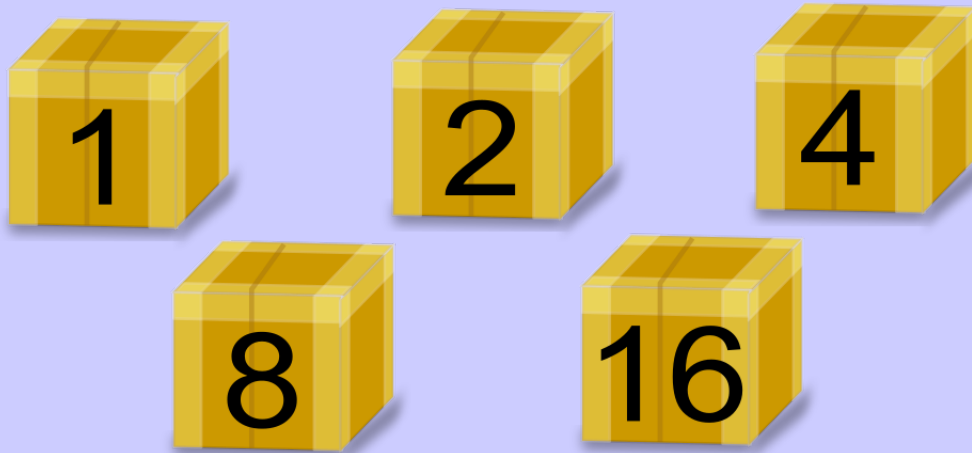
Questions

Part A

Boxes

Story

Boxes are shown below. Each box is labeled with its mass in kilograms.



Xena the delivery beaver fills out a form to order boxes. For example, to order boxes totaling exactly 9 kilograms, she fills out the form as follows:

	✓			✓
16	8	4	2	1

Question

How should she fill out the form to order boxes totaling exactly 20 kilograms?

(A)

✓		✓		✓
16	8	4	2	1

(B)

✓			✓	
16	8	4	2	1

(C)

✓		✓		
16	8	4	2	1

(D)

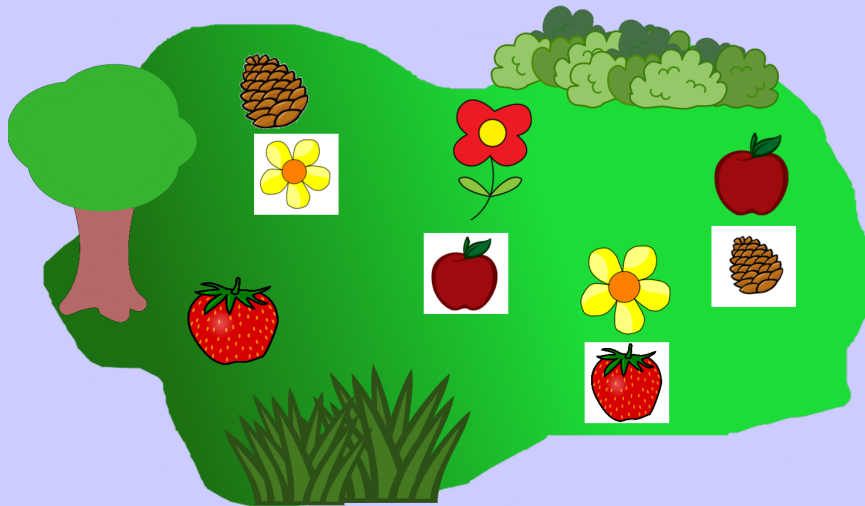
	✓	✓	✓	✓
16	8	4	2	1

Secret Recipe

Story

Beavers are preparing for a Food Festival. They would like to bake a cake but their baker is on vacation. Keith decides to try to bake the cake. He remembers that it is important to add five essential ingredients in the correct order.

