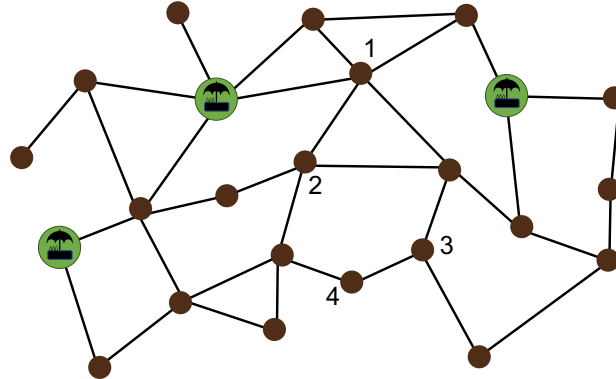


Tasks T1 – T7 carry 3 points each

T1. Juice carts

During summer, in Beaverland, the weather is too hot, so the mayor decided to distribute juice carts at some corners throughout the city. The corners where the juice carts should be positioned must be chosen in a way that ensures every citizen can reach a juice cart from any corner in the city walking 2 full streets at most.

The image below shows a map of the city. The brown dots indicate corners, streets are represented by lines connecting dots or circles, and the juice cart icons represent the corners where a juice cart has already been deployed.



Unfortunately, the mayor got a call from a fellow beaver who complained that from one of the corners (he couldn't remember which one) it was not possible to reach a juice cart by walking at most 2 streets. In order to solve this problem, the mayor requested the placement of an additional juice cart at one of the numbered corners shown in the map above.

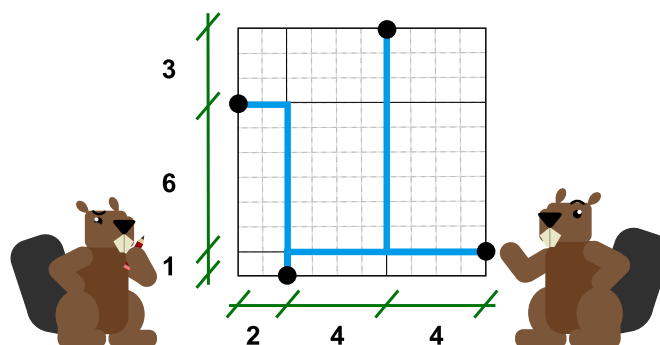
Question / Challenge

Where should the new juice cart be positioned such that it is possible to reach a juice cart from any corner in the city walking two streets at most?

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

T2. Channel plan

Beaver Maurice, an architect, presents his plan for the construction of a water channel to connect the four dwellings of the village, indicated on the map with black circles. Maurice finds it nice to follow the horizontal and vertical lines that cross each of the dwellings; on his 10x10 drawing he reported the distances between these lines and, in blue, a possible layout of the channel.



Beaver Jakob notes that this channel is a total of 26 units long... however, to work less, it could be made shorter!

Question / Challenge

How long is the shortest channel that can be made by joining horizontal and vertical segments on those lines?

A) 22

B) 23

C) 24

D) 25

T3. Elimination tournament

Eight teams participate in an elimination tournament. Each team is identified by a number, from Team 1 to Team 8.

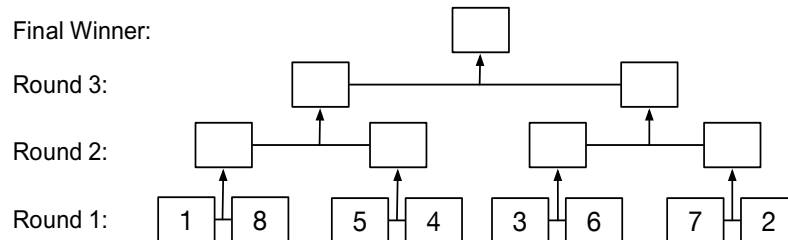
The winners of each round continue to the next round in the competition, while the losing teams are eliminated.

The results of the tournament are represented in the chart below.

1) At the beginning, all teams (with their numbers in the boxes) are shown at the bottom row.

2) A horizontal line between 2 adjacent boxes means that the 2 teams are playing against each other. For example, Team 1 is playing against Team 8.

3) The winning team's number is then written in the empty box above each pair of teams. This is repeated until the final winner of the tournament is found. There is only one winner per game.



