Tasks T1 – T10 carry 3 points each

T1: License number

All cars in beaver city have license plates composed of numbers. The Beaver car mechanic Tim has thought of a solution to find the license numbers of his customers faster than before. He uses a table with entry numbers. To calculate the entry number for a specific license number, he simply sums up the first two digits and inserts the full license number in the field with this entry number. If this field is taken already, he takes the next free field below (with a higher entry number).

The table initially contains the entry for a Ford Mondeo type car with license number 357900. According to his entry rule it is stored at entry number 8, since 3+5=8.

Question

Here is a picture of the table of entries after 7 more license numbers have been inserted.

0		
1	011234	Toyota Camry
2	115678	VW Golf
3	209874	Ford Focus
4	113598	Toyota Corolla
5		
6		
7		
8	357900	Ford Mondeo
9	093366	Kia Rio
10		
11	561478	VW Jetta
12	652147	Ford Fiesta

Which of the following sequences could have been the order in which the license numbers were inserted?

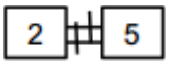
A)
115678 VW Golf
011234 Toyota Camry
561478 VW Jetta
652147 Ford Fiesta
093366 Kia Rio
209874 Ford Focus
113598 Toyota Corolla

B)
115678 VW Golf
011234 Toyota Camry
561478 VW Jetta
113598 Toyota Corolla
652147 Ford Fiesta
093366 Kia Rio
209874 Ford Focus

C)
652147 Ford Fiesta
209874 Ford Focus
115678 VW Golf
561478 VW Jetta
011234 Toyota Camry
093366 Kia Rio
113598 Toyota Corolla

D)
093366 Kia Rio
115678 VW Golf
652147 Ford Fiesta
561478 VW Jetta
209874 Ford Focus
113598 Toyota Corolla
011234 Toyota Camry

T2: Draw a maze

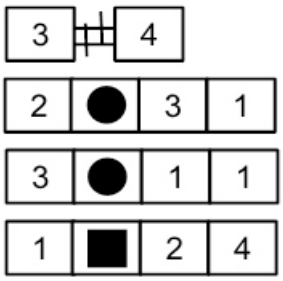
The command 

draws a grid of squares with 2 rows and 5 columns.

The command 

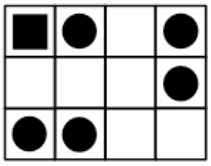
inserts a triangle inside each of the 2 squares in a row starting at the first row and the third column.
After executing the two commands we get this grid:

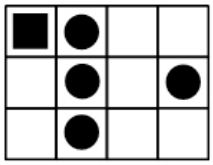
Now we use the following sequence of commands:

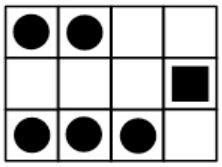


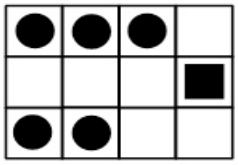
Question

What is the result?

A) 

B) 

C) 

D) 

T3: Postfix Stackmachine

Here is a simple calculating machine. It stacks the boxes coming from the right until a box with an operating sign (+,-,* or /) appears. Then this calculation is carried out with the three topmost boxes and they are replaced by one single box containing the result of the calculation.

Try these examples:

- 2+3 must be entered as 2 3 +
- 10-2 must be entered as 10 2 –
- 5*2+3 must be entered as 5 2 * 3 +
- 5+2*3 must be entered as 5 2 3 * +
- (8-2)*(3+4) must be entered as 8 2 - 3 4 + *

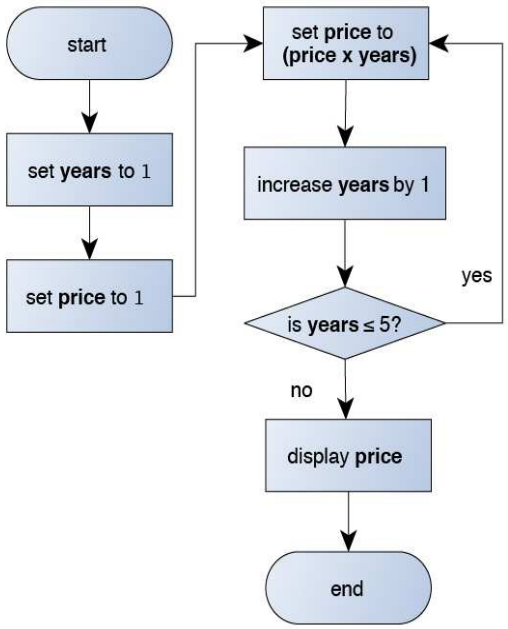
Question

Which of the following expressions is correct for the calculation of **4*(8+3)-2**?

A) 2 8 3 + * 4 -
B) 4 2 3 + * 8 -
C) 4 8 3 + * 2 -
D) 4 8 2 + * 3 -

T4: Price of cheese

The price of cheese in Beaverland changes depending on how old it is. In order to calculate the price, we can use flowcharts, which are diagrams used to explain a process. Below is the flowchart to calculate the price of a piece of cheese after 5 years have passed. The cheese starts out with the price of 1.



Question

What is the price displayed at the end?

