

Tasks T1 – T7 carry 3 points each

T1. Caesar cipher

The Beaver Caesar sends you a letter with a strange word in it: “LPDJLQDWLRQ”. You asked some of your friends what could the message mean and you found out that the clever beaver Caesar, whenever he wants to send important messages, he shifts the letters from the alphabet with 3.



Figure 1: Letter from Beaver Caesar

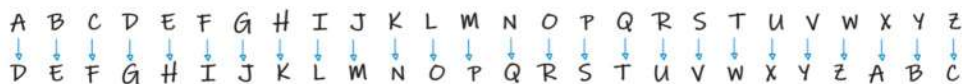


Figure 2: Letters shifted with three

Question / Challenge

What message did the beaver Caesar send to you?

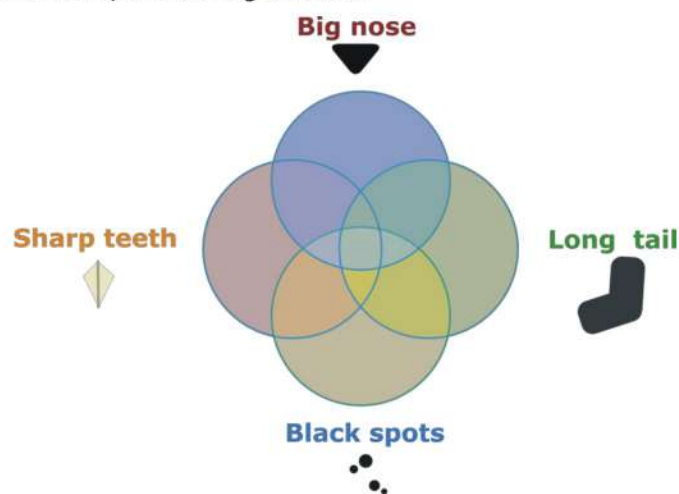
- A) illusionist B) spectacular C) imagination D) expectation

T2. Venn Beavers

The beavers in the village all share one or more of the following characteristics:

- A: Long tail
- B: Big nose
- C: Sharp teeth
- D: Black spots

Beaver Venn wants to find out which beavers share which characteristics. She writes down the characteristics for each beaver and she wants to show her findings by placing each beaver in the correct spot in the diagram below.



But Beaver Venn made a mistake. Not all beavers can be placed in this diagram.


Question / Challenge

Which beaver below cannot be placed in Beaver Venn's diagram?

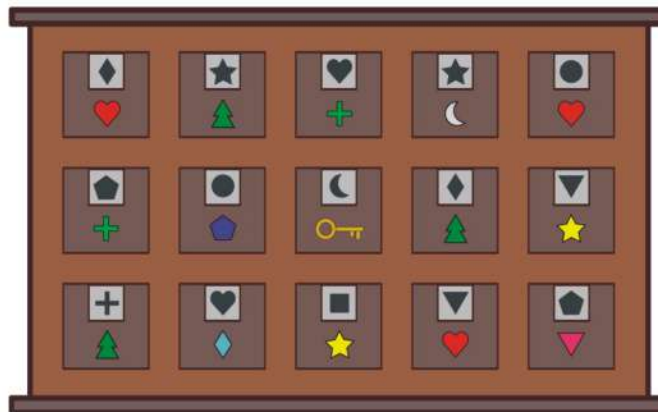


T3. The gift

Bella's mom bought a present and locked it in the safe.

























She gave Bella a blue ball and said: "You can have the gift if you can solve the puzzle and get the key that is in the middlemost drawer." 

To open a drawer Bella must put an object of the correct shape in the key hole on the drawer. Then the drawer pops open and she can get the object which is shown on the front of the drawer and lies in the drawer.



