UNIVERSITY OF
WATERLOO

The CENTRE for EDUCATION in
MATHEMATICS and COMPUTING

2020
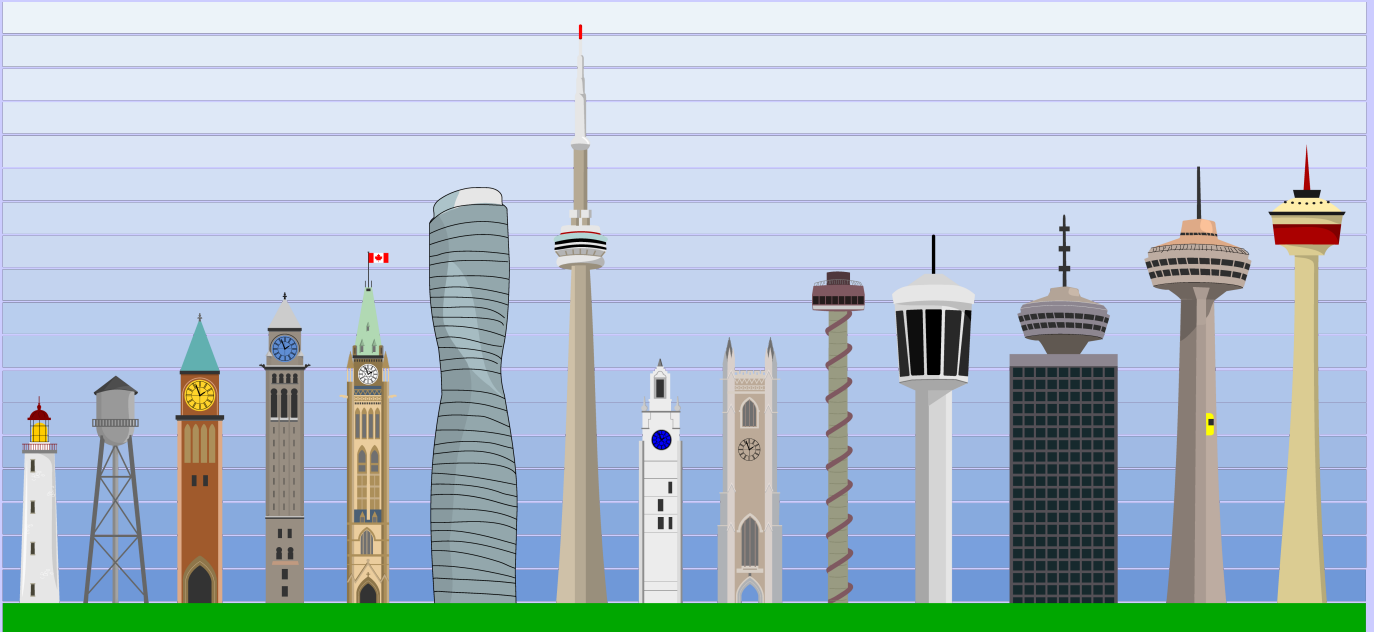*Beaver*
Computing
Challenge
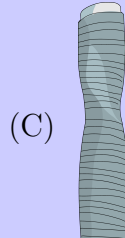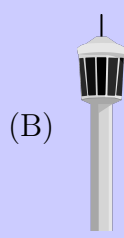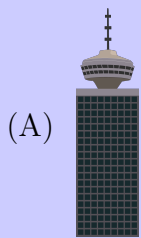*(Grade 7 & 8)*

Questions

Part A

Skyline

A skyline consists of 14 towers as shown.