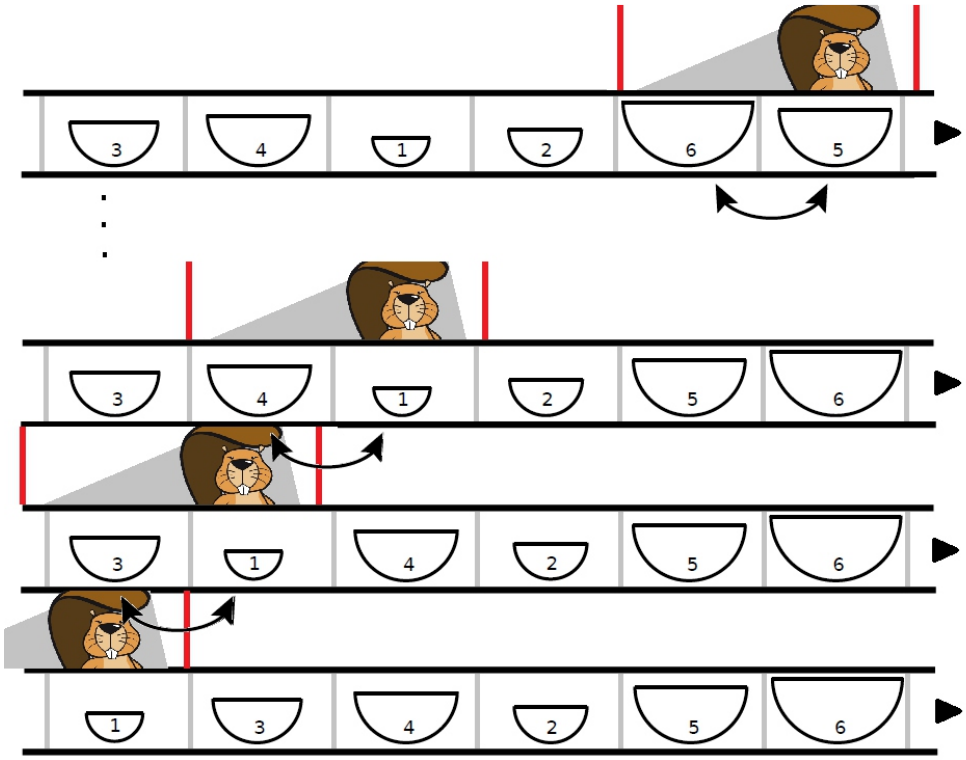
A) 105 **B)** 110
C) 115 **D)** 120

T5: Bowl Factory

A factory produces sets of 6 bowls of different sizes. A long conveyor belt moves the bowls one by one, from left to right.

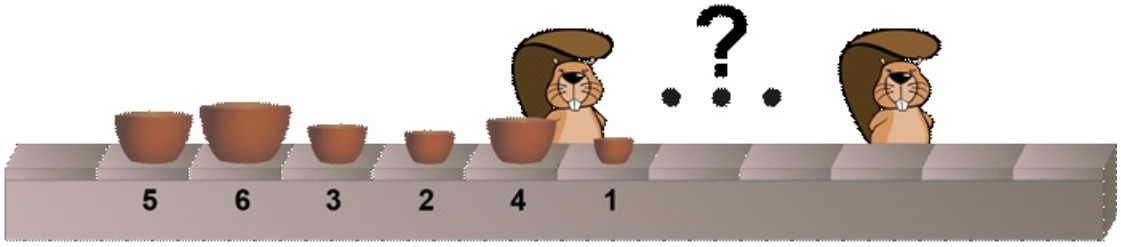
Bowl production places the 6 bowls of each set on the belt grouped together, but in arbitrary order. Before packing the bowls, they need to be sorted like this:

To help with the sorting, the factory places beaver workers along the conveyor belt. When a set of bowls passes a worker, he will swap any two neighboring bowls that are in the wrong order. See how the order of a set of bowls changes as it passes **one worker**:



Question

How many workers does this set of bowls have to pass in order to get sorted?



A) 3 **B)** 4
C) 5 **D)** 6

T6: Password check

For reasons of security it is better not to store passwords directly into a database (so they cannot easily be stolen). Instead, you put a codeword into the database that is derived from the original password with a special program. When the user enters a password, the system applies this program to it and then checks whether the resulting codeword matches the one in the database.

BTC - the Bebras Telephone Company - uses this technique with a program of their own invention. (This was a bad idea, because their program is very unsafe!)

Their program works as follows:

- A password must contain upper case letters only (A-Z)
- The resulting codeword consists of 26 numbers: first the number of A's in the password, then the number of B's, and so on…

For example, the password INFORMATION results in the codeword 10000100200012200101000000, as illustrated below:

```
INFORMATION


ABCDEFGHIJKLMNOPQRSTUVWXYZ
10000100200012200101000000
```

Question

The boss of BTC has a login account with password BREAKFAST. There are however many other passwords that will work instead. Which of the following passwords **will NOT** give you access to the bosses account?

A) AFTERBEAK **B)** BAKERSFAT
C) BARKFEAST **D)** FREAKSTAB

T7: Lollipops 2

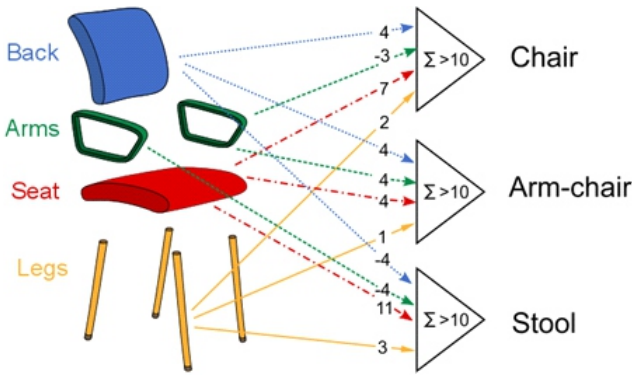
A single lollipop costs 12 beuros.
A package with two lollipops costs 20 beuros.
A package with four costs 44 beuros.
A package with eight costs 72 beuros.
A box with sixteen costs 150 beuros.

Question

What is the minimal amount of money that we need in order to buy 21 lollipops? It is allowed to buy more than you need and give some lollipops away.

A) 190 **B)** 196
C) 200 **D)** 214

T8: A chair or an armchair?



The Beaver Research Center for Artificial Indolence has devised a recognition system for resting furniture based on 3 "neurons". They consider the parts of the object by summing up points (accordingly to the numbers shown in the left picture) if it has a back, arms, a seat, or legs. Neurons recognize *chairs*, *arm-chairs*, or *stools* when for one of the neurons the sum exceeds 10, and for others it is less or equal than 10.

For example, the object on the right has a back, no arms, a seat an legs. Hence, it gives 13 points on first neuron, 9 on the second an 10 on the third. Therefore it will be recognized as a *"chair"*.

