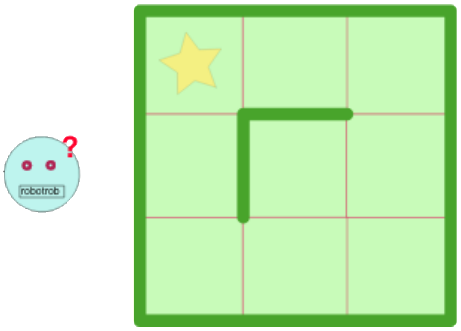
Tasks T1 – T7 carry 3 points each

T1. Recover my robot

Natasha lost her robot in a park. The park is a square composed of 3×3 smaller squares. The robot could have been lost in any of the nine squares.

Natasha can manually send a sequence of commands to the robot. She can command it to move either one square UP, LEFT, RIGHT or DOWN. If the robot is moving towards a wall, it won't be able to go further and stands still. The walls are drawn on the picture by a thick (green) line.



Question / Challenge

Natasha doesn't know where the robot is. What is the shortest sequence of commands that she can send to the robot, so that it reaches the square with a star?

A) DOWN - LEFT - DOWN - LEFT - UP - UP
B) RIGHT - UP - UP - LEFT - LEFT
C) RIGHT - UP - RIGHT - UP - LEFT - LEFT
D) UP - RIGHT - UP - LEFT – LEFT

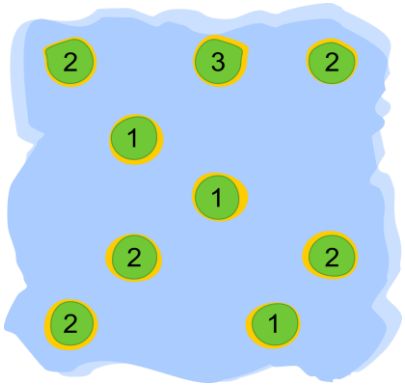
T2. Bridges and Islands

The map below shows islands represented by each circle. To travel between them, beaver needs to build some bridges. The numbers indicated in each island tell how many bridges must connect to that island. The bridges can only be built horizontally or vertically. Once all the bridges are built, the bridges system must make it possible to travel from any island to any other island.

For example, a certain group of islands has a map shown on the left. Once all the bridges are built, its bridges system would be as shown on the right.

Question / Challenge

How many bridges does one need to build in the map below?

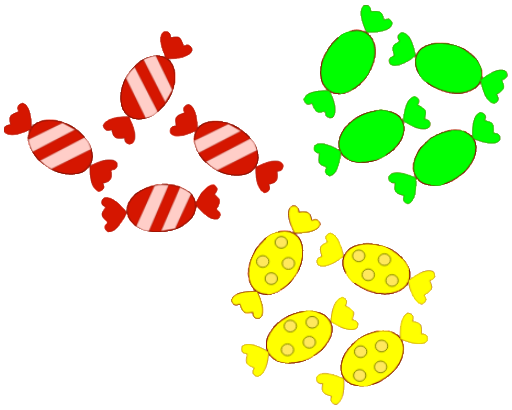


A) 7 **B)** 8 **C)** 9 **D)** 10

T3. A bag of candies

Peti has a bag of candies. There are 4 green, 4 yellow and 4 red candies in the bag. Peti plays with his friend and they have some rules: the friend has three turns to take out a candy from the bag and he has to collect them in a bowl.

- Each time he takes out a green candy, he has to put it in the bowl and he takes out one more candy from the bag (though it is still considered as the same turn)
- If he takes out a yellow candy, he eats it right away without putting it in the bowl.
- If he takes out a red one, he has to put it in the bowl immediately.



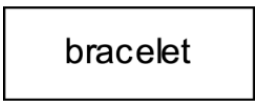
Question / Challenge

What is the maximum number of candies that can be in the bowl after the third turn?