The height of a tower is measured from the bottom of its base to its highest point, including any flagpoles or antennas.
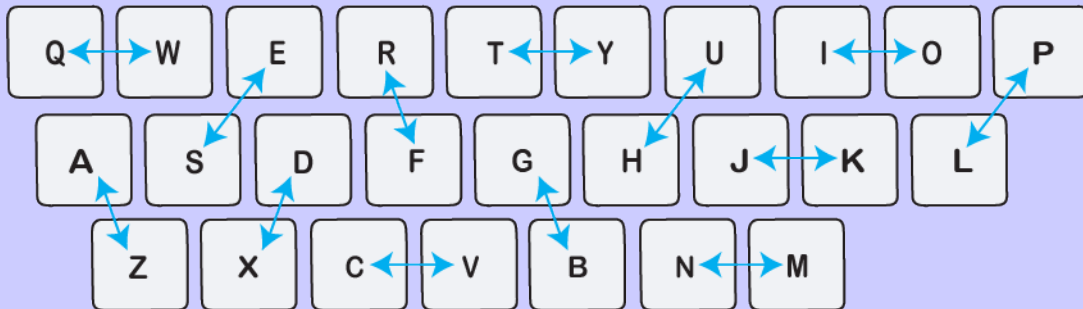
Question

If the towers are listed from shortest to tallest, which tower would be 10th in the list?

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

Crypto Keys

Story

Jan uses a special keyboard for writing secret messages. When a key on the keyboard is pressed, a different letter is displayed on the screen, according to the following keyboard map:

The arrows indicate which letter is displayed when each key is pressed. For example, when Jan presses the "S" key, the letter "E" is displayed on the screen, and when Jan presses the "E" key, the letter "S" is displayed on the screen.

Jan types a message and the letters "QOEU" are displayed on the screen, in that order.

Question

What was the original message typed by Jan?

(A) WASH

(B) WITH

(C) WISP

(D) WISH

Cookies

Story

Four children ask for cookies.

Adam says "I don't want stripes on my cookie."
Bella says "I want my cookie to be a circle or a square."
Cai says "I want a cookie with little round dots."
Diego says "I want a star-shaped cookie."

Question

Which of the following assignment of cookies will satisfy all the children's requests?

	Adam	Bella	Cai	Diego
(A)	striped square	dotted triangle	circle with hearts	star

	Adam	Bella	Cai	Diego
(B)	circle with hearts	dotted triangle	striped square	star

	Adam	Bella	Cai	Diego
(C)	circle with hearts	striped square	dotted triangle	star

	Adam	Bella	Cai	Diego
(D)	star	striped square	dotted triangle	circle with hearts

Connect the Dots

Zhi likes to draw. He creates his pictures by drawing dots and then connecting them with line segments in one motion, never picking up his pencil and never drawing the same line segment twice.

This is how Zhi draws a picture of a house:
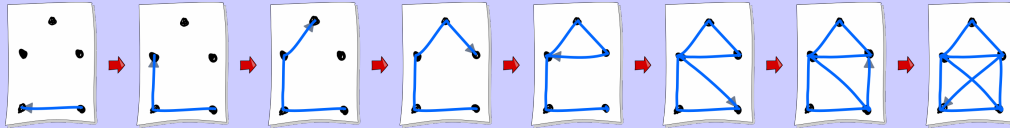
Which of the following pictures can Zhi draw?

(A)   (B)   (C)   (D)
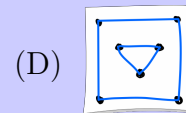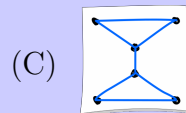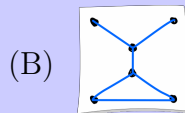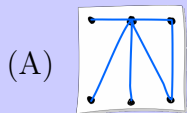
Towns and Highways