Question

Which of the following objects will NOT be recognized by the recognition system?

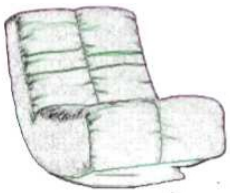
A)

(back, arms, seat)

B)

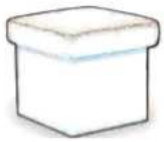
(arms, seat, legs)

C)



(back, seat)

D)



(seat)

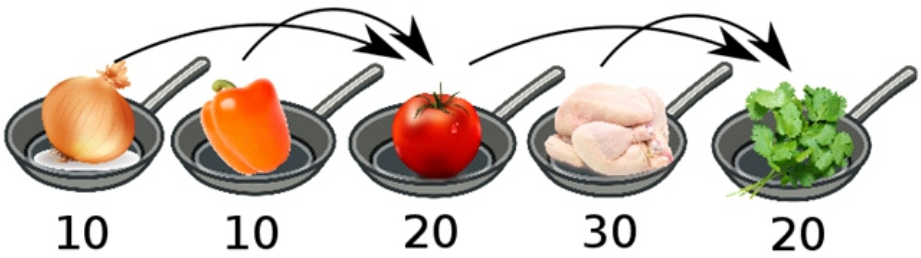
T9: Chakhokhbili

Beaver Sergo loves to cook. His favorite meal is Chakhokhbili.

When cooking in the garden he uses a single burner. He performs the following actions after each other:

1	Cook an onion	10 minutes
2	Cook a bell pepper	10 minutes
3	Combine the cooked onion and cooked bell pepper, add a tomato and cook this together	20 minutes
4	Cook a chicken	30 minutes
5	Combine everything from steps 3 and 4, add some spices, and cook it all.	20 minutes

In total Sergo needs 90 minutes to prepare his Chakhokhbili.



Question

When Sergo cooks at home he has many burners available. He uses more burners so his meal is ready sooner. Which of the following statements is **NOT** correct?

A) With 2 burners it is possible reduce the cooking time by 10 minutes
B) With 2 burners, it is possible to reduce the cooking time by 30 minutes
C) With 3 burners, it is possible to reduce the cooking time by 40 minutes
D) With 4 burners, it is possible to reduce the cooking time by 50 minutes

T10: Two drawing robots

James created two drawing robots that can execute commands:
move - robot goes 1 step forward
turn - robot turns by 90 degrees

James puts robots on the floor, and send them three commands to each robot.

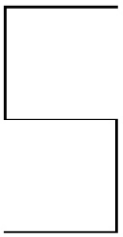
James noticed that one robot interprets the **turn** command as turning 90 degrees to the right, but the second one interprets it as turning 90 degrees to the left.

Then James tried to paint many pictures by putting each robot to a **different place** on the floor but giving both of them always **the same set of commands**. Also the robots **can't be in one place** at any point of time.

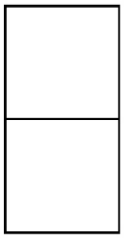
Question

Which picture could **not be drawn** by the two robots?

A)

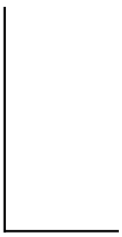


B)



C)

D)



Tasks T11 – T20 carry 4 points each

T11: LED lights

Lights are arranged into a rectangular table, as shown below. Some of the lights are on (light yellow squares), some of them are off (dark gray squares).

A touch on a particular square changes the state of all the lights in the same row and the same column.

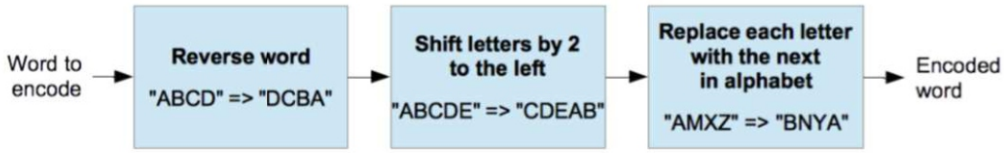
Question

What is the smallest number of touches required to turn off all the lights?

A) 3 **B)** 4
C) 5 **D)** 6

T12: You won't find it

Beaver Alex and Beaver Betty send each other messages using the following sequence of transformations on every word.



For example, the word "BEAVER" is transformed according to the following steps:

"BEAVER" => "REVAEB" => "VAEBRE" => "WBFCSF"

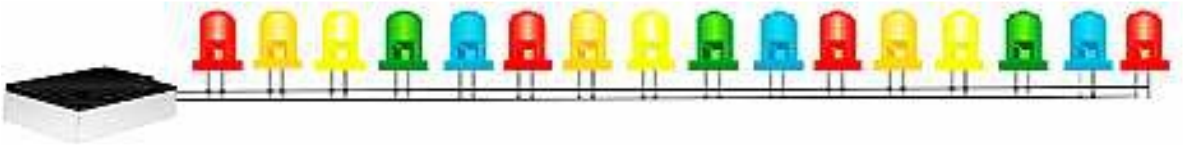
Question

Beaver Betty receives the message "PMGEP" from Beaver Alex. What did Alex want to say?

A) LODGE **B)** RIVER
C) FLOOD **D)** KNOCK

T13: Sixteen Diodes

Bob experiments with a controller that gives signals to 16 light-emitting diodes labeled from 1 to 16.



When the controller gives a signal to a diode, the diode changes its state: If it is currently off, it will be switched on. If it is currently on, it will be switched off.

Bob wrote a continuous program. Every second, the program gives a signal to some of 16 diodes: in the 1st second to all of the diodes, in the 2nd second to every second diodes, in 3rd second to every third diodes, and so on.

Question

Initially, all of the diodes were switched off.
After running the program for several minutes, which of the diodes will be switched on?