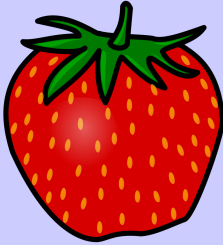
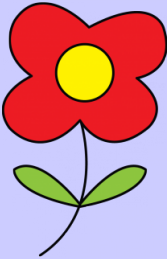
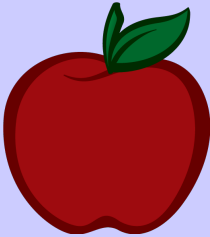

When he gets to the garden shown below, he finds a white piece of paper beside all but one ingredient. The paper shows which ingredient must be added next.



So, for example, a yellow five-petal flower must be added immediately after a pine cone. And, since there is no paper beside the strawberry, it must be added last.

Question

Which ingredient must be added first?

- A)  B)  C)  D) 

Shaman Pictures

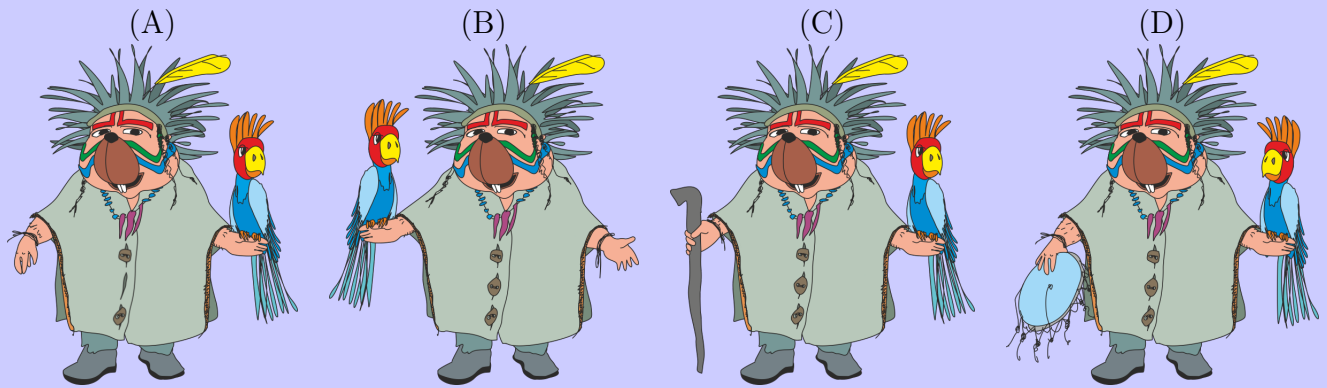
Story

An artist painted several images of a shaman. In her favourite image, the shaman

- has a parrot in *his* left hand,
- does not hold a stick, and
- each button on his coat is buttoned.

Question

Which image is her favourite painting?