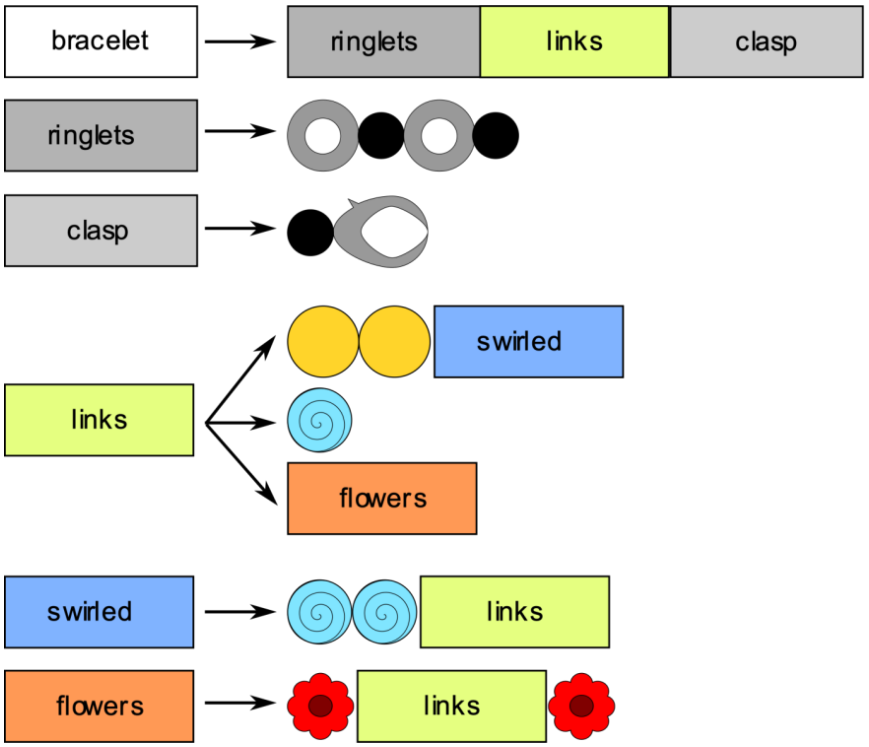
A) 5 **B)** 6 **C)** 7 **D)** 9

T4. Friendship Bracelets

Stephen makes bracelets starting with

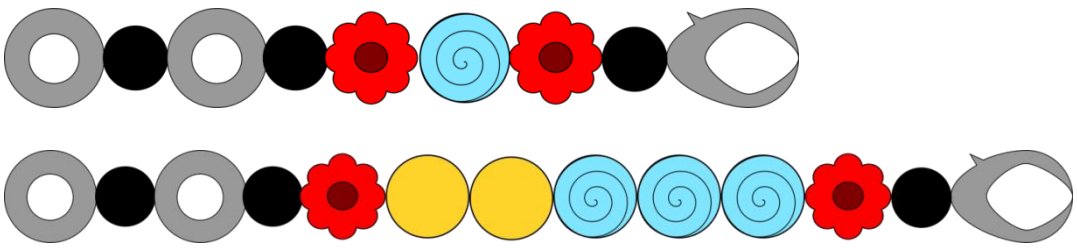


and using the rules below.



That is, every symbol on the left is replaced with one of the sequences of symbols it points to.

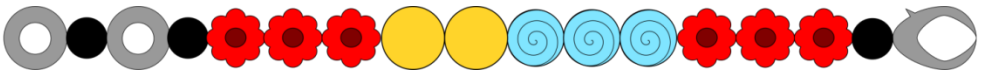
For example, using these rules several times, Stephen can make these two bracele ts.

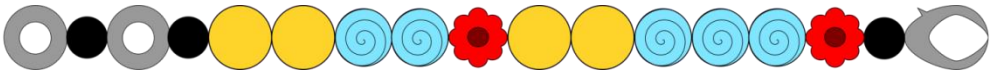


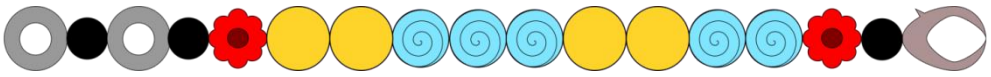
Stephen made four bracelets for four of his friends, using the same rules. One of the friends broke the bracelet and made a mistake trying to fix it.

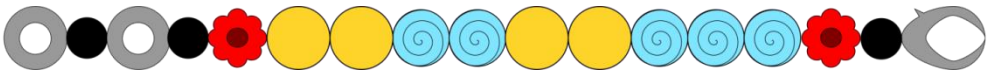
Question / Challenge

Which of the four bracelets below is the one with the mistake?

A) 

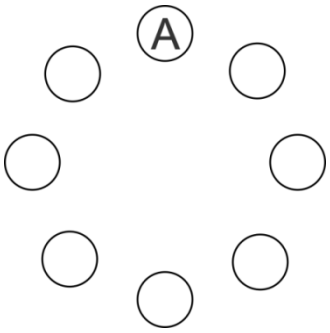
B) 

C) 

D) 

T5. Seating plan

Eight friends sit around a circle, as shown below. They are all facing inwards.

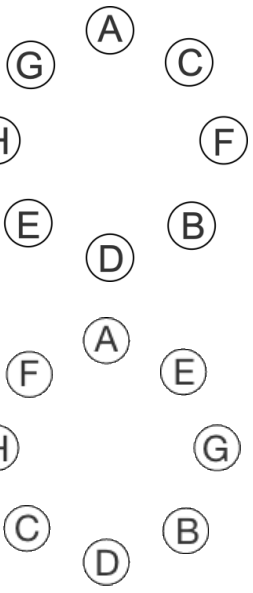


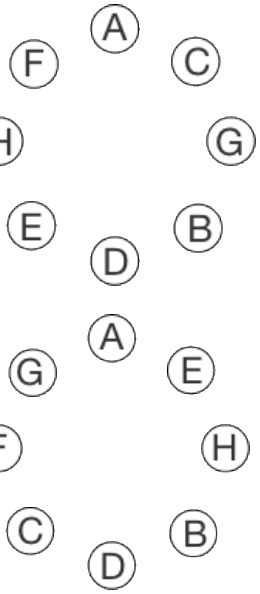
We know the following facts about where the friends sit:

1. Alice sits directly opposite to David.
2. Henry sits between Greta and Eugene
3. Franny is not beside Alice or David.
4. There is one person between Greta and Clare.
5. Eugene is beside David, on David's left.