A) 1, 3, 5, 7 **B)** 1, 4, 8, 16
C) 1, 4, 9, 16 **D)** 1, 4, 7, 10

T14: Card Match

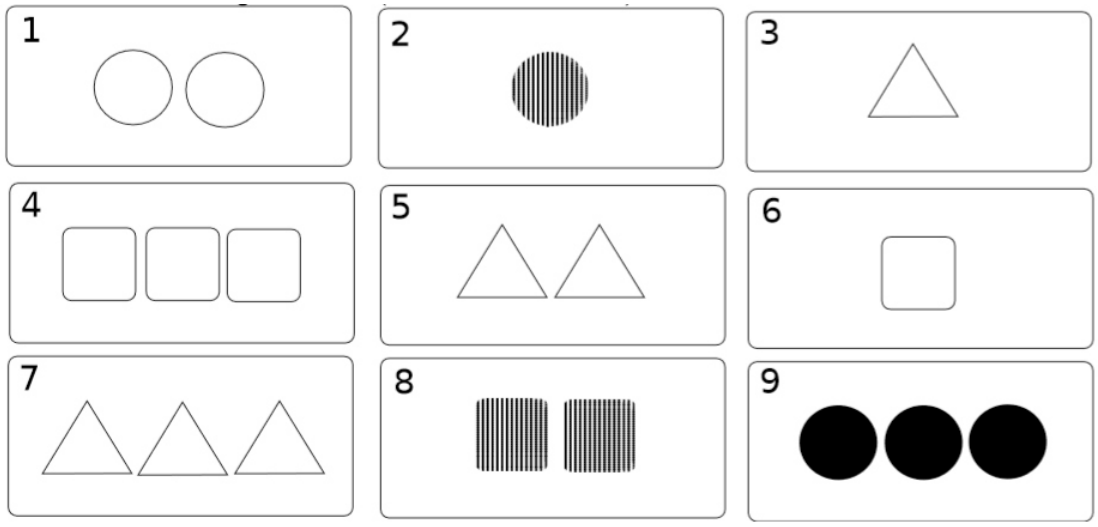
Each of the nine cards below has three attributes:

- The shape of the objects (triangle, square or circle)
- The number of objects (1, 2 or 3 objects)
- The fill style of the objects (empty, striped, solid)

A *group* is a collection of three cards such that the three cards satisfy **all** of the following three conditions:

- The objects on the three cards either all have the same shape, or all have a different shape
- All three cards have the same number of objects, or there is different number of objects on each card
- The objects on the three cards have the same fill style, or the objects on the cards all have a different fill style.

Consider the following nine cards (numbered from 1 to 9):



Notice that cards 1,2,9 are a group since:

- they have the same shape (circle)
- they have a different number of shapes on each card
- they have a different fill type on each card

Each group is described by a list of increasing numbers of cards, so we cannot describe the group 1, 2, 9 as 2, 9, 1.

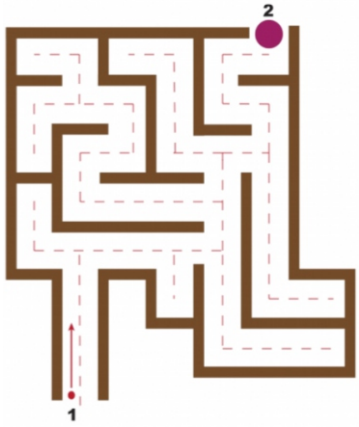
Question

Allowing a card to appear in any number of groups, how many groups can be formed with the cards above (including the group 1, 2, 9)?

A) 3 **B)** 4
C) 5 **D)** 6

T15: The Intricate Labyrinth

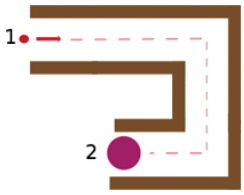
Anna, Bert, Carlo, and Dora want to walk through a labyrinth from the entrance (1) to the exit (2). Each person has its own rules for finding the exit. They repeatedly apply their rules until they reach the exit. Each one tried their rules on a different small example labyrinth.



Below are the rules and the example labyrinths:

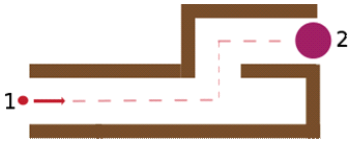
Anna

If I do not face a wall, I go straight.
If I face a wall, I turn right.



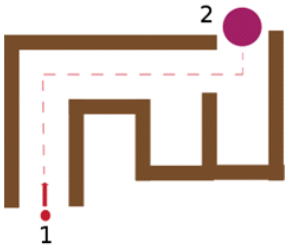
Bert

If there is no wall on the left side, I turn left and go straight.
Else, if I face a wall, I turn right.
Else, if I do not face a wall, I go straight.



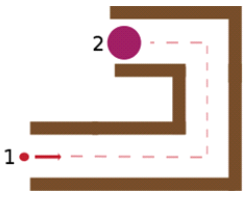
Carlo

If I do not face a wall, I go straight.
If I face a wall, I turn right and go straight until I face another wall where I turn left and go straight.



Dora

If I do not face a wall, I go straight.
If I face a wall I turn left.



Question

Which person will find the exit from this labyrinth?

A) Anna **B)** Bert
C) Carlo **D)** Dora

T16: Important Parts

Information in the human genome is essentially encoded by the four components: Adenin, Cytosin, Guanin, and Thymin. Often, genes are characterized as sequences of characters A, C, G, and T, like CAGGAGGAT.

Such sequences may be very long. Researchers are looking for their important parts, which must occur at least twice in a sequence. The importance of a part is characterized by its *value*, which is computed as follows:
part length + number of its occurrences in the sequence.

Then, the most significant part of a sequence is the part with the highest value. For example: The most significant part of the sequence CAGGAGGAT is AGGA. Its value is 6: AGGA is 4 characters long, and it occurs 2 times in the sequence. G is less important, because its value is 5: it occurs 4 times, but is only 1 character long.