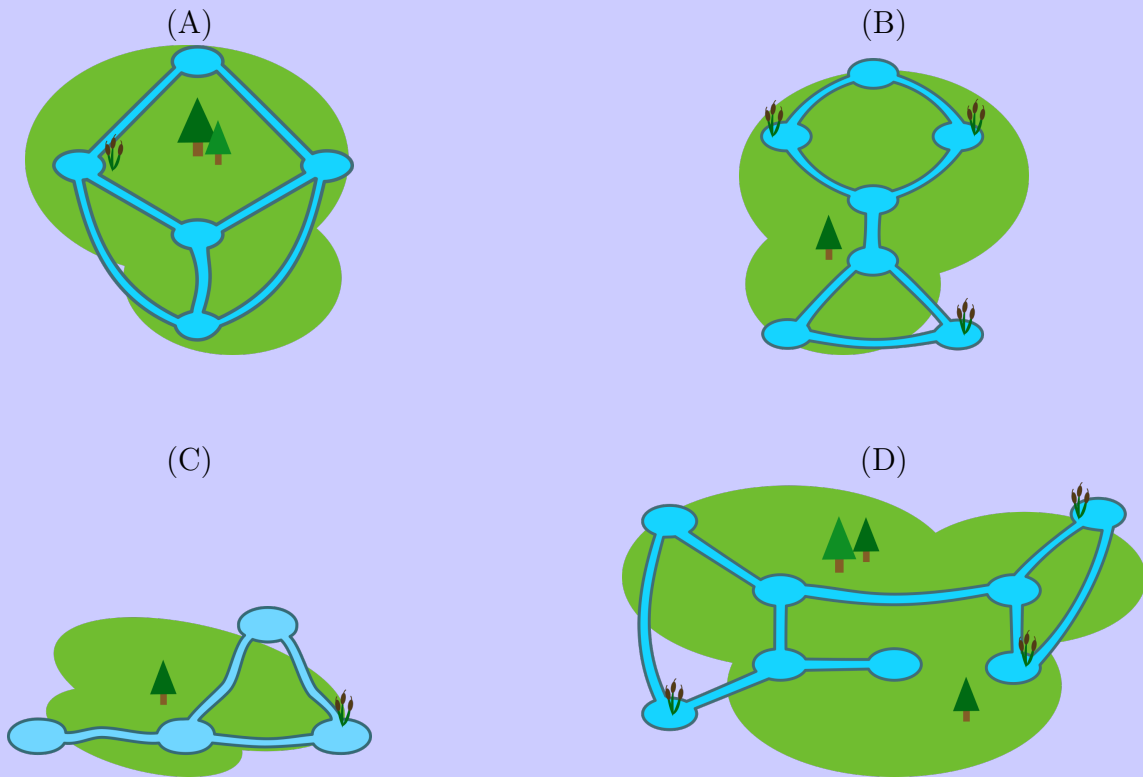
Pond Planning

Story

Beaver neighbourhoods consist of rivers flowing between ponds. Patricia is grumpy and wants to build one dam in each neighbourhood that will cause trouble. That is, she wants to block a single river so that beavers will not be able to travel between all pairs of ponds in the neighbourhood.

Question

In which of the following neighbourhoods is Patricia unable to build her dam?



Party Banner

Story

You have a long roll of coloured paper for a party you are hosting. The paper consists of the following pattern repeated more than once:



A beaver cut out a section of the paper between pieces of length 11 and 6 as shown below.



Question

Which of the following can be the length of the paper cut out by the beaver?

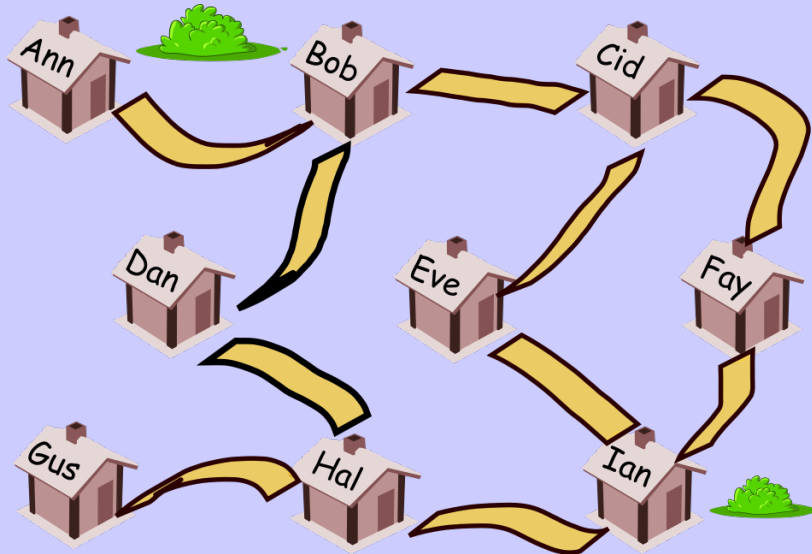
- (A) 31
- (B) 32
- (C) 33
- (D) 34

Part B

Firefighter

Story

The mayor of Beaverville is looking for volunteer firefighters. A map showing the possible volunteers' homes and how they are connected by roads is shown below. He wants to ensure that every home in the town is either the home of a volunteer or is connected by a single road to the home of a volunteer.



Question

What is the minimum number of volunteers the mayor needs?

- (A) 1
- (B) 2
- (C) 3
- (D) 4

Propagate

Story

Roberta Beaver has purchased an old computer that only allows one digit after the decimal point in any calculation. Anything after that digit is removed. Sometimes this results in an *error* which is the difference between the stored value and the exact value.