Question / Challenge

Which table setting is correct?

A) 

B) 

C)

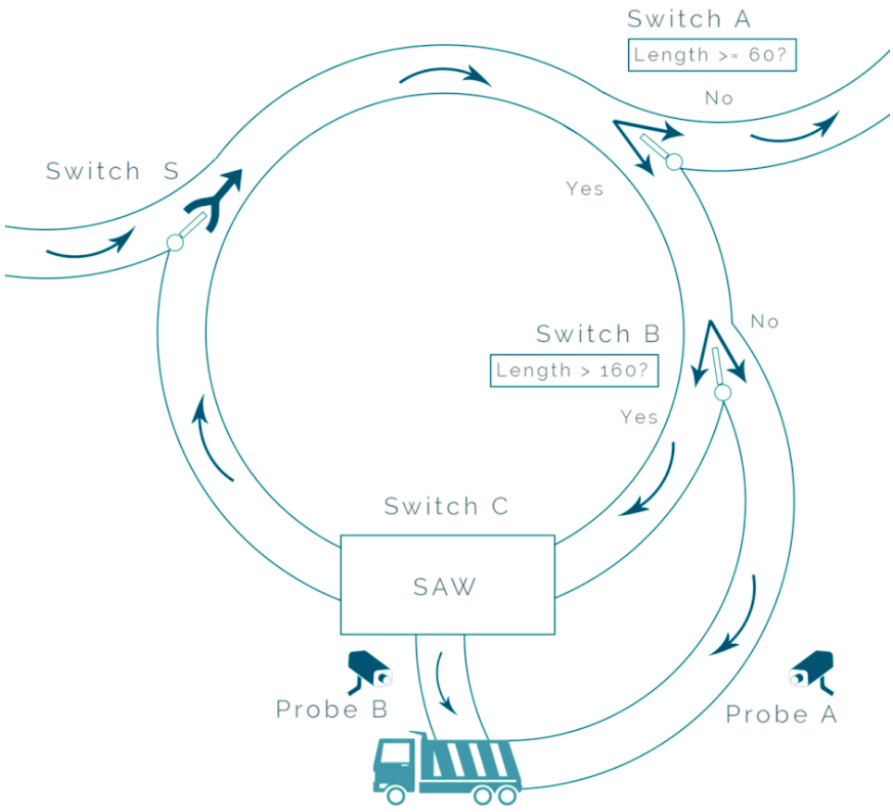
D)

T6. Sawmill

To build a log house you need logs of the right length. Logs arrive with various lengths, and the factory below puts each log with a length between 60 cm and 160 cm on a truck.

The logs arrive at the left of the factory. The different parts of the factory are:

- **Switch S** automatically prioritises logs from two streams into one stream.
- **Switch A** allows logs of length >= 60 cm to pass and sends away shorter logs.
- **Switch B** allows logs of length > 160 cm to pass and sends the rest to the truck.
- **Switch C** activates a saw to saw the log in two. The first one will be 160 cm long and immediately send it to the truck. The remaining log passes on for more processing.
- **Probe A** and **Probe B** are used to count the number of logs sent to the truck.
-



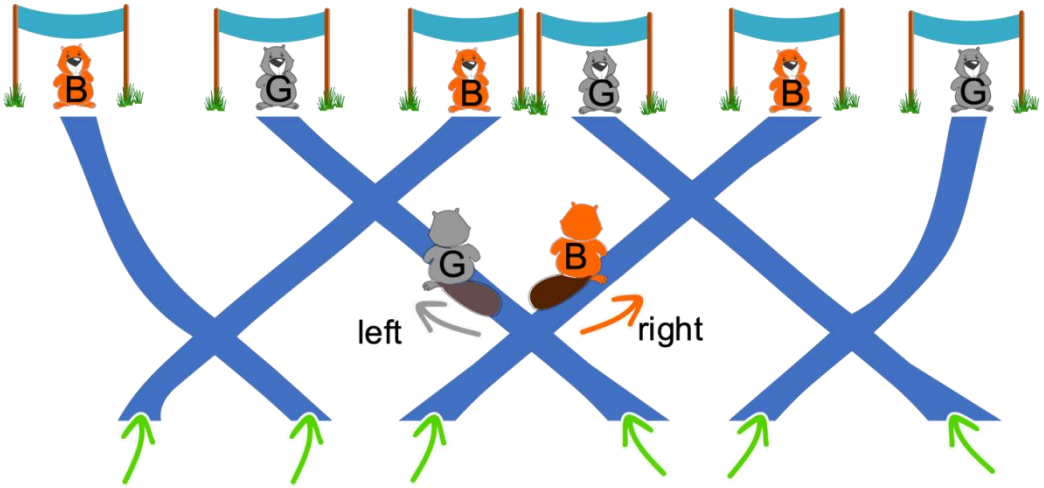
Question / Challenge

Three logs of different sizes (60 cm, 140 cm and 360 cm) are sent to the factory. When all of the logs have been completely processed, what are the values counted by the probes?