After the entire tournament finished, four beavers (Andy, Beth, Cece and Daniel), who watched the tournament, wrote down how many times each team's number appeared in the final chart. Unfortunately, only one of the beavers has gotten the counts right.

	Andy	Beth	Cece	Daniel
Team 1	1	2	1	1
Team 2	4	1	2	1
Team 3	3	1	3	1
Team 4	1	1	1	1
Team 5	2	3	2	3
Team 6	1	4	4	2
Team 7	2	2	1	2
Team 8	1	1	2	4

Question / Challenge

Which beaver was correct in counting?

A) Andy

B) Beth

C) Cece

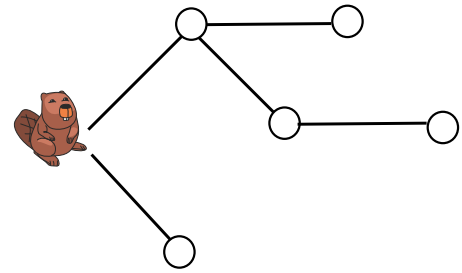
D) Daniel

T4. Thomas and his friends

Thomas's village has only six houses, including his own. All the roads between houses take the same amount of time to walk.

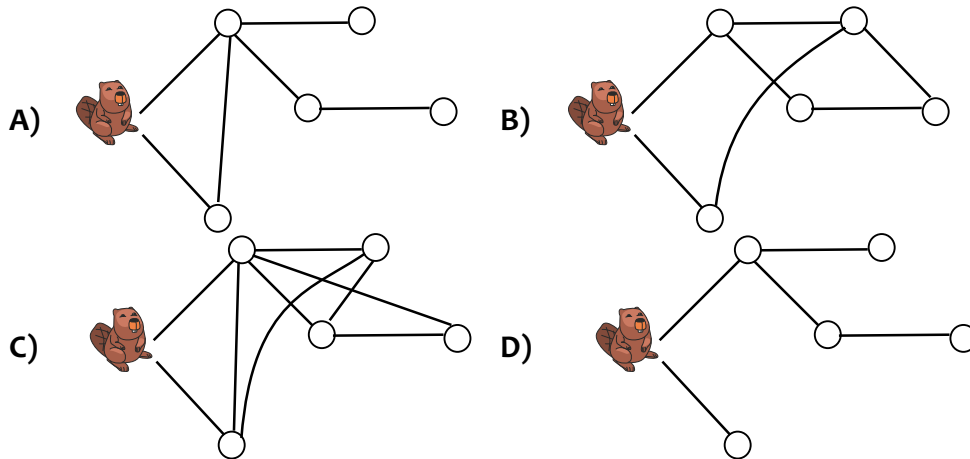
He constructed a map of roads that connect his house to other houses so that he can go from his house to any other house using the shortest path.

The map made by Thomas does not necessarily contain all the roads in the village because he included only the shortest paths.



Question / Challenge

There are many ways that a map of the village with all roads included could look. Which of these options can not be the full map of the village, given Thomas' map?



T5. Circles and Squares

Claire prepared a computer-controlled machine to print random patterns of circles and squares on white tablecloths.

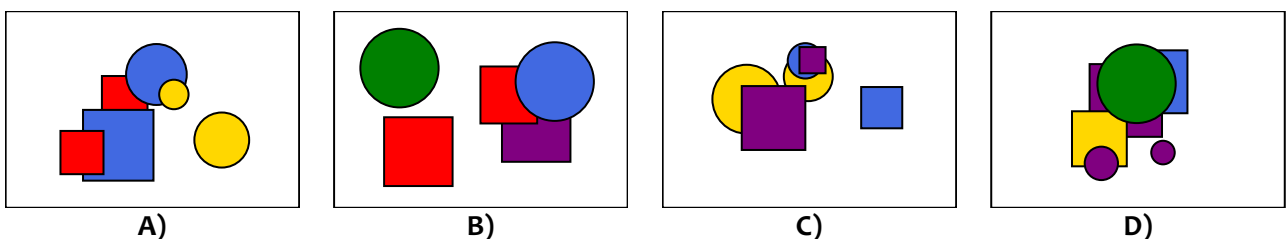
The machine follows the instruction given below:

Repeat the following sequence of these two commands **3 times**:

- print a **square** of random size, in a random place on the tablecloth and with a random color except for white
- print a **circle** of random size, in a random place on the tablecloth and with a random color except for white

Question / Challenge

Which of the tablecloths **could not be created** according to the given instructions?