For example, if we try to compute $\frac{7}{5}$ on Roberta's machine, this will be stored as 1.4 which is the exact value of $\frac{7}{5}$. This gives an error of 0. However, if we compute $\frac{7}{4}$, this will be stored as 1.7 since $\frac{7}{4} = 1.75$ and "5" will be removed from the end. This gives an error of 0.05.

Extra digits are removed after every operation. For example, when Roberta computes $(\frac{3}{2}) \times (\frac{2}{3})$, she computes $\frac{3}{2}$ to give 1.5, then $\frac{2}{3}$ to give 0.6, and then 1.5×0.6 to give 0.9. This gives an error of 0.1.

Question

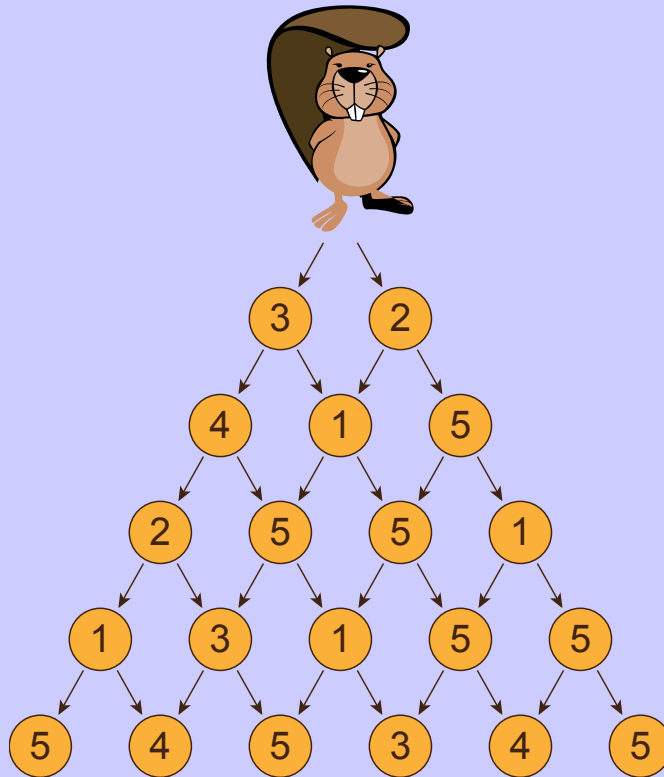
If Roberta computes $((\frac{10}{3}) \times (\frac{10}{3})) \times 9$, what is the error?

- (A) 0.0
- (B) 1.3
- (C) 2.8
- (D) 3.3

Collecting Wood

Story

During his descent from the mountain top, the beaver, Theseas, is collecting wood for his lodge from several stations. Every station holds a different amount of wood. While he is descending, he cannot change direction and start climbing again, that is, he can only go in the directions of the arrows. The paths between stations are given in the image below. Every circle is a station and the number in the circle represents the amount of wood available at that station.



Question

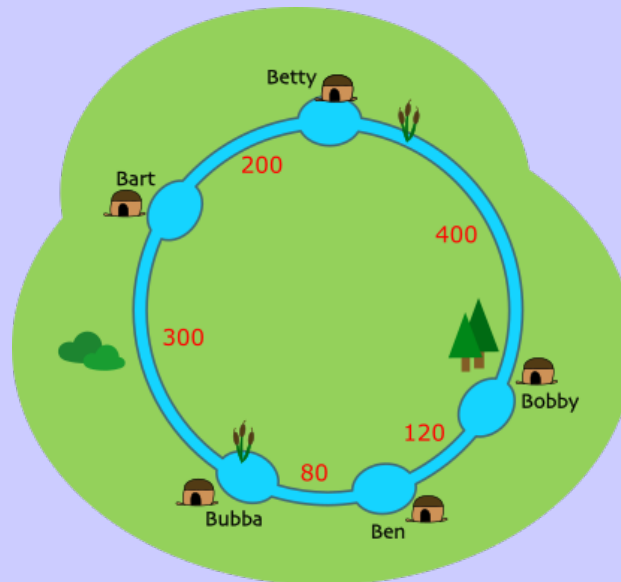
What is the maximum total amount of wood that Theseas can collect during his descent?