Question

What is the most significant part of the sequence: **CATTGTTGTTGCATT ?**

A) GTTGC **B)** TTGTT
C) CATTG **D)** GCATT

T17: Robot painting

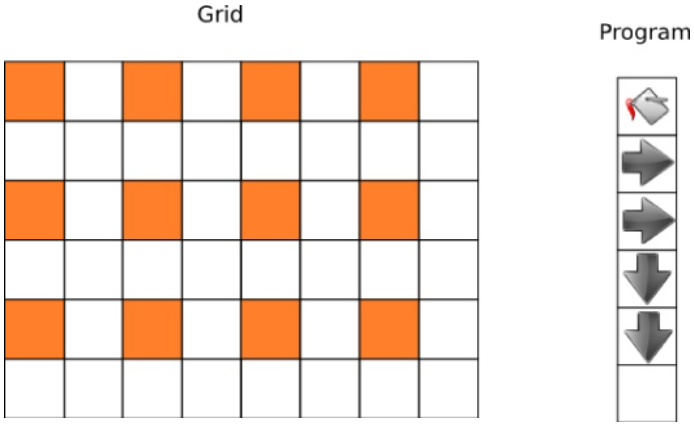
A computer screen consists of a grid of pixels. A small part of the computer screen is shown in the image below. It consists of 6 rows of 8 pixels. The pixels on this screen can only be white or colored.

You can instruct a robot to color (some of) these pixels. You can give three different instructions:

Color	Color the current pixel. If the cell already has color, the program terminates.
Right	The robot moves one pixel to the right. If it would walk of the screen it moves the leftmost pixel of the same row.
Down	The robot moves one pixel down. If it would walk of the screen it moves to the top pixel of the same column

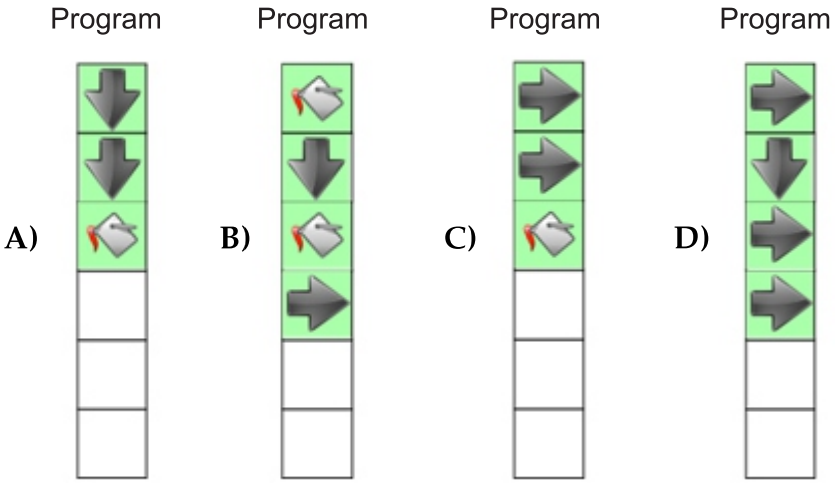
The robot starts in the pixel at the top left corner when the screen is completely white. The robot will keep repeating a given set of instructions until it tries to color a pixel that has already been colored.

The following image shows the result of repeating the program on the right.



Question

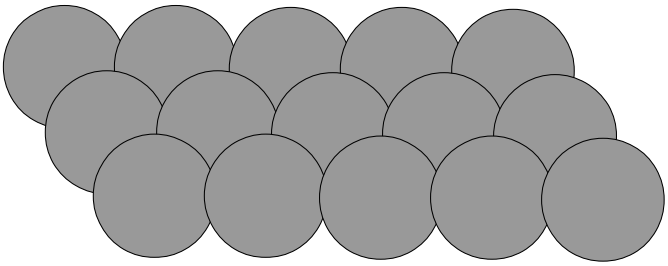
Which of the following programs will color all pixels on the screen?



T18: Pick up stones

You are playing a game with a beaver. In this game, there are some stones, and players take turns picking up stones. On each turn, a player can pick up 1, 2, or 3 stones. The player who picks up the last stone wins.

The game was originally played with 9 stones, and the history shows that the first player always can win the game by starting with taking 1 stone, no matter what the opponent do next. Now, you and the beaver are going to play with 15 stones.



Question

You are starting the game. How many stones should you pick up to surely win the game?

A) 1 **B)** 2
C) 3 **D)** There is no such a strategy for you to surely win the game.

T19: Time for change

In the country of Bebranada, they have an interesting set of coins in their currency. The coin values are:

- 1 cent
- 7 cents
- 12 cents
- 22 cents

You work in a bank, and a customer comes into the bank. The customer wants to withdraw 39 cents.

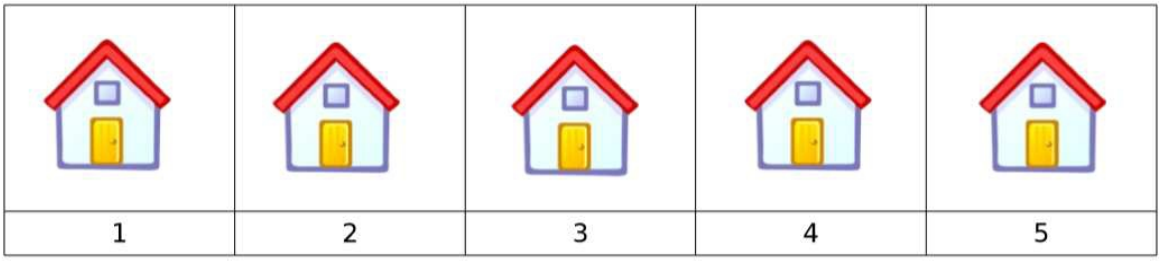
Question

What is the fewest number of coins that you can give out in total to the customer?

A) 4 **B)** 5
C) 6 **D)** 7

T20: Run Beaver run

Beaver the mailman has to deliver the mail at all the houses in one street. Consecutive houses are exactly 1 km apart. He gets paid for the distance walked from the first delivery to the last delivery, so he wants to walk as many kilometers as possible. He can choose the order in which to visit the houses: he can start at any house, and finish at any other house. He has to deliver the mail exactly once at each house, and after each delivery he must go directly to the next house in the scheduled order.