Story

A map of five towns (black dots) and four highways (coloured lines) is shown.
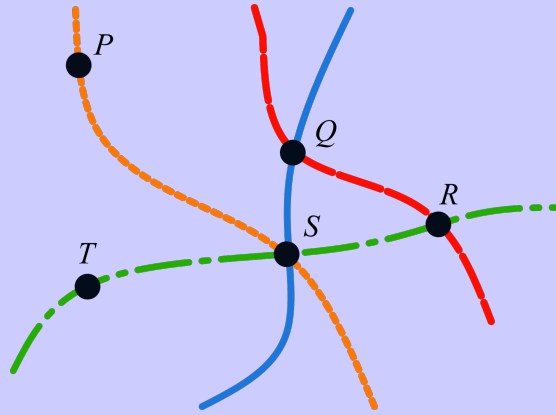
To represent this map using a diagram, there is one labelled circle per town and the following is true for every two towns:

1. If you can drive from one town to the other using exactly one of the four highways, then a straight line joins their circles.

2. If you cannot drive from one town to the other using exactly one of the four highways, then no straight line joins their circles.

Question

Which diagram represents the given map?

(A)

(B)

(C)

(D)
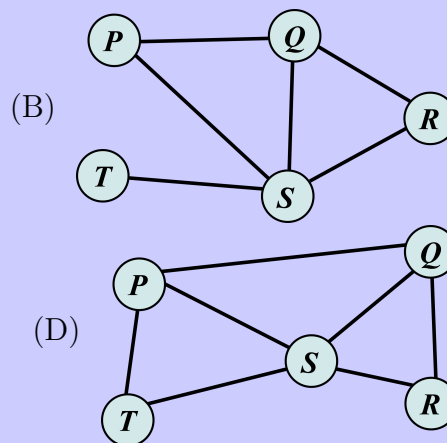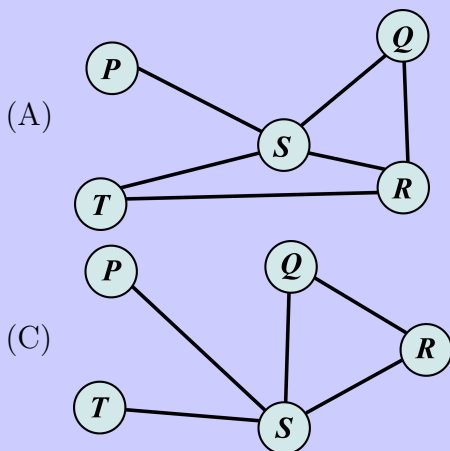
Part B

Library Books

Story

Beavertown Library has only a small pile of books. When a beaver wishes to borrow a book, they take the book that is on the top of the pile and record their name. When a beaver returns a book, they place their book on the top of the pile and record their name again.

At the beginning of the week the pile of books was arranged as shown:

The library's records at the end of the week show the following information:

Charlotte's Web
Curious George
Go, Dog, Go!
The Hobbit
Fox in Socks

Alba – Borrow
Felix – Borrow
Alba – Return
Marta – Borrow
Felix – Return
Cato – Borrow

Question

Which book did Cato borrow?

(A) Charlotte's Web

(B) Curious George

(C) Go, Dog, Go!

(D) The Hobbit

Market Exchange

Story

A beaver goes to a market to trade items. It has one carrot 🥕 but needs one fir tree 🌲.

Each stall of the market allows a different trade as shown:

Stall	Give	Get
P	🥕 (carrot)	🐟 (fish)
Q	🪙 (coin)	🐟 (fish)
R	💍 (ring)	🧁 (cupcake)
S	🥕 (carrot)	🧁 (cupcake)
T	🪙 (coin)	🌲 (fir tree)
U	💍 (ring)	🌲 (fir tree)
V	🧁 (cupcake)	💍 (ring)
W	🥕 (carrot)	🍁 (maple leaf)

Question

Which of the following sequences of stalls should the beaver visit in order to trade its carrot 🥕 for one fir tree 🌲?

(A) P, Q, T

(B) W, T, U

(C) S, V, U

(D) S, R, U

10

House Painting

Story

To brighten up the street Mei lives on, each white house will be painted red (R), green (G) or blue (B).