- (A) 19
- (B) 20
- (C) 21
- (D) 22

Meeting

Story

Five beavers happily live around a circular canal. They decided to have regular meetings at one of their residences. They want to minimize the total swimming distances for them to get to the meeting place.



Question

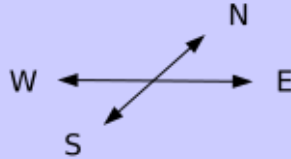
At whose residence will the meeting take place?

- (A) Bobby
- (B) Ben
- (C) Bubba
- (D) Bart

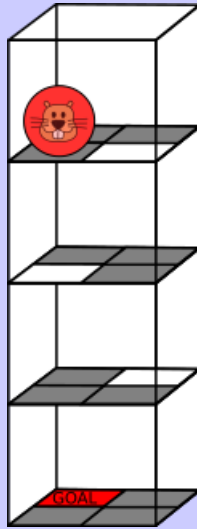
Spherical Robot

Story

The BeaverBall is a toy operated by remote control which can be used to move the toy in four possible directions:



The BeaverBall operates inside a tower with its initial position shown below.



If the BeaverBall moves to a white square, it drops down one level falling directly onto the square below. The BeaverBall ignores commands that cause it to move outside the tower.

Question

Which of the following lists of directions will cause the BeaverBall to reach the GOAL?

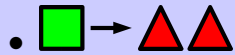
- (A) E, W, N, W, W
- (B) E, W, N, E, S, W
- (C) E, W, E, N, S, W
- (D) E, N, W, S, N, E, W

Part C

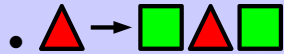
Replacing Shapes

Story

Alice the beaver plays a game with shaped cards. She starts with a single card that is a square and uses the following set of replacement rules.



meaning each square card is replaced by two triangle cards, and

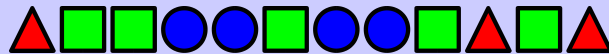


meaning each triangle card is replaced by one square card, one triangle and another square (in that order).

The result of following these rules three times is shown below.

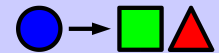
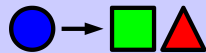
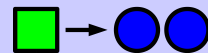
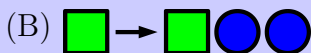


Boris the beaver plays a similar game. He starts with one of a square, triangle or circle and he plays with a different set of replacement rules. The result of following these rules three times is shown below.



Question

Which of the following set of replacement rules might Boris have used?



Magic Potions

Story

Betaro Beaver discovered five types of magic potions with the following effects:

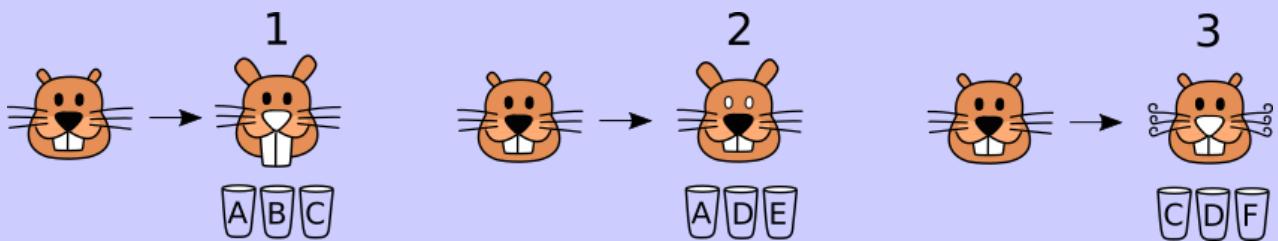
- makes ears longer
- makes teeth longer
- makes whiskers curly
- colours a nose white
- colours eyes white

Betaro put each magic potion into a different cup and additionally put water into a sixth cup. Betaro labelled the cups A to F and forgot to record which cup contains which magic potion!