T6. Time Costs Money

The TechGenius Corporation company has a new system that can speed up the execution of tasks.

The system can handle multiple tasks simultaneously, and its capacity can be increased by adding more processing units. Each processing unit can handle 1 task at a time.

The company has received 4 tasks (Task 1, Task 2, Task 3, and Task 4) that need to be executed as soon as possible. The processing time for each task is given below:

Task 1: 6 minutes

Task 2: 4 minutes

Task 3: 9 minutes

Task 4: 3 minutes

TechGenius Corporation currently has 2 processing units available. They can buy additional processing units, but each unit costs £500, and they want to minimize their spending.

Question / Challenge

What is the minimum amount of money TechGenius Corp. needs to spend on additional processing units to complete all tasks in the shortest amount of time?

A) £0

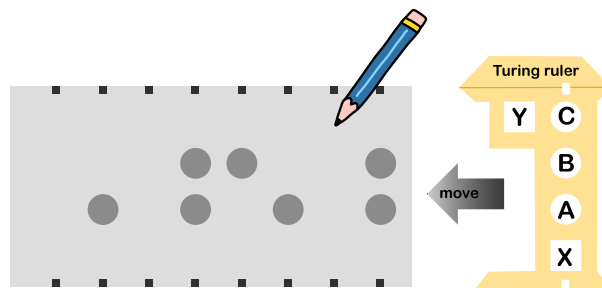
B) £500

C) £1000

D) £1500

T7. Fancy ruler

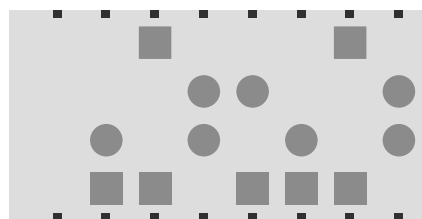
A fancy ruler with 5 holes (A, B, C, X, Y) and a pencil are used to draw gray squares on a sheet of paper.



The algorithm for drawing gray squares at locations X and Y can be described as follows.

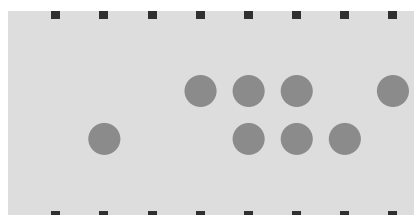
- Start with the first column on the right.
- If you see two or more gray circles through holes A, B, and C, draw a square at location Y. Bear in mind that a square drawn at location Y will appear as a circle when viewed through hole C.
- If the number of gray circles through holes A, B, and C is odd, draw a square at location X.
- After moving one column to the left, repeat the same process until the leftmost column.

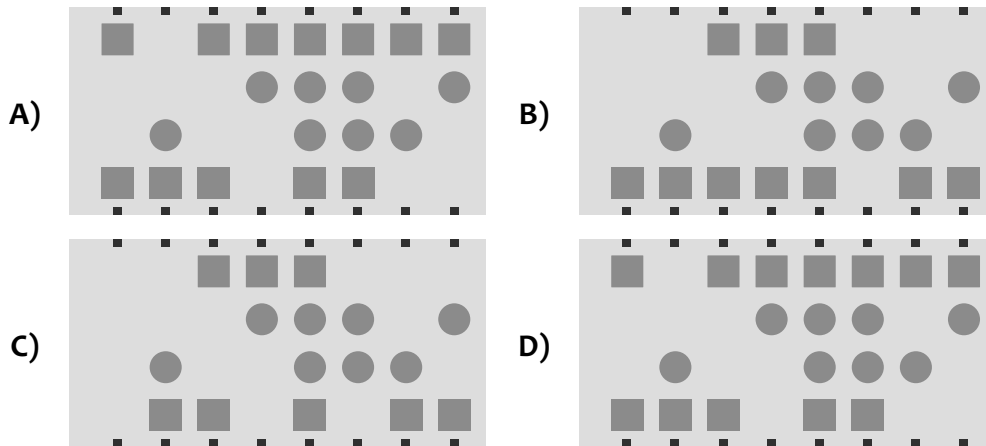
This is the result for the example from above:



Question / Challenge

What will be the result for the following sheet?