Question

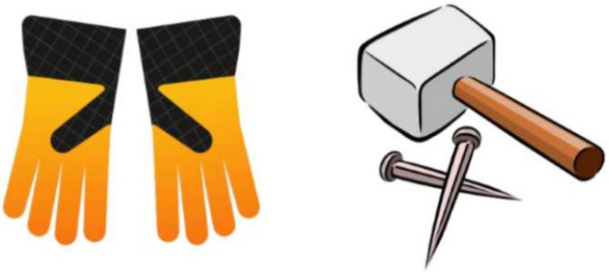
Which is the longest distance that Beaver the mailman can walk while delivering mail to these houses?

A) 8 km **B)** 9 km
C) 10 km **D)** 11 km

Tasks T21 – T30 carry 5 points each

T21: The hammer, gloves and nail

Beavers Quentin and Clémence are building their lodge on a river. To add a new log, they need a hammer, protection gloves and a nail. There is only one hammer and one pair of gloves, they have to share. Those are placed respectively on the north bank and the south bank of the river.



If Beaver Quentin takes the hammer and Beaver Clémence takes the gloves, Beaver Quentin will wait for the gloves to become available and Beaver Clémence will

wait for the hammer to become available. They will wait indefinitely as neither resource will ever become available.

Question

Which of the sequences of operations below ensures that, whatever their work speed is, Beavers Quentin and Clémence will never be waiting indefinitely for a resource?

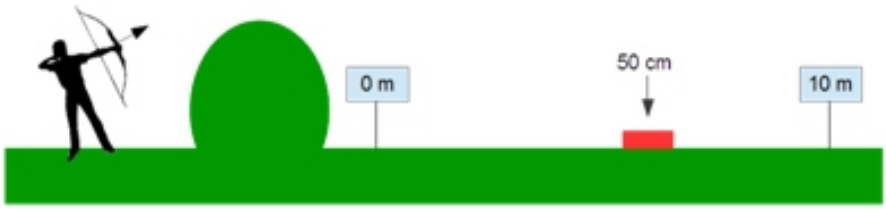
The available operations are:

C = cut off a log
H = fetch the hammer
T = take a nail
G = fetch the gloves
N = nail the log
B = put back the hammer and gloves
S = start over

A) Beaver Quentin: C H T G N B S, and Beaver Clémence: T C G H N B S
B) Beaver Quentin: H G C T N B S, and Beaver Clémence: C T H G N B
C) Beaver Quentin: C H G T N B S, and Beaver Clémence: C G H T N B S
D) Beaver Quentin: G T C H N B S, and Beaver Clémence: H C T G N B S

T22: Reaching the target

Archery Arnaud would like to reach a target with his arrow. He can adjust the arc to shoot an arrow in a range between 0 m and 10 m. The position of the target is unknown, but after each shoot, his friend Marc tells Arnaud whether the arrow reached the ground before or after the target.



Question

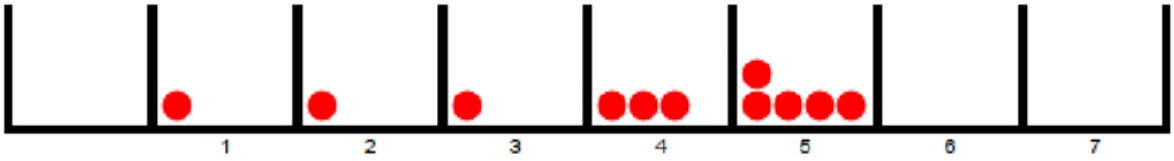
Given that the target has a width of 50 cm, what is **the minimal number** of arrows needed to be sure to hit the target, no matter where it is located?

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

T23: A pebble game

The goal of this game is to move all the pebbles to the GOAL box by following one simple rule: a box numbered from 1 to 7 can be emptied only if the number of pebbles in the box is equal to the box number itself; its pebbles are distributed equally on all the boxes to its left, one pebble per box. The game is won when all the pebbles are successfully moved into the GOAL box.

In the game situation below, the sequence of moves to empty the pebbles to the GOAL box is: 1 – 5 – 1 – 2 – 1 – 4 – 1 – 3 – 1 – 2 – 1.



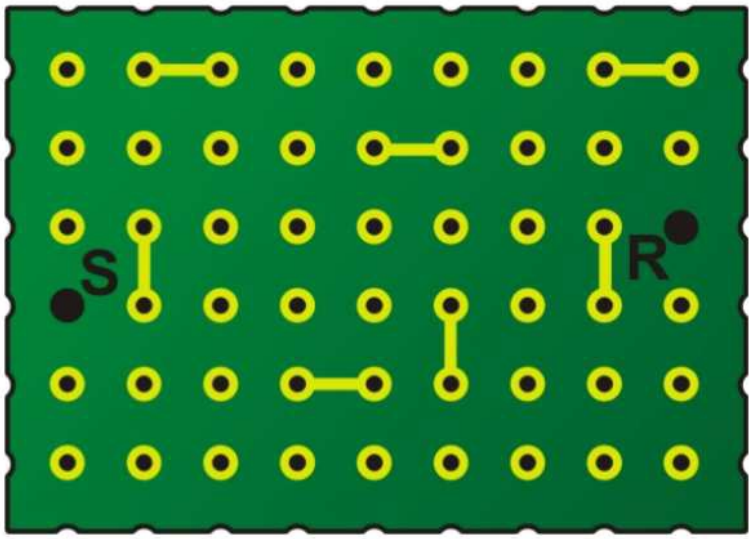
Question

What is the maximum number of pebbles in a winnable game with 7 boxes (not including the GOAL box)?

A) 17 **B)** 21
C) 43 **D)** 84

T24: Building a chip II

A small chip is composed of a grid of contacts (marked as dots). Some are already connected (marked as line segments). Connectors are always only between adjacent contacts, horizontally or vertically. We want to connect S and R with a continuous sequence of connectors, which do not touch any already connected contacts.