A) Probe A: 1 log, Probe B: 3 logs
B) Probe A: 3 logs, Probe B: 1 log
C) Probe A: 2 logs, Probe B: 2 logs
D) Probe A: 0 logs, Probe B: 4 logs

T7. Beaver Network

There is network of passages that beavers enter and exit. There are six entrances and six exits. Exactly one beaver enters at each entrance. There are two types of beavers, grey and brown. If two beavers meet at a junction and they are of two different colors, the brown beaver will go to the right while the grey one will go to the left. Six beavers enter the network of passages at the same time.



Question / Challenge

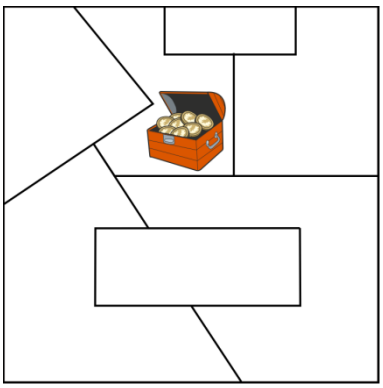
For the following order of beavers exiting the network: BGBGBG what is the order they entered the network?

A) BBBBGG
B) BBBBGG or GGGBBB
C) BBGBGG or BBBGGG
D) GBGBGB

Tasks T8 – T14 carry 4 points each

T8. Coding map

King of the beavers has hidden his treasure in a country of 7 provinces as shown in the map below.

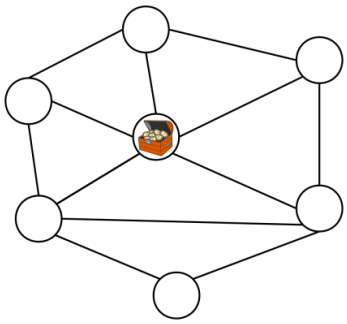


The king created an encoded map. Circles denote provinces and two circles are connected by a line if the corresponding provinces border each other. To confuse the thieves, the king made three more false encoded maps.

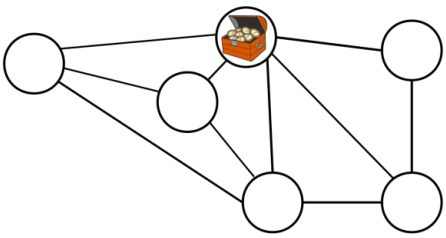
Question / Challenge

Which map is real?

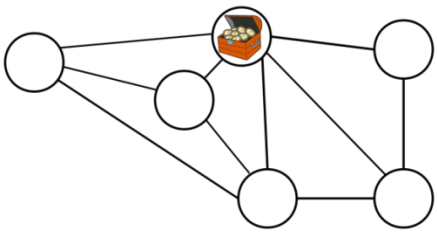
A)



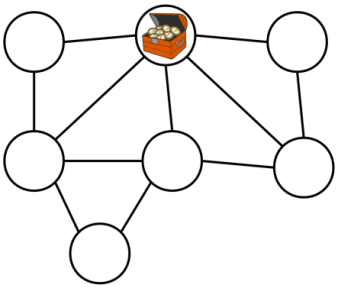
B)



C)



D)



T9. Zac's House And Three Trunks

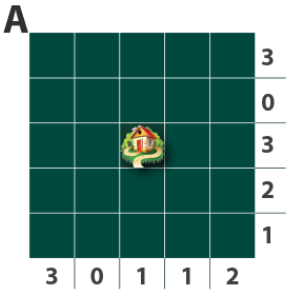
Farms in Zacland are divided into square fields with the farmhouse in the center square. Every year, the farmer must decide whether a field will grow wheat or grass, and they must report the wheat fields to the government. The report must include the sum of wheat fields in each row and column so it can be checked by satellite.

One farm's report is shown in the picture.

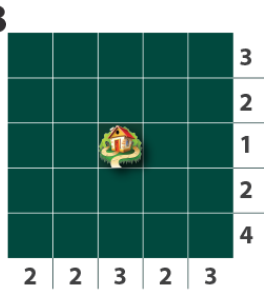
Question / Challenge

Which of the following is a possible, accurate report?

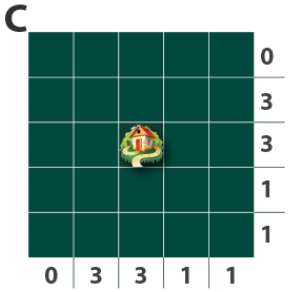
A



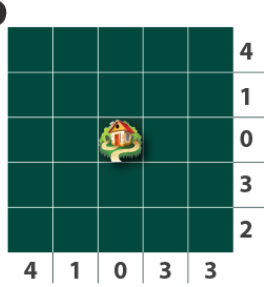
B



C



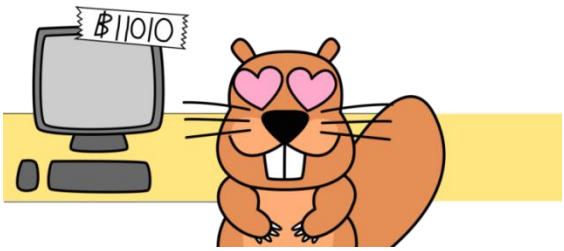
D



A) A **B)** B **C)** C **D)** D

T10. B-taro's shopping

B-taro goes shopping. He has one of each of these coins: ฿1, ฿10 and ฿100 plus two notes: one of ฿1000 and another of ฿10000. He wants to buy the best value computer he can without getting any change.
He decided to buy a computer that costs ฿11010.