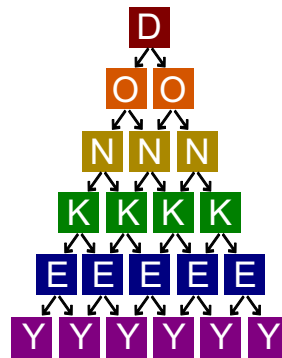




Tasks T8 – T14 carry 4 points each

T8. Triangle

June the beaver took blocks of letters and stacked them in a triangle, as shown below.



She can find different paths from top to bottom through adjacent blocks in a triangle. She tries to count all the times she takes different paths when reading the same word.

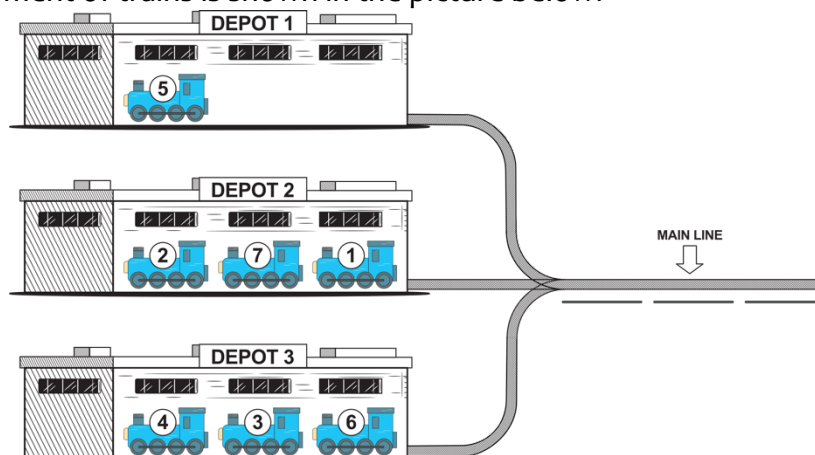
Question / Challenge

Exactly how many different ways can June read "DONKEY"?

- A) 5 B) 6 C) 32 D) 720

T9. Trains

John has 7 trains (numbered 1 to 7) and 3 toy depots where he can park his trains. The current deployment of trains is shown in the picture below.



John can make the following moves:

OUT(X) - moves the first train from the right of depot X outside to the main line, so that it becomes the first train on the left of the main line.

IN(X) – moves the first train on the left of the main line inside to depot X, so that it becomes the first train from the right of the depot.

There can be no more than 3 trains on the main line or in a depot at the same time.

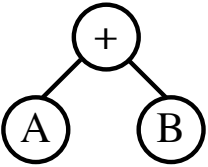
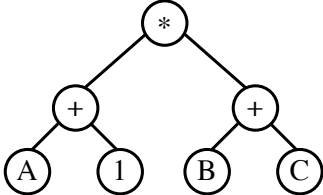
Question / Challenge

Which set of operations results in the trains numbered 1, 2, 3 from left to right in depot 1?

- A) OUT(1) - OUT(2) - IN(1) - OUT(2) - OUT(2) - IN(1) - OUT(3)
- B) OUT(1) - OUT(2) - IN(1) - OUT(2) - OUT(2) - IN(1) - OUT(3) - IN(2) - OUT(3) - IN(1)
- C) OUT(1) - OUT(2) - IN(1) - OUT(2) - IN(1) - OUT(3) - IN(2) - OUT(3) - IN(1)
- D) OUT(1) - OUT(2) - IN(1) - OUT(2) - OUT(2) - IN(1) - OUT(3) - OUT(3) - IN(1)

