



UNIVERSITY OF
WATERLOO



The CENTRE for EDUCATION in
MATHEMATICS and COMPUTING



2017
Beaver
Computing
Challenge
(Grade 9 & 10)

Questions

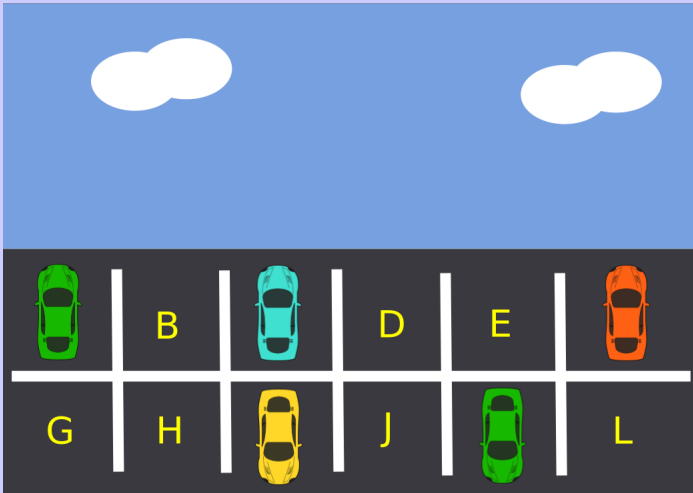
Part A

Parking Lot

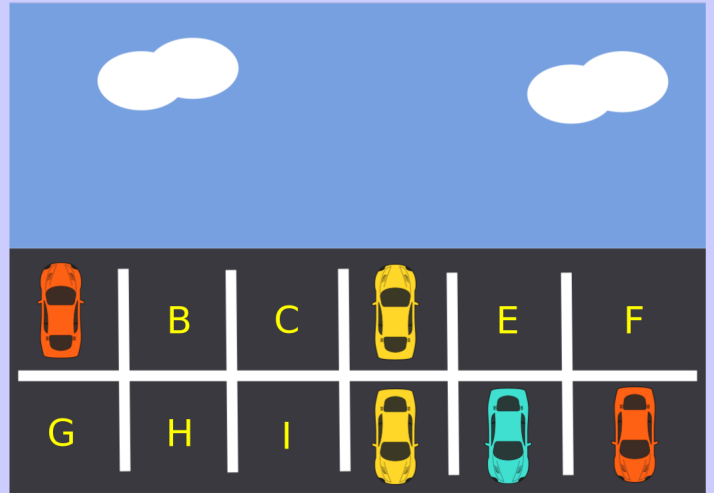
Story

There are 12 spaces for cars in a parking lot. The pictures below show which spaces were used on Monday and which spaces were used on Tuesday.

Parking lot on Monday



Parking lot on Tuesday



Question

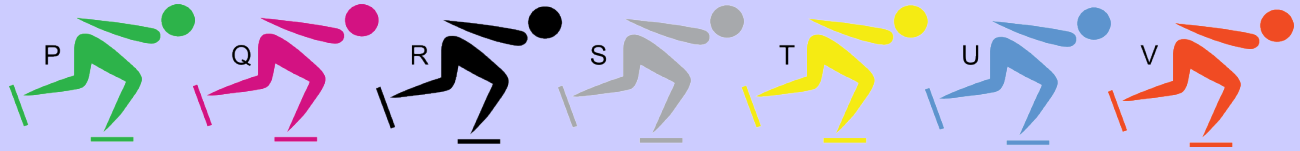
How many parking spaces were empty on both Monday and Tuesday?

- (A) 3
- (B) 4
- (C) 5
- (D) 6

Skaters

Story

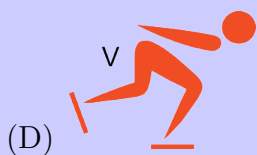
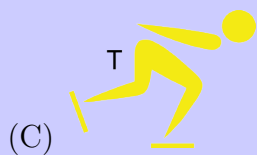
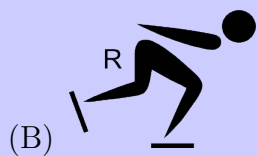
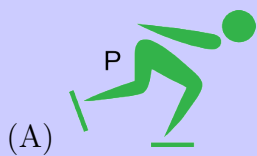
Seven people are skating in a line on a very long, frozen canal. They begin as shown below.