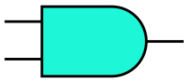
Question / Challenge

If we rank all the possible prices, with the most expensive at the top, that B-taro can pay without getting change, where does ฿11010 rank?

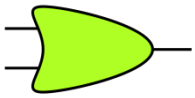
A) 5th most expensive
B) 6th most expensive
C) 11th most expensive
D) 26th most expensive

T11. Glass recycle

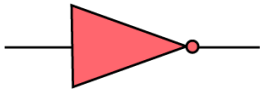
The Principal is very preoccupied with recycling glass in her school and she has observed that glass is either white or colored.
She has received magic machines that transform glass.
Two types of magic machine take 2 units of recyclable glass and transform them.
A third machine takes one unit of glass and transforms it.



This machine will produce white glass only if two white glass units are inserted. Any other combination inserted will produce colored glass.

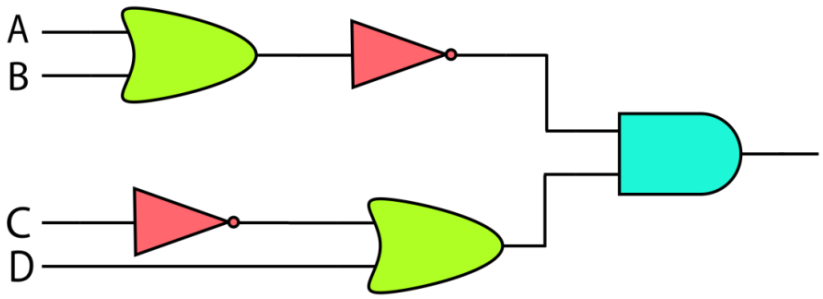


This machine will produce colored glass only if two colored glass units are inserted. Any other combination inserted will produce white glass.



This machine will turn colored glass into white glass or white glass into colored.

She made the following system:



Question / Challenge

What kind of glass could be inserted into the machines at A, B, C and D so that the resulting glass is white?

A) A = white, B = white, C = colored, D = white
B) A = colored, B = colored, C = colored, D = white
C) A = white, B = colored, C = colored, D = white
D) A = colored, B = colored, C = white, D = colored

T12. Operator Overloading

In programming, mathematical operators like "*" (multiplication) or "+" (addition) can have multiple meanings depending on the types of operands they are used on. This is called "operator overloading".
This is a typical example (working in different programming languages):
2*3 results to 6 because both operands are numbers "2"*3 results to "222" because the first operand is a text (also called "string"). The star-operator is used here to duplicate characters or strings. 2*"3" results to "33" because the second operand is a string. "2"*"3" results in an error, because both operands are strings. No meaning for the *-operator was defined for both operands being strings. 2+3 results to 5 because both operands are numbers "2"+"3" results to "23" because both operands are strings. The +-operator is used here to concatenate strings. "2"+3 or 2+"3" both result in errors. No meaning for the +-operator was defined for these combination of operand types.

In other words:
number * number: multiplication
string * number: string duplication
string * string: error
number + number: addition
string + string: concatenation
string + number: error
number + string: error

Question / Challenge

Look at the following line:

...><(((°>.....><(((°>.....><(((°>.....><(((°>...

Which expression correctly produces the four fish swimming from left to right?
Look carefully, some solutions might produce wrong patterns, some solutions might produce errors.
Hint: in any case "*" is evaluated before "+" (Operator Precedence)

A) (3*"." + "><" + 3*"(" + "°>" + 3*".")*"2"*2
B) (3*"." + "><" + 3*"(" + "°>")*2*2 + 3*"."
C) (3*"." + "><" + "3"*"(" + "°>" + 3*".")*2*2
D) (3*"." + "><" + 3*"(" + "°>" + 3*".")*2*2

T13. Aircraft Scheduling

When an aircraft lands at an airport, it is assigned a corridor to avoid accidents. This is a designated airspace, which separates planes from each other.
At the Bebrasland airport, two aircraft cannot have the same corridor if they are landing within 15 minutes of each other.

For example, if we have Flight #1 landing at 6:10 AM, Flight #2 landing at 6:25 AM and Flight #3 landing at 6:26 AM, then Flight #1 and Flight #2 cannot be assigned the same corridor whereas Flight #3 can be assigned the same corridor as Flight #1, but not the same corridor as Flight #2.

You are the Air Traffic Controller at the airport today and your job is to assign corridors for the scheduled flights shown in the table below.