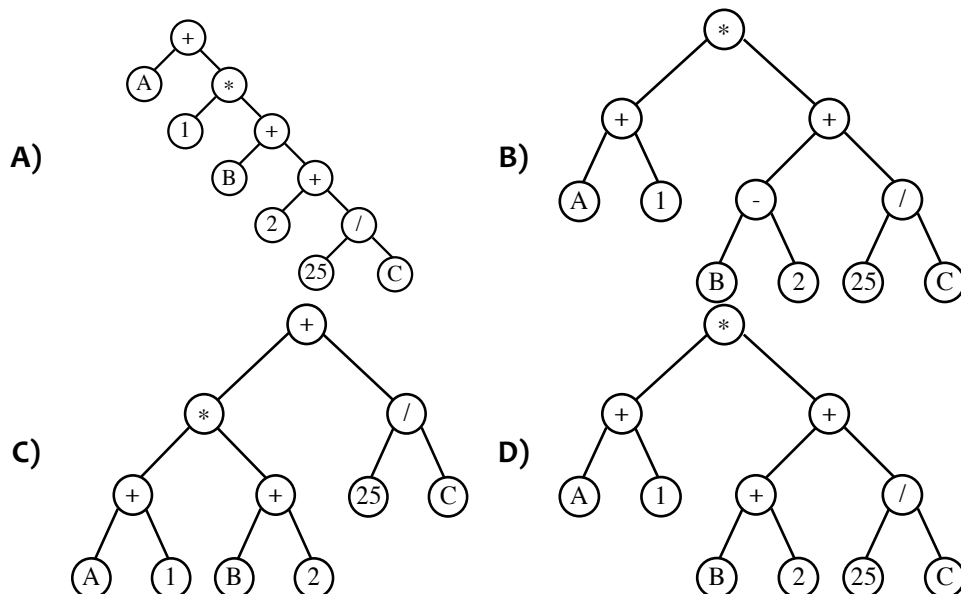
T10. Reverse Polish notation

Little Beaver and his friend thought of transforming the mathematical operations: addition (+), subtraction (-), multiplication (*), division (/), into a graphic representation, which they would then encode as follows (for A, B and C are variables or constants):

1. The operation $A+B$ is represented in the image below:  where the coding rule is: A B +.	2. The operation $(A+1)*(B+C)$ is represented in the image below:  where the coding rule is: A 1 + B C + *.
---	--

Question / Challenge

For coding rule **A 1 + B 2 + * 25 C / +** choose the correct representation from the following images:



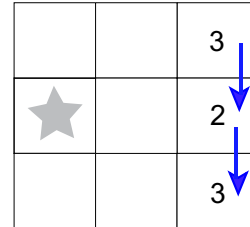
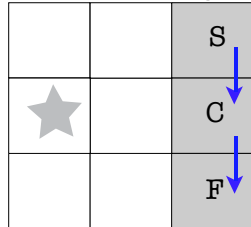
T11. Closer or Further

Daniel is playing a game to find out where the treasure was buried in a grid of squares. Daniel begins from a starting square denoted as **S** and he can move **a step** at one time only

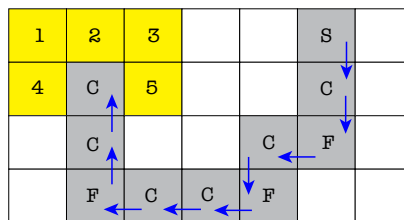
Time Allowed: 120 minutes

horizontally or vertically to the neighbor squares. After each step, Daniel receives a signal indicating whether he is closer (C) to or further away (F) from the treasure, where the **distance** to the treasure is the minimum number of steps reaching there.

For example, on the 3×3 grid shown below, the treasure is buried under the square marked ★. Daniel goes forward two steps following the arrows. The distances from the two squares to the treasure are shown below on the right. Daniel gets the signals “C” and “F”, respectively, after each step.



Now, Daniel is given another 4×7 grid, where his path follows the arrows and the obtained signals are also reported. Then, Daniel is given a hint that the treasure is buried under one of the five numbered squares.



Question / Challenge

Under which numbered square the treasure was buried?

- A) 2 B) 3 C) 4 D) 5

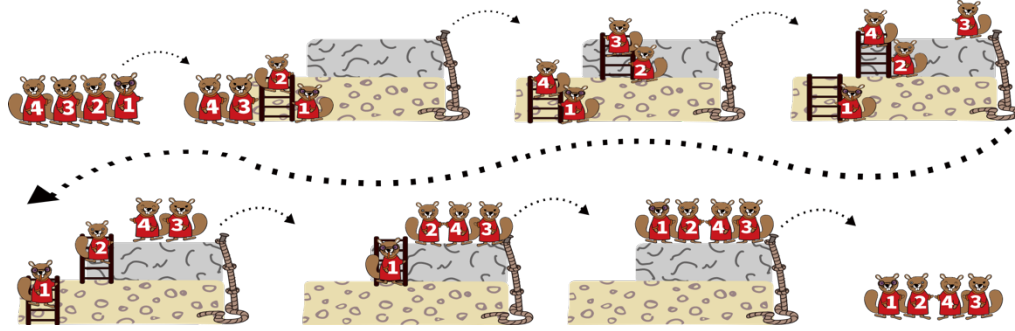
T12. Uphill

Beavers are practicing climbing steep hills for an upcoming hiking trip. The beavers line up and walk in a single line. All beavers are carrying a ladder. When they reach a steep climb, the beaver at the front of the line holds up their ladder for others to climb.