After every minute the person at the front of the line moves to the end of the line. For example, after one minute, U will be in front of the line, since V will move behind P.

Question

Which skater will be at the front of the line after 60 minutes?



Risk

Story

Darren's computer is connected to the Internet but does not have any antivirus or firewall software. None of the accounts on his computer are protected by a password.



Question

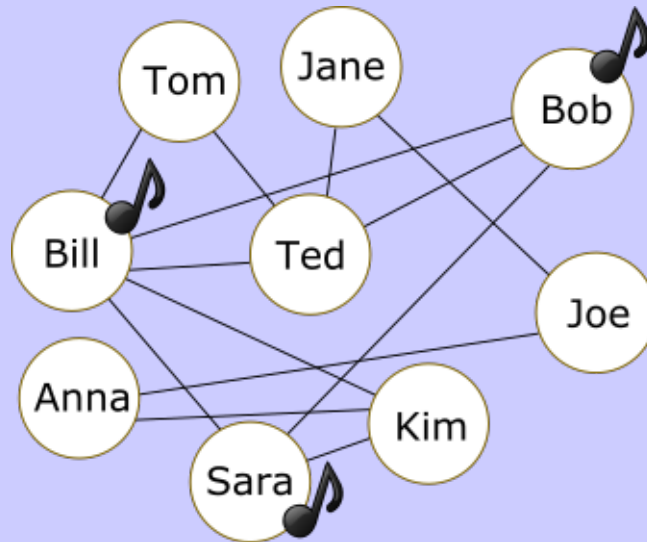
Which computers are at risk because of this?

- (A) only Darren's own computer
- (B) only the computers in the same room as Darren's computer
- (C) only the computers in the same country as Darren
- (D) all computers in the world which are connected to the Internet and set up like Darren's

Popular Song

Story

The lines in the diagram show exactly which pairs of students in a class are friends. A popular artist releases a new song on Monday and there is a musical note beside each student that buys the song that day.



Every day after that, if a student has not bought the song yet but at least half of their friends did buy the song before this day, he or she will also buy the song. Otherwise they do not buy the song yet.

Question









What is the earliest day when all students in the class own the song?


- (A) Wednesday
- (B) Thursday
- (C) Saturday
- (D) Sunday

Soda Shoppe

Story

Four friends each buy one drink. How happy each person will be for each type of drink is shown in the table below. The more hearts indicated, the happier a person will be. Unfortunately, only one of each of the four types of drinks is available.

				
Anna				
Bernard				
Christine				
Daniel				

For example, Anna prefers  with happiness ,  with happiness , and so on.

Question

When measured by the total number of hearts, what is the happiest the friends can be?