Flight	Time
9W2400	7:00
9W1321	7:21
AI561	7:20
AI620	7:18
EK427	7:03
SG147	7:12

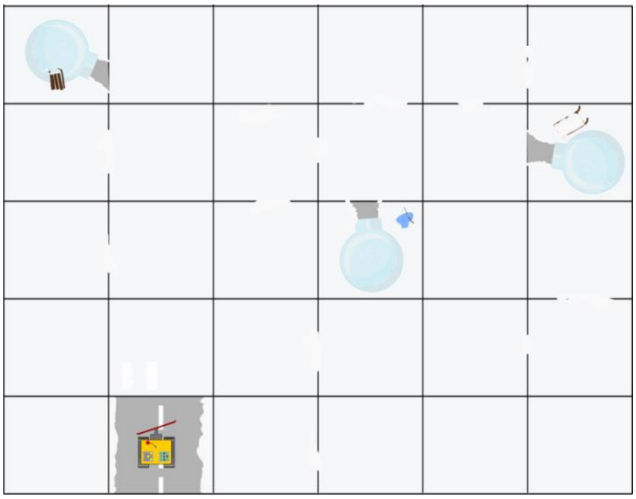
Question / Challenge

What is the minimum number of corridors needed to ensure that all the above flights land according to the rules?

A) 0 **B)** 3 **C)** 4 **D)** 8

T14. Rescue Mission

After a snow storm, three people want their igloos connected to the main road system again. A robotic snowplow is given the task to clear a path to do this. The robot then needs to return to its starting position.



Notes:

It takes 1 hour to move from one square to another if there is no snow in either square.
It takes 2 hours to move from one square to another if snow needs to be cleared.
It takes no time for the robot to turn around in a cleared square.
The robot does not need to go to an igloo, just clear the square in front of it's entrance so the people can walk out.

Question / Challenge

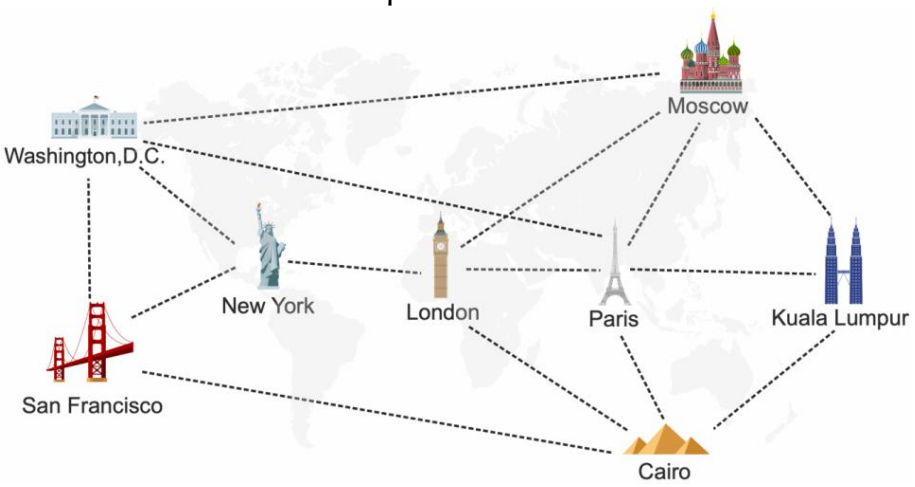
What is the minimum time the robot needs to accomplish the task?

A) 21 hours **B)** 13 hours **C)** 5 hours **D)** 3 hours

Tasks T15 – T21 carry 5 points each

T15. Greener Flight Routes

The Bebras International Airline has a lot of flight routes connecting several big cities in the world as shown in the picture:



CO_2 emissions are a major cause of global warming. In order to reduce CO_2 emissions, the airline wants to drop some of the flight routes without disrupting the ability of the customers to fly to any city.
For example, if the flight route between San Francisco and Washington, D.C. were to be dropped, customers could fly from San Francisco to New York and then from New York to Washington, D.C.

Question / Challenge

For the flight routes shown above, what is the maximum number of routes the airline can drop?

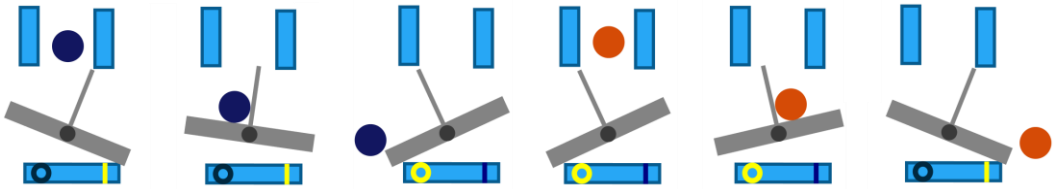
A) 6 **B)** 7 **C)** 8 **D)** 9

T16. Counter

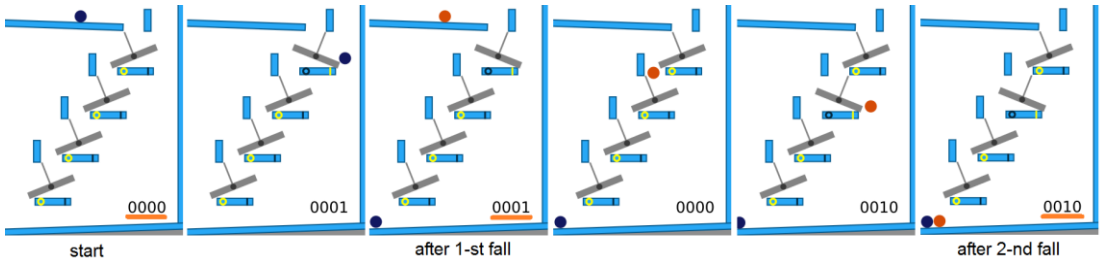
In this machine, there are four bars that can tilt.