After all the houses have been painted, the following must be true:

1. Two houses next to each other must not be the same colour.

2. A house must not be the same colour as the house directly across the street.

Before painting, these are the houses on Mei's street:
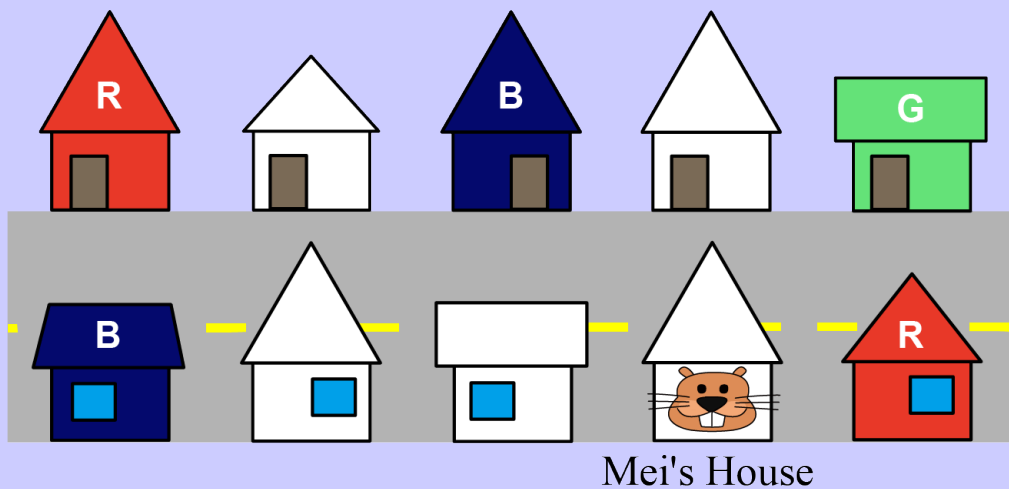
Mei's House

Question

Which colour(s) can be used for Mei's house?

(A) Only red can be used.

(B) Only blue can be used.

(C) Only green can be used.

(D) Either red or green can be used.

Treasure Hunt

Story
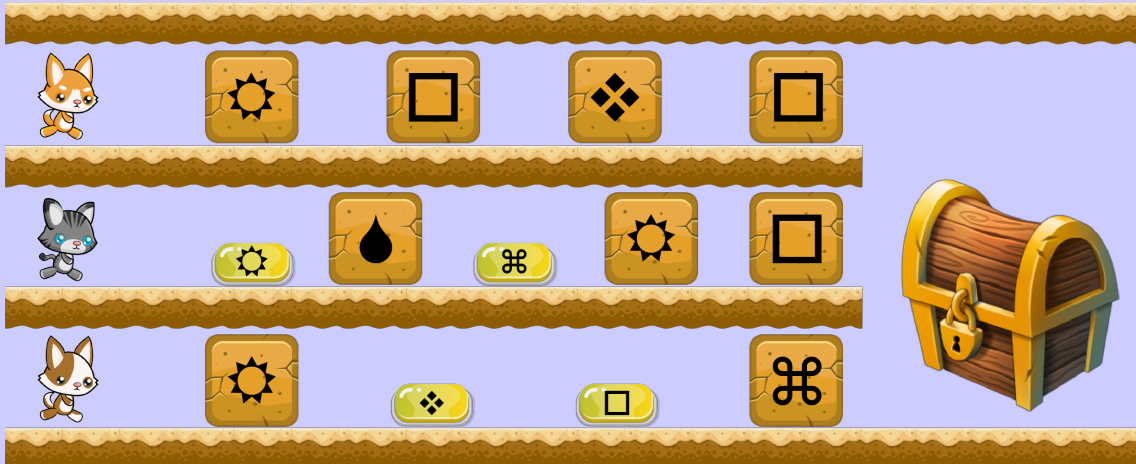
Three explorers are working together to find a hidden treasure chest. They each take a different path (upper, middle, or lower) and they explore their paths by running from left to right.