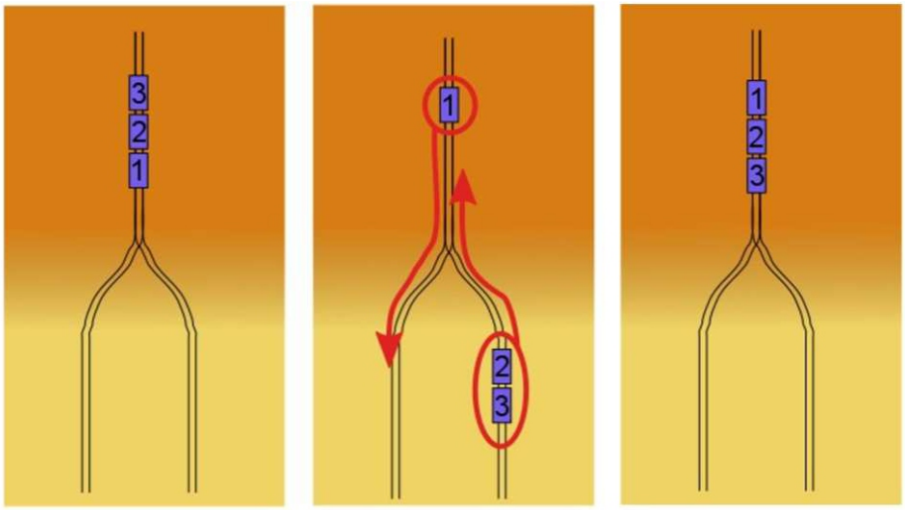


Question

How many different ways are there to connect S and R with the least possible number of connectors?

A) 5 **B)** 13
C) 15 **D)** 16

T25: Sorting trains



Three train cars stand on a hill, as shown in the left image. The train operator wants to invert the order of all train cars, i.e. to place them in the order shown in the right image.

To achieve his goal, the operator may use two railway tracks going downhill, and perform two types of operations, displayed on the middle image:

1. Downhill: Push one train car from uphill to downhill on any of the two railways.
2. Uphill: Push *all* train cars from some railway up to the hill. (If there are, for example, two train cars on a railroad, he should push them together)

A downhill operation is very easy for the operator, trains cars go down by themselves, so he only needs to make an initial push.

An uphill operation is very hard, because he needs to push cars all the way up.

Question

What is the minimal number of **uphill** operations the train operator needs to perform to achieve his goal?

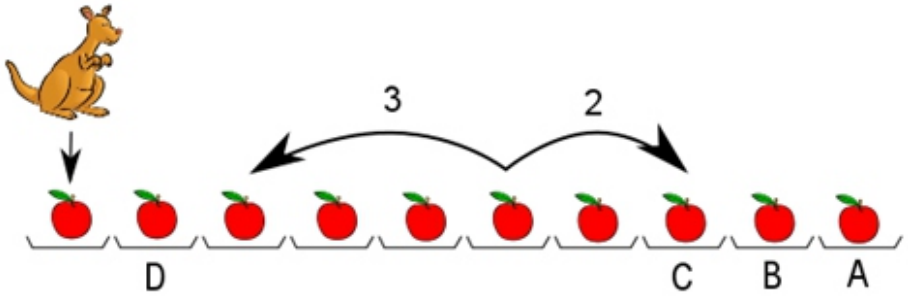
A) 1 **B)** 2
C) 3 **D)** 4

T26: Jumping hedgehog

There are 10 plates in a row. There is one apple on each plate.

Kangaroo Thomas loves to jump. First, he jumps onto the leftmost plate. On each single jump after this, he either jumps forward two plates, or backwards three plates. (An example of the two possible jumps from one plate is shown with arrows in the picture.)

Thomas only jumps onto plates with an apple. If he jumps onto a plate, he collects the apple from it.



Question

If Thomas collects all 10 apples, which apple does he collect last?

A) The rightmost apple
B) The second apple from the right
C) The third apple from the right
D) The second apple from the left

T27: Horse Races

Steven has 25 fast horses. He wants to determine which are the fastest three, in order.

He does not have a watch. He will have to use a race track on which only five horses can compete at once. You can assume that a horse always completes the race in the same time.

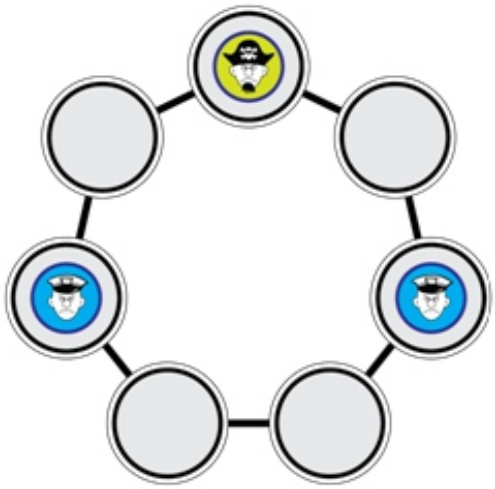
Question

What is the minimum number of races needed in order to determine which horses are the fastest, the second and the third?

A) 6
B) 7
C) 8
D) 18

T28: Pirates

Jane and Jill play a board game Pirate Hunters. At each move, one of the policemen (but not both) moves to a neighboring place. In the next move, the pirate, who is faster and always jumps for two places. Policemen always move to an unoccupied place – they cannot move to a place occupied by the pirate or his colleague policeman. The game is finished when the pirate is forced to jump onto one of the policemen … which would be now (see the picture), except that it is currently the policemen turn. To win, the policemen must force the pirate into this position when it is the pirate's turn.



Question

Jane, who plays the pirate is quite skilled at evading being captured. If you help Jill play a perfect game, how many moves will she make before the pirate is caught?