- A bar tilted to the left = 0
- A bar tilted to the right = 1

When a ball drops and lands on a bar, the bar tilts and the ball rolls off.



Here is the machine when the first 2 balls are dropped.
In the first picture, all the bars are 0 and the counter shows 0000.



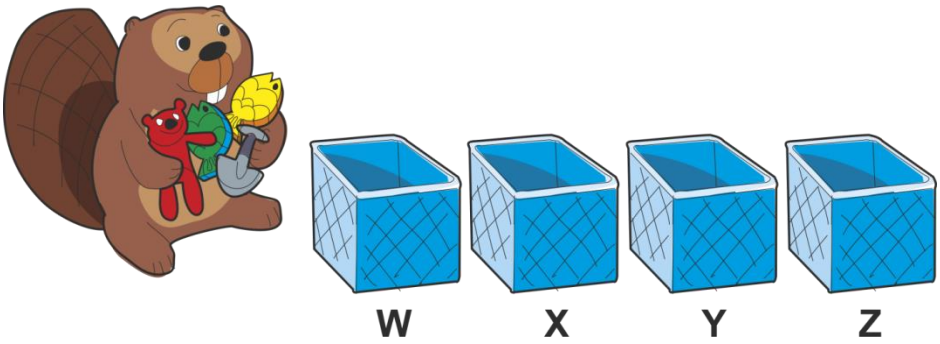
Question / Challenge

What will the counter be after 5 balls have been dropped?

A) 0111 **B)** 0101 **C)** 0100 **D)** 1110

T17. Triple Trouble

Mother Beaver has four toys and would like to put them into four boxes, labeled W, X, Y, Z. In each box she can put at most one toy.



Mother Beaver wants to verify **all** the following conditions:

1. At least one is true: A toy is in X **or** no toy is in Y **or** no toy is in Z.
2. At least one is true: A toy is in W **or** a toy is in X **or** no toy is in Z.
3. At least one is true: No toy in X **or** no toy in Y **or** a toy is in Z.
4. At least one is true: No toy in W **or** no toy in X **or** no toy in Y.
5. At least one is true: No toy in X **or** a toy is Y **or** no toy in Z.

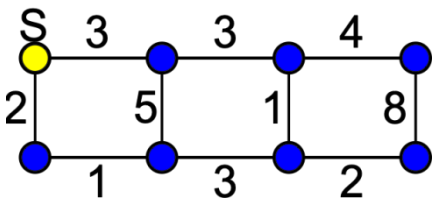
Question / Challenge

What is the **maximum number of toys** that she can put into the boxes, so that all the conditions above are satisfied?

A) 1 **B)** 2 **C)** 3 **D)** 4

T18. Byber Path

You drive for a delivery service called Byber. You start at location S and you have to drop off a package at each of the seven other locations, shown as circles. The locations are joined by roads shown as lines. The price you are paid for taking each road is shown as a number on the corresponding line. As you get paid for the total value of your tour, you would like to choose the roads which will make you the most money. You cannot visit any location more than once on your tour. You can finish at any location that you wish.



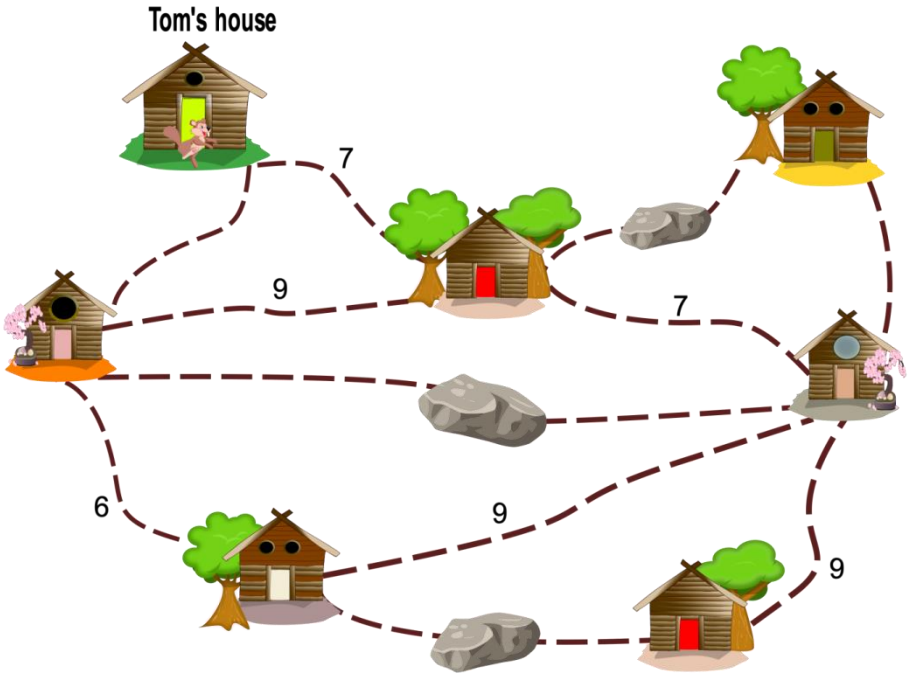
Question / Challenge

What is the most amount of money you can make dropping off these 7 packages?