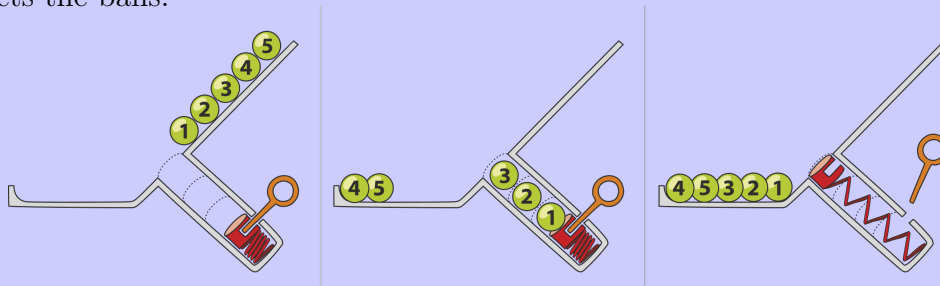
- (A) 13
- (B) 14
- (C) 15
- (D) 16

Part B

Balls

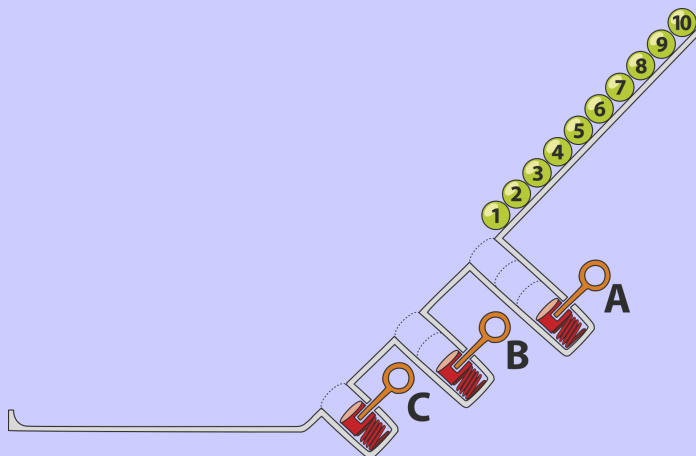
Story

Numbered balls roll down a ramp as shown below. When a ball comes to a hole, if there is enough space, the ball falls in. Otherwise, the ball rolls past the hole. A pin at the bottom of each hole can be pulled which ejects the balls.



Note the final ordering of the balls in the example above is 45321.

In the diagram below, ten balls roll down the ramp. Three holes, with pins labelled A, B, and C, have space for 3, 2 and 1 balls, respectively. After all ten balls stop moving, pin A is pulled. Then, after all the balls released from A stop moving, pin B is pulled. Finally, after all the balls released from B stop moving, pin C is pulled.



Question

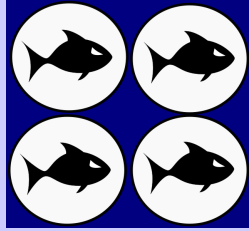
Which of the following is the final ordering of the balls?



Fish

Story

Four fish are placed on a tray as shown below.



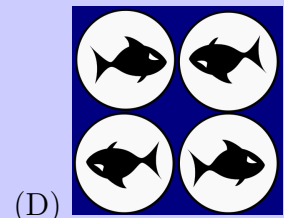
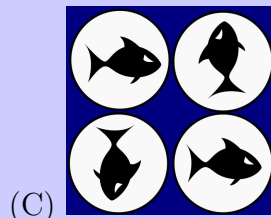
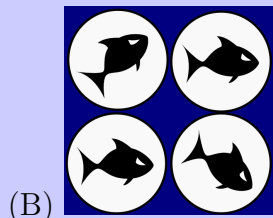
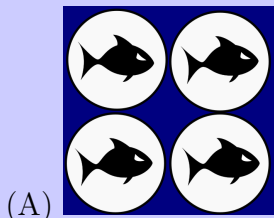
Every time a fish is turned clockwise, the fish diagonal to it also turns the same amount but in a counter-clockwise direction. For example, if the fish in the upper right turns 90° clockwise, then the fish in the lower left turns 90° counter-clockwise.

Aimi makes the following four turns in order.

1. Turn the fish in the upper left 45° clockwise.
2. Turn the fish in the lower left 90° clockwise.
3. Turn the fish in the lower right 90° clockwise.
4. Turn the fish in the upper left 45° clockwise.

Question

What does the tray look like after Aimi is done?

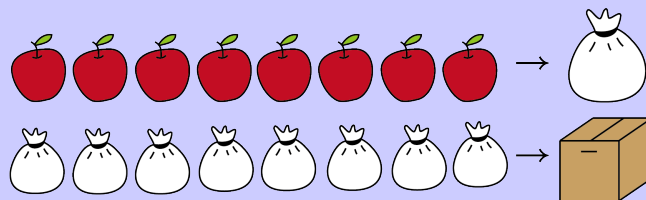


Apple Packing

Story





At the Beaver Apple Orchard, apples are either sold individually, or in bags of 8 apples (called Family Packs), or in boxes of 8 Family Packs. Therefore, apples are packed according to the following rules:

1. Apples are put in bags. Each bag can only hold exactly 8 apples. If there are less than 8 apples, they remain outside the bags as loose apples.
2. Bags are put in boxes. Each box can hold exactly 8 bags. If there are less than 8 bags, they are left outside the boxes as loose bags.