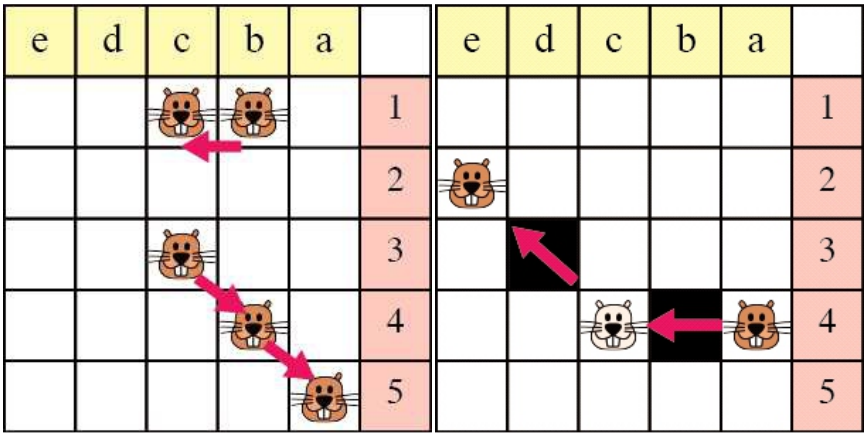
A) 2 **B)** 3
C) 5 **D)** Jill cannot win if Jane plays well

T29: Short Way

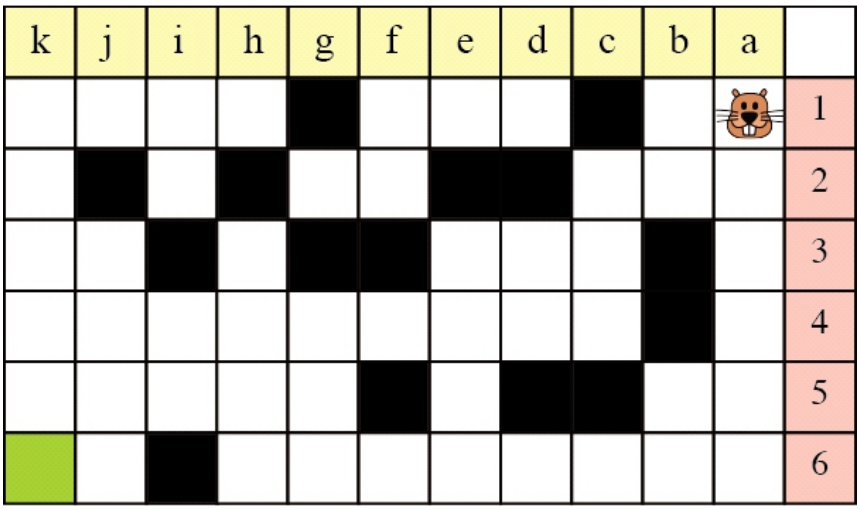
A board consists of black and white squares. A beaver can only stand on white squares. He can walk from a white square to any adjacent white square (horizontally, vertically or diagonally). When he walks this is counted as a single move.

Beaver can also jump over a black square. This can only happen if there is a white square directly behind the black square in the same direction. If beaver can make one or more jumps right after each other without walking in between, these jumps together are counted as a single move.

The following drawings illustrate this:
Left picture - From b1 to c1 is one move and from c3 to a5 is two moves.
Right picture - From a4 to e2 via c4 is one move.



Beaver stands in the upper right corner and wants to get to the bottom left corner.

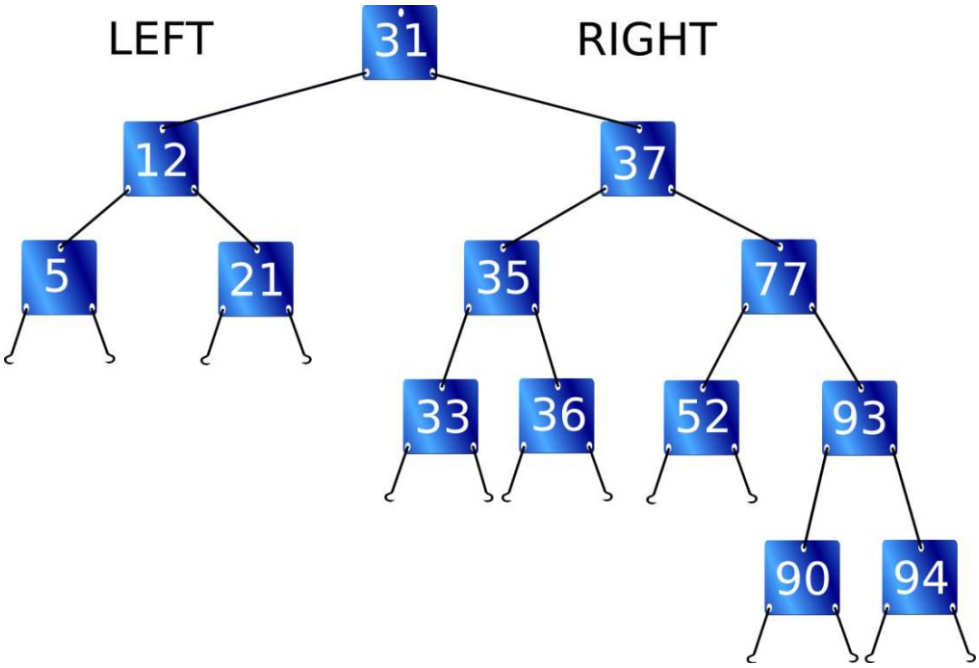


Question

What is the lowest number of moves beaver has to make to reach his destination?

A) 4 **B)** 5
C) 6 **D)** 7

T30: Number Cards



There is a structure made of numbered cards. Each numbered card is made like this:

- It has a hole on top and two wires at the bottom that can be connected to the top holes of other cards. These cards are called successor cards.
- An integer number N is written in each card.

If a numbered card is connected to the left wire, the number on it and the numbers on all its successor cards must be lower than N.

If a numbered card is connected to the right wire, the number on it and the numbers on all its successor cards must be greater than N.

Question

Some numbered cards have free wires. How many cards can be added to these wires to extend the structure?

A) 10 **B)** 11
C) 13 **D)** 14