Betaro called Taki for help. She solved the problem by experimenting on three of their other friends:

- Using the contents of cups A, B and C together produced the effects shown in Figure 1.
- Using the contents of cups A, D and E together produced the effects shown in Figure 2.
- Using the contents of cups C, D and F together produced the effects shown in Figure 3.



Question

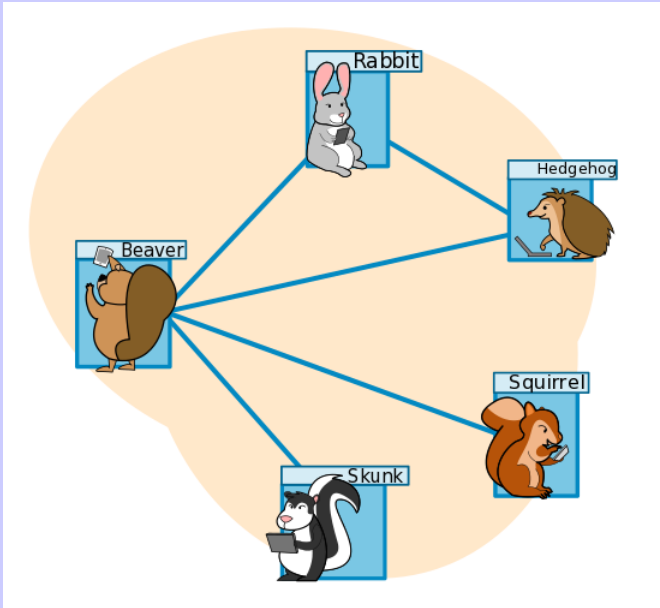
Which one of the cups contains pure water?

- (A) Cup A (B) Cup B (C) Cup C (D) Cup D

Instachat and Snapgram

Story

Information is given below about the friendships between a beaver, rabbit, hedgehog, squirrel and skunk on the social network Instachat. In the picture, the lines show which animals are friends with each other. The table records how many friends each animal has.



Animal	Number of Friends
beaver	4
rabbit	2
hedgehog	2
squirrel	1
skunk	1

Five different animals are on a different social network Snapgram and the same information is recorded in the same way.

Question

Which of the following cannot be the table recording how many friends each animal has on Snapgram?

(A)

Animal	Number of Friends
fox	2
groundhog	2
chipmunk	2
turtle	2
snake	2

(B)

Animal	Number of Friends
fox	2
groundhog	3
chipmunk	4
turtle	3
snake	2

(C)

Animal	Number of Friends
fox	1
groundhog	4
chipmunk	3
turtle	4
snake	1

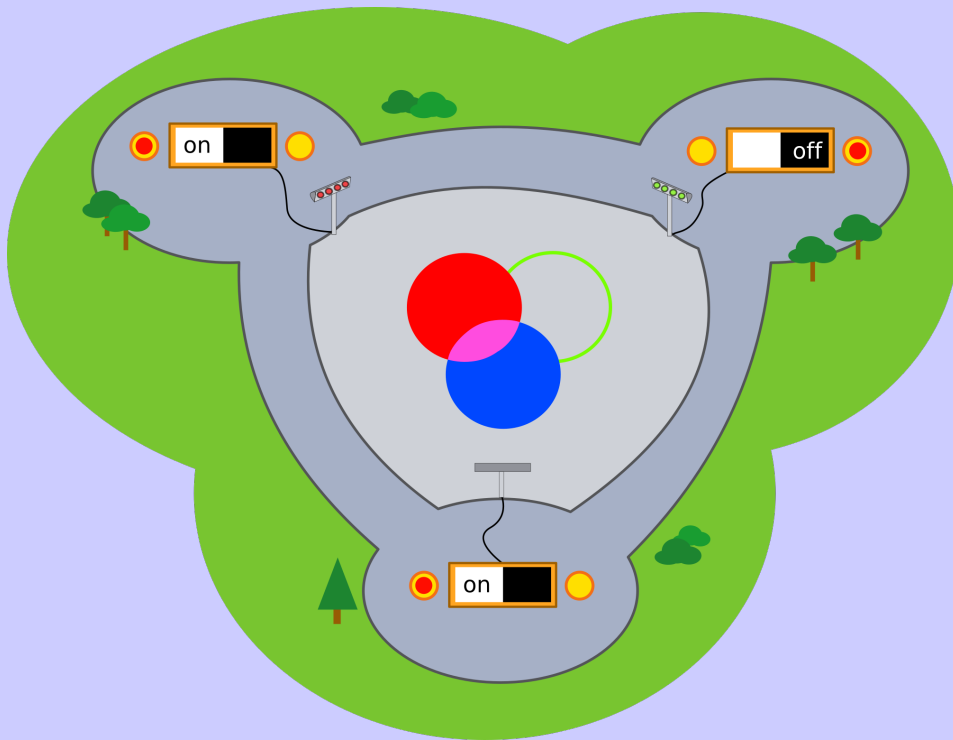
(D)