Question

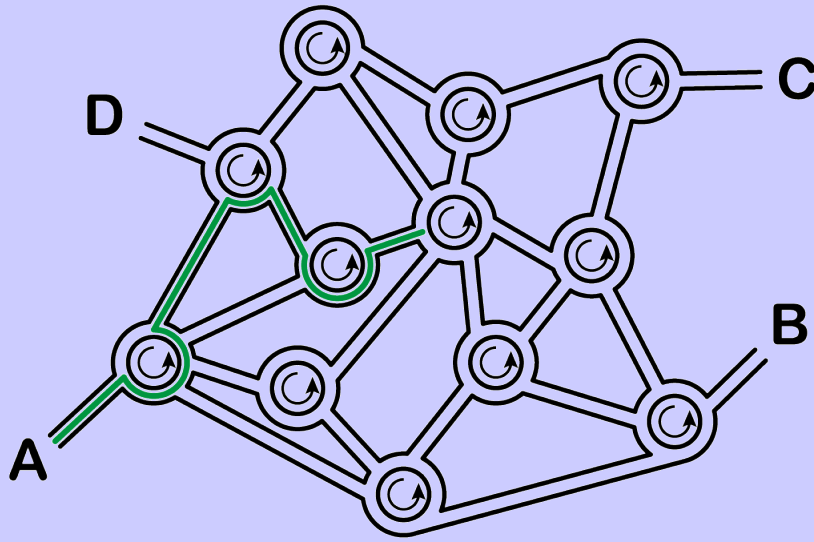
How many boxes, loose bags and loose apples are used to pack 275 apples?

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

Roundabout City

Story

In Roundabout City, navigation software gives instructions as a sequence of numbers, representing which exit number to take at each roundabout. For example, the instructions “4 1 2” mean to take the 4th exit at the first roundabout, the 1st exit at the next roundabout, and the 2nd exit at the next roundabout. The diagram shows this route highlighted in green, beginning at A.



Question

If we start from A and follow the sequence “3 1 3 2 3” where will we end up?