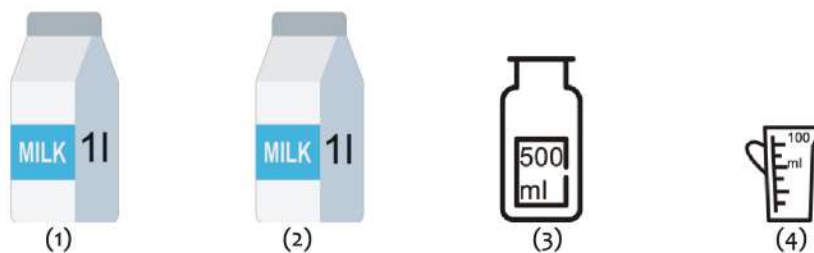
Question / Challenge

Which of the following sequences will help Bella get the key?

- A)  →  →  →  →  →  B)  →  →  →  →  → 
- C)  →  →  →  →  →  D)  →  →  →  →  → 

T4. Cake

Bruna wants to make a cake and needs to measure exactly 700ml of milk (she knows that 1000ml = 1l, one litre). Unfortunately, she only has two open packs of 1l of milk, each of them being little more than half full. But she also has at hand an empty bottle of 500ml and an empty cup of 100ml. So she thought of pouring the milk between recipients until she manages to obtain precisely 700ml in one of them.



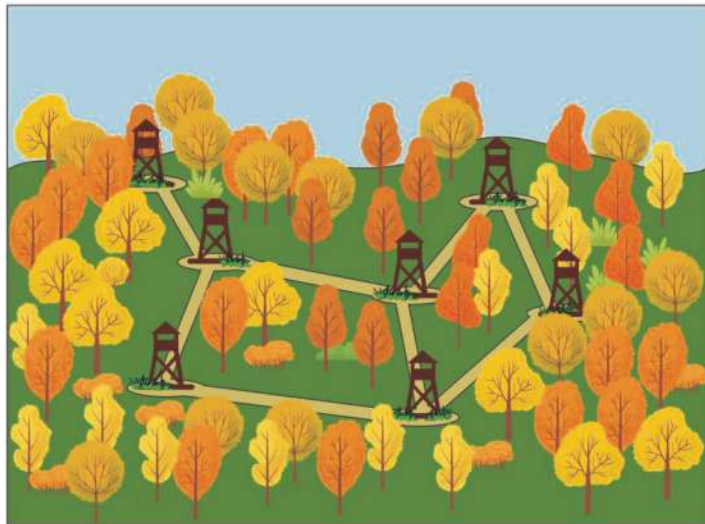
Question / Challenge

Which of the following sequences of pours would be useful to achieve Bruna's goal?
 Two items connected by an arrow in the sequences mean that we pour the contents of the first recipient (left) into the second (right) until this last recipient is full or until the first is empty, whichever happens first.

- A) (1)→(4); (1)→(3); (1)→(2); (3)→(1); (4)→(1); (2)→(4); (4)→(1).
- B) (1)→(3); (1)→(4); (1)→(2); (3)→(1); (4)→(1); (2)→(4); (4)→(1).
- C) (2)→(3); (2)→(1); (3)→(2); (1)→(4); (4)→(2); (1)→(4); (4)→(2).
- D) (1)→(4); (4)→(2); (1)→(4); (4)→(2).

T5. Forest Observation

The forest rangers need to observe the types of animals that wander onto the paths. They watch the paths from tall observation towers. There is only room for one ranger in each observation tower.



Question / Challenge

How many observation towers need to be occupied by a forest ranger in order to see all the paths?

- A) 3
- B) 4
- C) 6
- D) 7

T6. Line of Fish

Fish swim in a line as shown.



Occasionally, someone says the positions of two fish. If these positions are A and B where $A < B$, then

- all fish to the left of position A swim away, and
- all fish to the right of position B swim away.

For example, after someone said positions 2 and 17, there would then be 16 fish remaining in the line (now in positions 1, 2, ... 16) as follows:



Positions are numbered starting from 1 on the left and positions are renumbered after any fish swim away.

Starting with the original line of 20 fish,

- someone says positions 4 and 18, then
- someone says positions 6 and 12, and then
- someone says positions 2 and 5.