Animal	Number of Friends
fox	3
groundhog	3
chipmunk	4
turtle	3
snake	3

Switches

Story

Edward the beaver built a colourful lights display in the center of town. The lights can be made to flash in eight different pretty patterns by turning three switches on and off. Edward wants to test every pattern. To do so, he needs to try all eight different on/off combinations of the three switches. Unfortunately, the switches are each one kilometer apart and Edward has to walk to a switch to be able to change it.



Question

If Edward can start at any one of the switches, what is the least number of kilometers he has to walk?

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

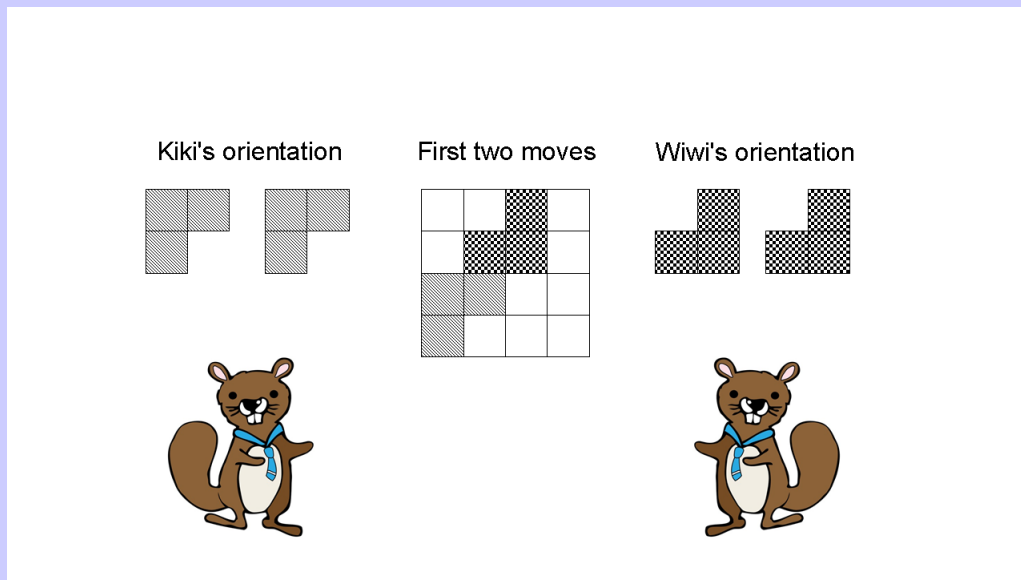
L-Game

Story

Kiki and Wiwi are playing L-Game on a 4x4 board. The player who can no longer play a piece loses. They take turns placing L-shaped pieces one at a time with Kiki playing first so that

- every piece placed by Kiki is oriented as shown below,
- every piece placed by Wiwi is oriented as shown below,
- every piece is placed entirely on the board, and
- no two pieces overlap.

The diagram below illustrates a possible board after each player has placed a piece once.



Question

Starting from an entirely empty board, how many of Kiki's nine possible first moves guarantee that Kiki will win no matter what?

- (A) 0
- (B) 1
- (C) 2
- (D) 3