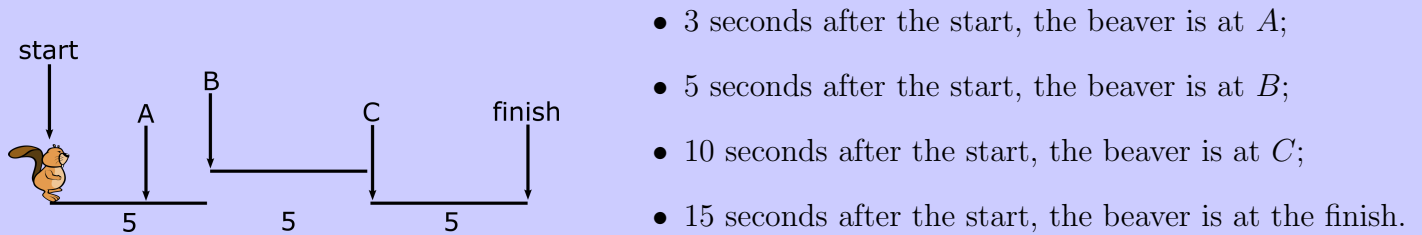
- (A) A
- (B) B
- (C) C
- (D) D

Jumpers

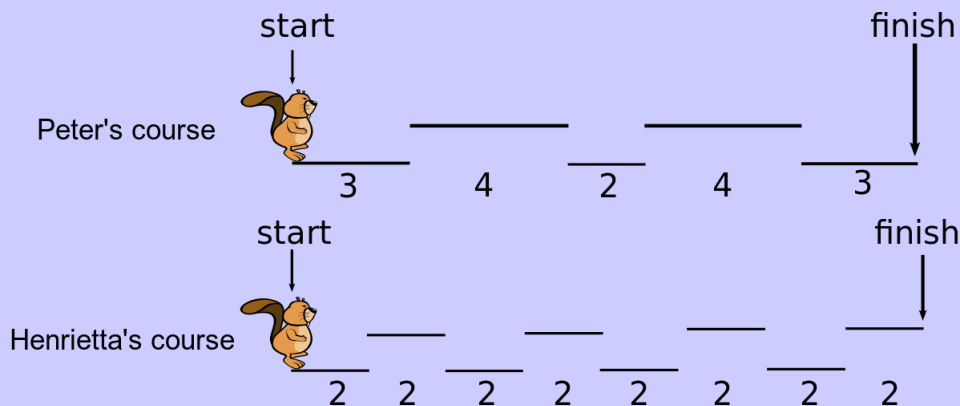
Story

Peter and Henrietta are playing a video game. They move a beaver at a constant speed from the start of a course to the finish. The course consists of platforms on two levels. At the end of each platform before the finish, the beaver jumps instantaneously up or down to the next platform. The amount of time to move over each platform of the game is shown below each platform.

Here is an example course:



Peter and Henrietta start playing the following two different courses at exactly the same time.



Question

For how long are both beavers moving along the top level at the same time?

- (A) 2 seconds
- (B) 4 seconds
- (C) 6 seconds
- (D) 8 seconds

Part C

Intrusion

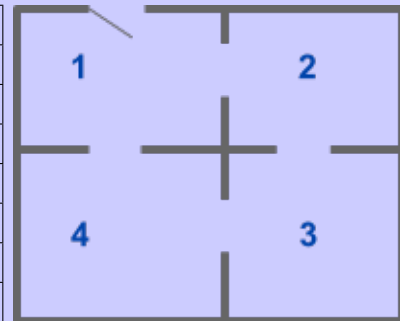
Story

In the Bebras Museum of Post-Modern Wood Art, there is an intelligent security system that detects intruders. An intruder is a person who has entered the museum, but not via the entrance. The entrance of the museum is in Room 1.

Each and every time a person enters or leaves a room, the system detects exactly how many people are in each room and records this in a table. The system always correctly allocates each person in the museum to a single room. It may happen that several people enter or leave a room at the same time.

The table shows the records of the intelligent security system and the image shows the layout of the rooms in the museum.

Time	Room 1	Room 2	Room 3	Room 4
10:00	2	0	0	0
10:07	3	0	0	0
10:08	2	1	0	0
10:12	4	1	1	0
10:13	2	2	3	0
10:17	5	2	2	1
10:20	4	1	2	2



Question

At what time did the system detect an intruder?

- (A) 10:07
- (B) 10:12
- (C) 10:13
- (D) 10:17

Super Hero

Story

A super hero watches over Beaver City from a straight path across a river. From every point along the path, the super hero needs to be able to see the point in the city directly across the river. Unfortunately, 16 walls of varying lengths stand between the river and the city as shown.



Fortunately, the super hero has X-ray vision and can see through a wall.

Unfortunately, the super hero can only see through one wall at a time.

Fortunately, the super hero is strong enough to destroy walls, and when he destroys a wall, he destroys it completely.

Unfortunately, destroying a wall makes the super hero very tired.

Question

What is the fewest number of walls that the super hero needs to destroy?

(A) 9

(B) 10

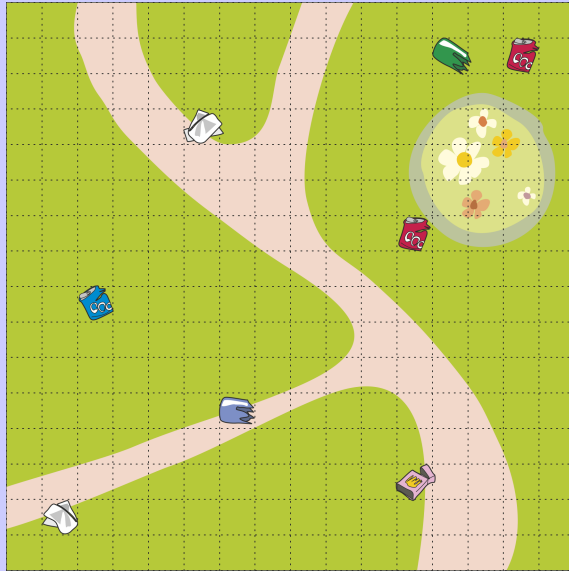
(C) 11

(D) 12

Litter

Story

All of the litter in the park shown below needs to be picked up. The park is a 16×16 grid.