All of the beavers who are holding ladders remain in place until all beavers who did not hold ladders have climbed to the top of the hill. Each beaver that was holding a ladder climbs up to the next level using their own ladder. They continue to climb in this way until they reach the top of the hill and each beaver joins as the last beaver in the line. When they finish climbing a hill they climb down using a rope and keep their order.

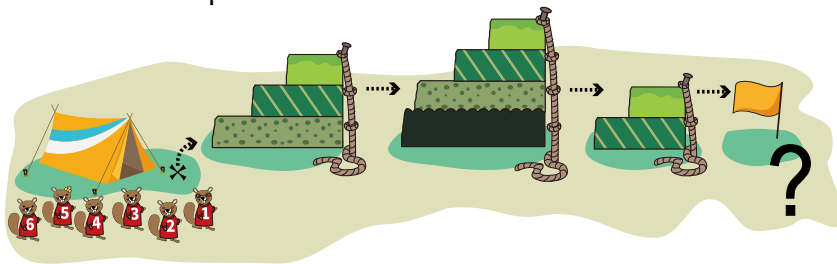
The figure below shows how four beavers climb up hills. They reach the foot of the first hill in the order 1234.

Beaver 1 holds up the first ladder. Beaver 2 climbs the ladder first, and holds their ladder for the second climb. Then Beavers 3 and 4 continue up both ladders to the top of the hill. Finally, 2 and 1 climb up in that order and join the other beavers at the top. So the final order of the beavers is 3421.



Question / Challenge

Six beavers go on a hiking trip in the terrain shown in the following figure. In what order do the beavers arrive at the question mark?



A) 654321

B) 214563

C) 365412

D) 214365

T13. The Basket Case

A group of people are attempting to keep exactly 10 apples in a basket. At any point in time, one of the people will observe the basket and take appropriate action according to the following rules:

	Observation	Action
1	They see <10 apples in the basket	Add an apple to the basket
2	They see >10 apples in the basket	Take an apple from the basket
3	They see 10 apples in the basket	Do nothing



Counting the number of apples happens instantly. However, it then takes exactly 5 seconds to add or remove an apple from the basket.

The people do not communicate with each other. Each person examines the basket at a certain time and an appropriate action is carried out 5 seconds later.

Question / Challenge

There are 9 apples in the basket when a stopwatch is started, and the people take turns observing the basket at the following times on this stopwatch:

Time	Event
0 seconds	Alice looks at the basket
4 seconds	Bob looks at the basket
7 seconds	Carol looks at the basket
8 seconds	Dan looks at the basket
10 seconds	Erin looks at the basket
11 seconds	Frank looks at the basket

After all six people have attempted to fix the number of apples in the basket, how many apples remain in the basket?

A) 8

B) 9

C) 10

D) 11

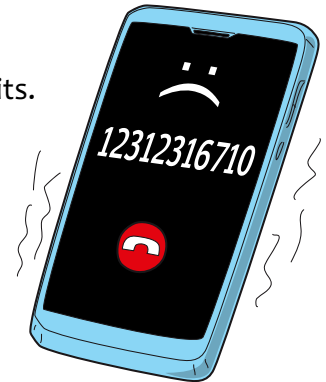
T14. Correcting error

In one country, a phone number consists of 11 digits. However, people tend to make mistakes when writing them down, so there is a rule to correct ONE mistake – all phone numbers must satisfy the following:

- 8th digit = the last digit of the sum of the first 7 digits (1st-7th).
- 9th digit = the last digit of the sum of the first 4 digits (1st-4th).
- 10th digit = the last digit of the sum of the 1st, 2nd, 5th & 6th digits.
- 11th digit = the last digit of the sum of the 1st, 3rd, 5th & 7th digits.

For example, 12345678046 is a correct phone number, because

- the 8th digit is 8 ($1+2+3+4+5+6+7 = 28$)
- the 9th digit is 0 ($1+2+3+4 = 10$)
- the 10th digit is 4 ($1+2+5+6 = 14$)
- the 11th digit is 6 ($1+3+5+7 = 16$)



Question / Challenge

Someone made ONE mistake and wrote down a phone number 12312316710. What was the correct phone number?