There are several large obstacles blocking their paths.

When an explorer encounters an obstacle, they must wait until it is crumbled before they can proceed. An obstacle is crumbled when one of the explorers steps on a stone that is marked with the same symbol as the obstacle. In fact, stepping on a stone crumbles *all* obstacles that are marked with the same symbol as the stone.

The obstacles, stones, and explorers are arranged as shown.

Question

Which explorer can get to the treasure chest?

(A)   (B)   (C)   (D) No explorer can get to the treasure chest.

Water Bottles

Dani is required to entirely fill as many empty water bottles as possible using a 50 litre tank.

Suppose she is given the following 10 empty bottles where each bottle is labelled with the number of litres it can hold.

Question

What is the maximum number of bottles that Dani can fill entirely?

(A) 4

(B) 7

(C) 8

(D) 10

Part C

Spider Car

Story
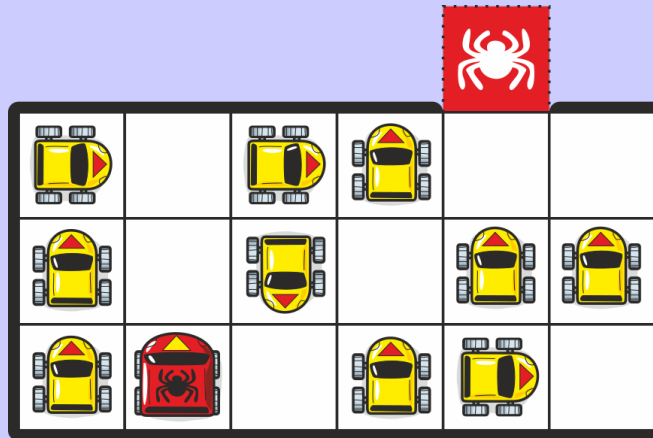
In the fenced area shown there are yellow cars and a single red spider car.
Ayo is trying to get the spider car in the spider square just outside the fenced area.

In one *move*, Ayo can:

- drive one car forward one square,

- reverse one car backwards one square,

- rotate one car left (90 degrees) in its current square, or

- rotate one car right (90 degrees) in its current square.

There can only be one car per square at any given time and only the spider car can be moved into the spider square.

Question

What is the minimum number of moves Ayo needs to get the spider car in the spider square?

(A) 9

(B) 11

(C) 13

(D) 15

Puzzle Pieces

Story

A beaver has a puzzle with 12 different types of pieces, 4 of which are red, 4 of which are yellow, and 4 of which are blue, as shown below. There is an unlimited number of each type of piece.
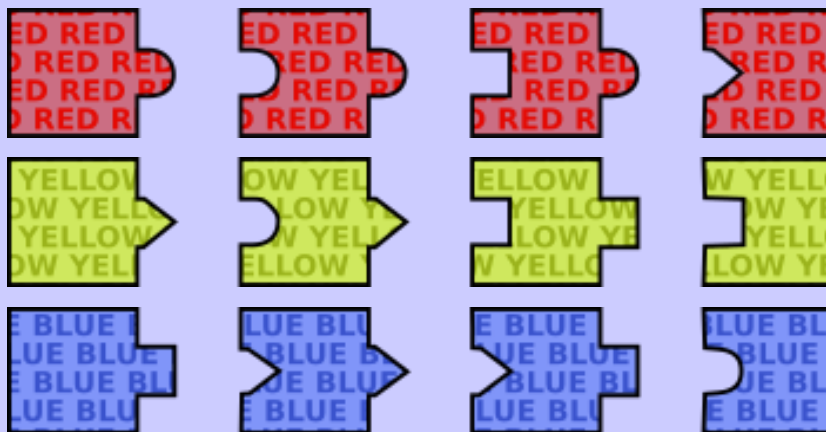
Using these pieces, the beaver can create various colour sequences. The first piece in a sequence must have a flat left side and the last piece must have a flat right side. Pieces join in the usual way but two pieces can't be joined on their flat sides and pieces can't be rotated. One possible sequence is shown below.