Lucy must divide the entire park into square regions of sizes 1×1 , 2×2 , 4×4 and 8×8 . Each of the square regions must contain at most one piece of litter.

Question

What is the fewest possible number of regions that Lucy can divide the park into?

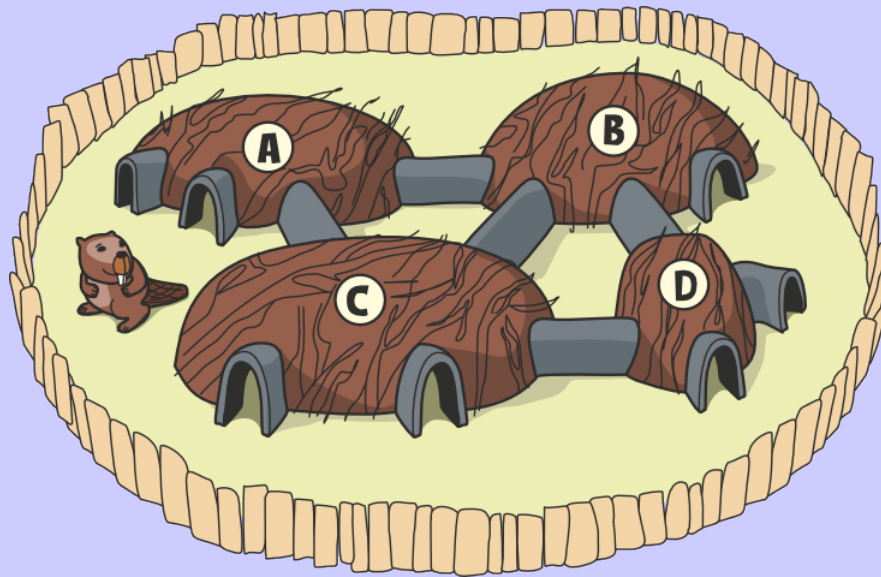
- (A) 9
- (B) 13
- (C) 16
- (D) 64

Beaver Lodge

Story

The Beaver family has built a lodge with 4 rooms and 5 tunnels connecting rooms as shown. There are also 7 doorways to the outside.

The Beaver children have noticed that it is possible to start in one of the rooms and run along a path passing through all of the tunnels and all of the doorways without walking through any doorway or tunnel twice.



Question

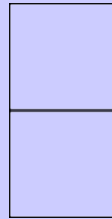
In which room did the Beaver children start running along such a path?

- (A) Room A
- (B) Room B
- (C) Room C
- (D) Room D

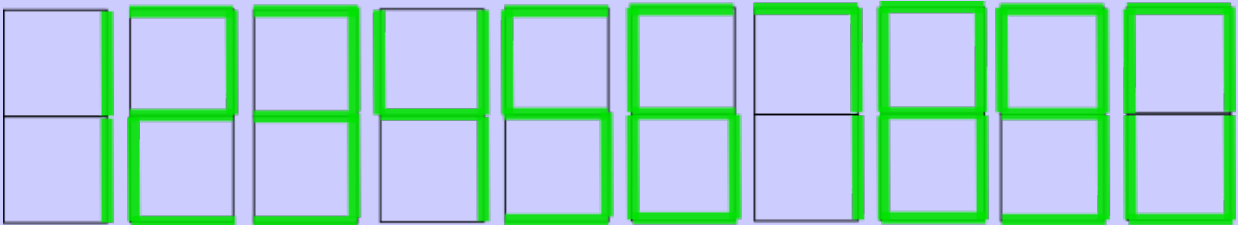
Broken Digital Clock

Story

On a digital clock, each digit can be formed by lighting up some of the seven segments.



Below, each of the digits from 0–9 are shown by lighting up some of those seven segments.



Suppose that some of the seven segments are not working but each of the ten digits can still be determined unambiguously.

Question

What is the largest possible number of segments that are not working?

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