- A) 12312313710 B) 12312316780 C) 12315316710 D) 32322316710

Tasks T15 – T21 carry 5 points each

T15. Electronic lock

Beaver Bob installed an electronic code lock on the front door of his house. To open it, you need to press several different number buttons in the correct sequence. Originally the password was:

0	2	4	3	1
---	---	---	---	---

To make it difficult to guess, he encoded the password in the following form:

0>>0, 1>>3, 2>>0, 3>>1, 4>>0

The notation “I>>K” means that to the left of the number I there are exactly K numbers greater than I.

“0>>0, 2>>0 and 4>>0” means there are no larger numbers to the left of the numbers 0, 2, 4 in the password.

“1>>3” means there are three larger numbers to the left of the number 1, which are 2, 3, 4.

And “3>>1” means there is one larger number to the left of the number 3, which is 4.

Bob changed the password to a more complex 8-digit one, encoded as:

0>>3, 1>>2, 2>>4, 3>>4, 4>>1, 5>>1, 6>>1, 7>>0.

Question / Challenge

What is Bob’s new password?

--	--	--	--	--	--	--	--

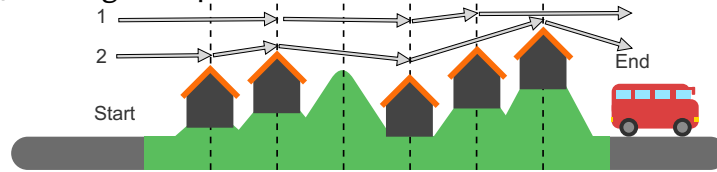
- A) 7 0 1 4 5 6 2 3 B) 7 4 1 0 5 6 2 3 C) 7 4 1 6 5 3 2 0 D) 7 4 1 0 5 3 2 6

T16. Counting

Mia enjoys walking holidays where she stays somewhere different each night. The diagram shows the complete walk Mia is considering for her next holiday. Mia can only walk one or two sections (marked by dashed lines) in a day. It shows the start, end, and all the places she can stop for the night. Two possible routes are shown on the diagram:

Route 1 will have 3 overnight stops.

Route 2 will have 4 overnight stops.



Question / Challenge

How many different routes (including the two shown) could Mia take on her walking holiday?

A) 10

B) 4

C) 5

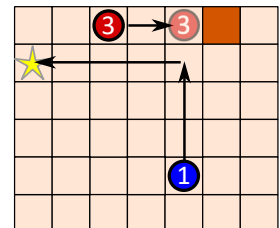
D) 6

T17. Bumping robots

The goal of the Bumping robots game is to give the robot instructions to move from its current location to the star ★. An obstacle is defined as something that the robot cannot go through. The game has the following rules:

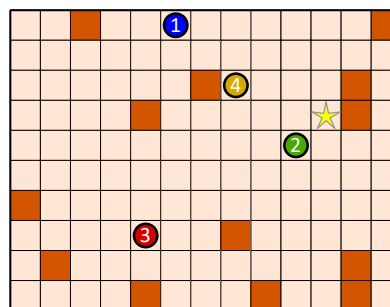
1. Brown squares on the board are obstacles.
2. Other robots are also obstacles.
3. The robot can be programmed to move in 4 directions only. The directions are up (↑), down (↓), right (→), left (←).
4. Once the robot starts moving in a direction, it won't stop until it hits an obstacle or the edge of the board.
5. When a robot starts its movement, the other robots will wait until this robot stops.

In the example shown to the right, the player can move robot ① to the star by combining 3 moves. The first moves robot ③ to the right. This will make it move and stop next to the obstacle shown. Then move robot ① up and take advantage of the stopped robot ③. Then finally, move robot ① left.



Question / Challenge

Given the situation on this board, what is the minimum number of moves required for robot ① to stop on the star ★?



A) 3

B) 4

C) 6

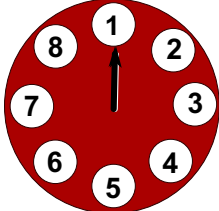
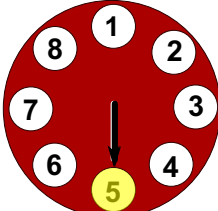
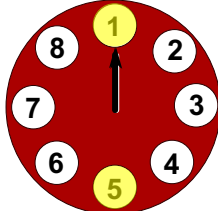
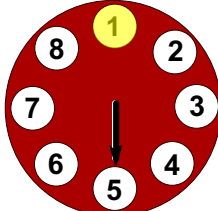
D) 7

T18. OpenIt

A beaver has to unlock a safe by lighting up the correct number combination.