Question

Which of the following colour sequences **cannot** be constructed?

(A) YELLOW → BLUE → BLUE → RED → BLUE

(B) BLUE → YELLOW → RED → YELLOW → RED

(C) RED → RED → YELLOW → BLUE → BLUE

(D) BLUE → RED → YELLOW → BLUE → RED

Spreading the News

Twelve beavers share news with each other using a network of wires as shown:
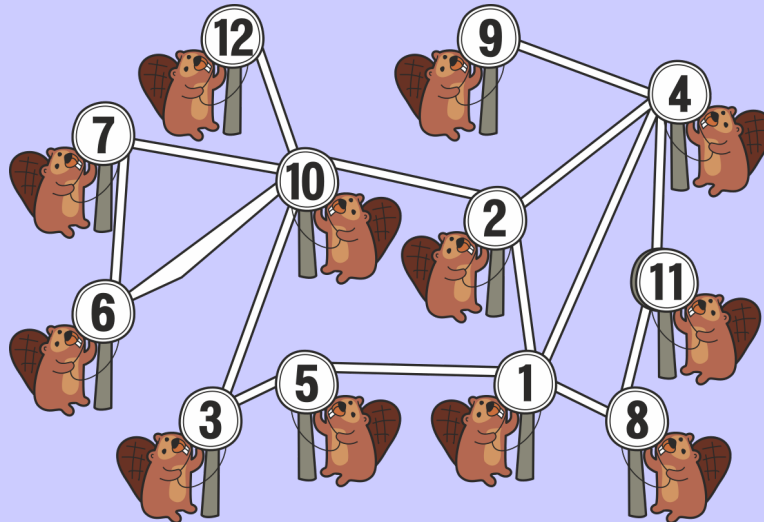
Two beavers can share news if they are directly connected by a wire. For example, beaver 6 is directly connected to beavers 7 and 10 but not to beaver 3.

All beavers want to hear news as quickly as possible. As such, a beaver with news uses all of its wires simultaneously to inform the other beavers that it is directly connected to.

For example, if beaver 8 has news it will inform beavers 1 and 11 right away. Next, beavers 1 and 11 will further spread the news, at the same time, to beavers 2, 4, and 5. The beavers continue to spread the news using their wires until all beavers have been informed.

Question

If there is news that should be spread as quickly as possible, which beaver should be informed of the news first?

- (A) 1
- (B) 2
- (C) 4
- (D) 10

Book Organizer

Story

Bora uses a flowchart to organize her books onto three shelves. When she gets a new book, she starts at the top of the flowchart and follows its instructions to determine on which shelf the book belongs.