A) 23 **B)** 24 **C)** 25 **D)** 26

T19. Visits

Little Tom is at home and wants to visit all his relatives. To use some of the roads he has to pay a fee (they are shown in the picture below). If he uses a road more than once, he doesn't have to pay again. Some of the roads are blocked by rocks, so they cannot be used.



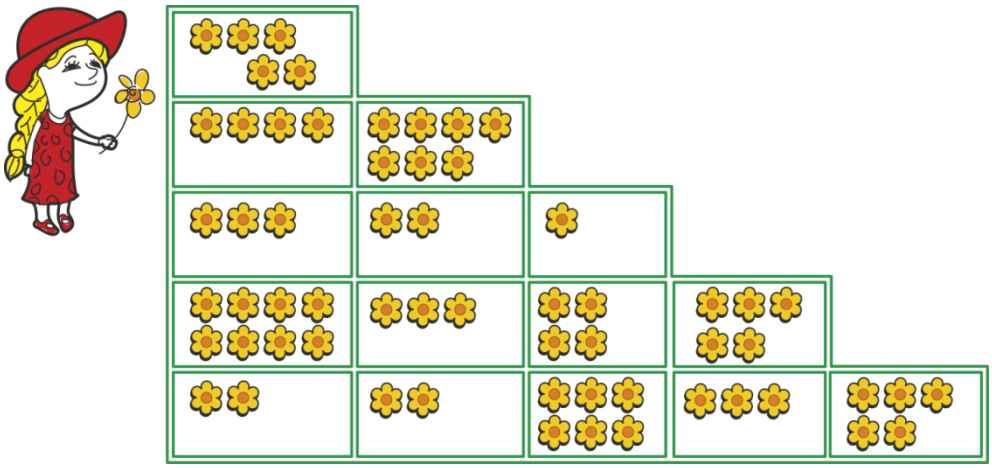
Question / Challenge

What is the minimum amount of money Little Tom must have in order to be able to visit all his relatives?

A) 7 **B)** 14 **C)** 23 **D)** 29

T20. Red Riding Hood

Red Riding Hood wants to pick up flowers from her grandmother's garden. The garden is divided into several parts, each part having a certain number of flowers planted inside. Red Riding Hood starts her journey from the part on the top left and makes her way down to the part on the bottom right **going just down or right.**



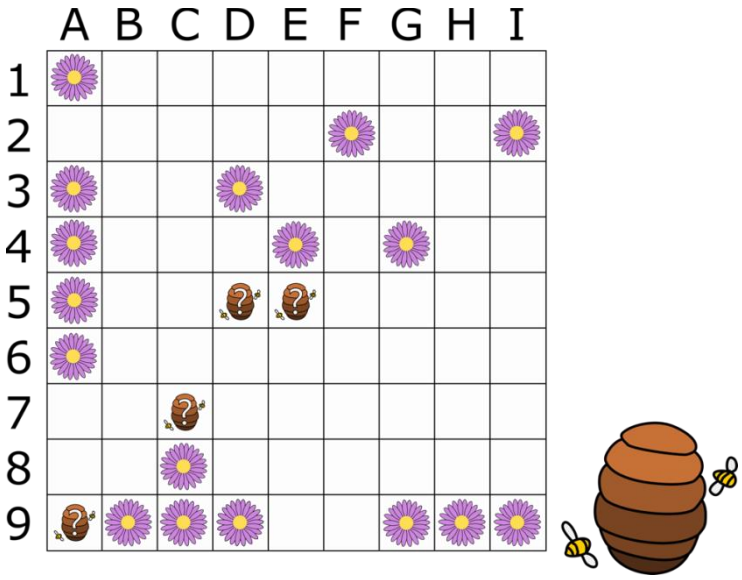
Question / Challenge

What is the maximum number of flowers that she can collect during her journey?

A) 35 **B)** 38 **C)** 58 **D)** 41

T21. Bee Hive

A beekeeper has a hive with bees. He wants to place the hive so that the sum of distances from the hive to every flower is minimum. The field with flowers is represented in the following grid, with rows from 1 to 9 and columns from A to I.



The bees only fly horizontally and vertically on this field, so the distance between two tiles is the sum of the horizontal distance and the vertical distance. For example, the distance between C4 and D7 is 4 (3 tiles vertically plus 1 tile horizontally).

Question / Challenge

Where should the beekeeper place the hive so that the sum of distances from the hive to every flower is minimum? (possible locations are marked with on the map)

A) D5 **B)** C7 **C)** E5 **D)** A9