On each move, the beaver can rotate the arrow clockwise for either 3 or 4 steps. The arrow toggles the light of the number it lands on: if the number's light was off, the light is turned on; if the number's light was on, the light is turned off.

For example, this is what happens if the beaver makes 3 moves, each rotating by 4 steps:

Starting position	After 1st move (4 steps)	After 2nd move (4 steps)	After 3rd move (4 steps)
			

Question / Challenge

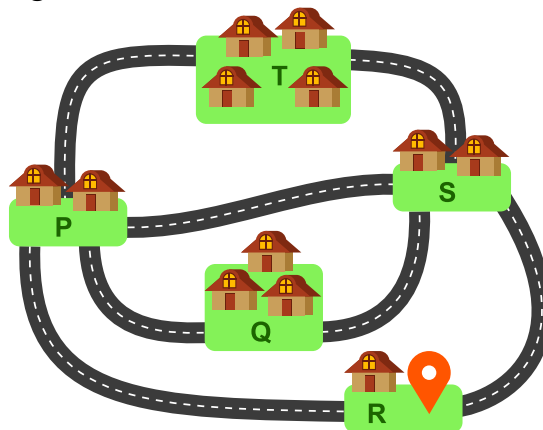
To open the safe, the beaver needs to light up **only 7 and 8** (no other numbers should be lit).

What is the **minimum number of moves** the beaver needs to do in order to light up only 7 and 8 from the starting position shown above?

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

T19. Carrot Routes

A company that digitalizes maps is collecting all the necessary pictures to chart every road that interconnects the villages displayed on the map below. Due to time constraints, they only have seven hours to capture these images. They can choose any route that enables them to accomplish this task, bearing in mind that it takes exactly one hour to capture pictures of the roads linking each village.



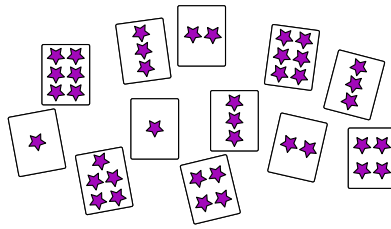
Question / Challenge

Starting from village R, how many different routes could the car use, to complete the map pictures in exactly 7 hours?

- A) 6 B) 8 C) 10 D) 12

T20. Handing out Card

A pack of playing cards consists of 12 cards with stars as shown below.



In a favourite card game, two cards must be handed out to each beaver but there is a rule that must be followed.

The Rule:

The total number of stars on the two cards of each beaver playing the game must be the same.

Question / Challenge

What is the maximum number of beavers who can play this game, using this pack of cards?

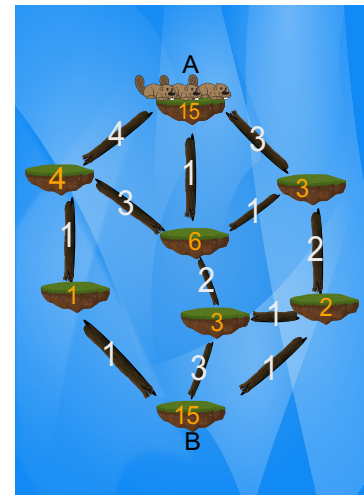
- A) 3 beavers B) 4 beavers C) 5 beavers D) 6 beavers

T21. Moving to Another Island

There are 15 beavers on island A who want to attend the party on island B, as shown in the picture.

The other islands are empty. The beavers are wearing their best clothes and don't want to get wet on the way, so they walk over the logs to island B. The beavers move across islands according to the following rules:

- The number on each log represents the maximum number of beavers that can cross it at the same time.
- The number on the island represents the maximum number of beavers that can be on each island at the same time.
- For islands A and B, a maximum of 15 beavers can be on each of these islands at any given time.
- Groups of beavers walk over the logs in many steps. For example in step one - four beavers from island A can go to the island on the left, one to the island in the middle and three to the island on the right.
- Only when all beavers have arrived on their islands can the second step begin. They can, of course, decide that any or all of the beavers do not move in one of the steps and stay on their island.



Question / Challenge

What is the maximum number of beavers that can be on island B after the 5th step?

- A) 11 B) 12 C) 13 D) 15