Each diamond in the flowchart includes a "yes" or "no" question about the book's title. The answer determines which arrow leading away from the diamond Bora will follow. When an arrow points at a shelf, the book is added to that shelf. Otherwise, Bora continues to move through the flowchart.
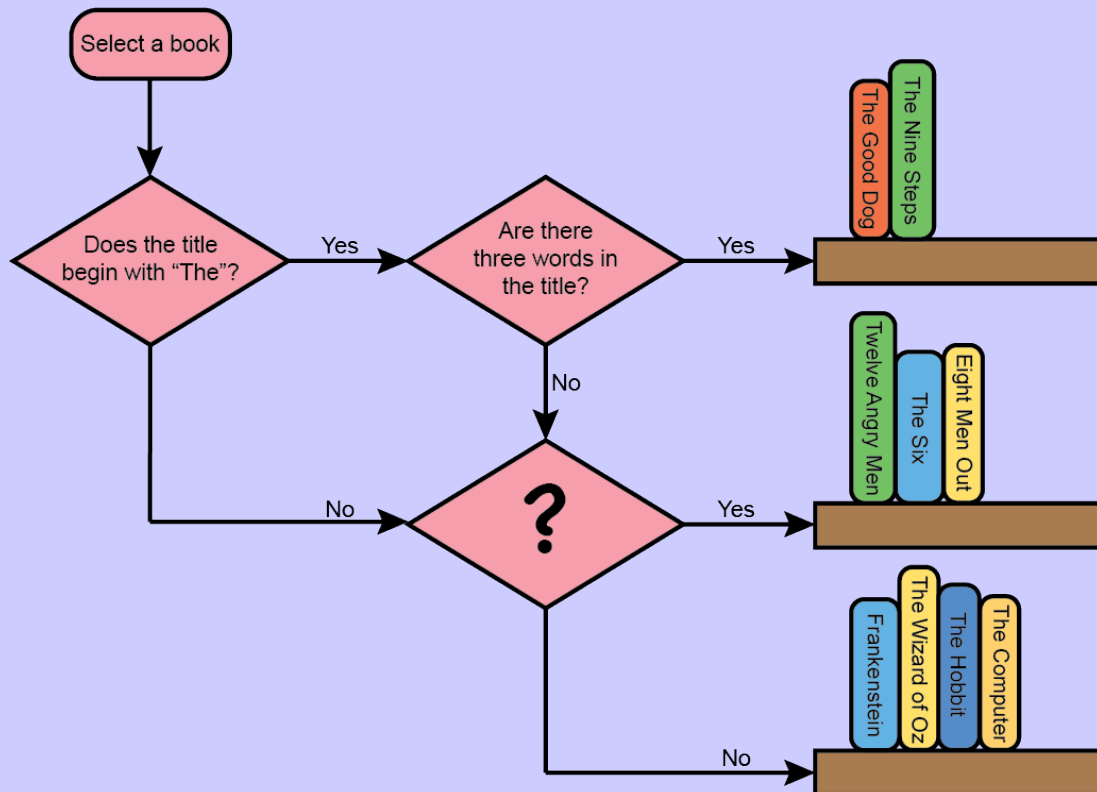
Question

If Bora's books end up on the shelves as shown, which of the following questions could have appeared in the diamond marked with a question mark (?) in the flowchart?

- (A) Does the title include the word "Men"?
- (B) Are there fewer than four words in the title?
- (C) Is the letter "i" in the title?
- (D) Does the title include a number?

Train Trip

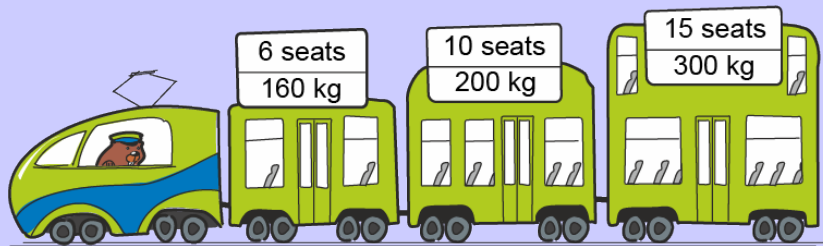A train has three carriages, with the number of available seats and luggage limits as shown:

Eight beaver families would like to go on a train trip, but

- every beaver must sit on its own seat,
- if one member of a family sits in a carriage, then all members of that same family must sit in that same carriage,
- a family's luggage must be in the same carriage as the family, and
- the total luggage weight has to be within the limits of each carriage.

Details about each family and their luggage are given in the following table:

Family	Number of Members	Luggage Weight (kg)
Avsec	3	50
Bizjak	4	80
Cerar	5	110
Dolenc	4	80
Erjavec	2	40
Furlan	3	70
Gabric	6	130
Hacin	5	100

Question

What is the maximum number of families that can go on the trip?

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