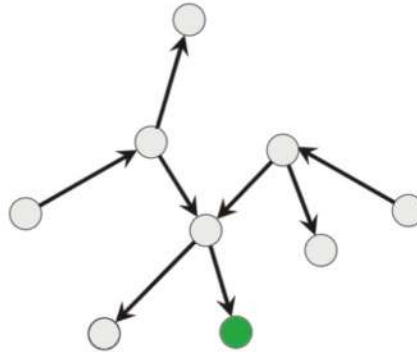
Question / Challenge

After this, which of the following is the new line of fish?

- A)  B) 
 C)  D) 

T7. Following the rows

Professor Beaver drew the diagram below on the blackboard.



Question / Challenge

He asked his students to find out how many circles can they start out from in order to reach the green circle, following the arrows. Which is the correct answer?

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

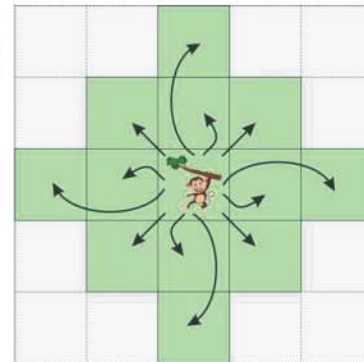
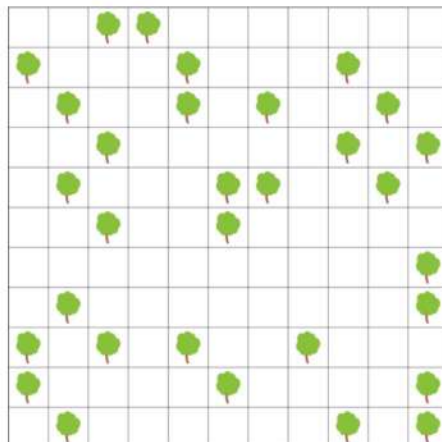
Tasks T8 – T14 carry 4 points each

T8. Jumping Jack

Jack is not a beaver. He is a monkey living in a park. From one tree, he can jump to another tree if it's either up to two cells away horizontally or vertically, or one cell away diagonally, as shown in the diagram.

Jack plays a game in which he jumps to as many different trees as possible without touching the ground. He can start from any tree in the park.

Map of the park:



Question / Challenge

What is the maximum number of different trees Jack can visit in one go without touching the ground?

- A) 6 B) 8 C) 10 D) 11

T9. Longest Sequence

Here is a sequence of length 16 made using two different shapes:



You may change the shape of exactly two items in the sequence.

Question / Challenge

What is the [length of the] longest unbroken chain of identical shapes possible?

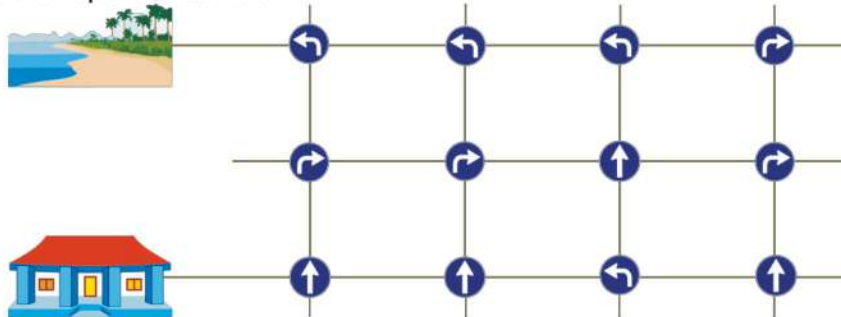
- A) 7 B) 8 C) 9 D) 10

T10. Self-Driving Cars

Some new models of self-driving cars are under test. The cars can recognize traffic signs, but sometimes they fail to recognize a sign. When a car does not recognize a sign, it will ignore it and keep driving straight ahead. These are the signs used on the test track and their meanings:

	Drive straight ahead.
	Turn right here.
	Turn left here.

This is the map of the test track:



Each sign has always the same meaning, whatever is the direction of a car. For example, for a car just leaving the school, the sign on the first crossroad means "drive straight ahead", so that at the next crossroad it gets the same sign.

Question / Challenge

Starting from the school, which of the following cars reaches the beach?

- A) Car A fails to recognize the third sign it encounters.
 B) Car B fails to recognize the fourth sign it encounters.
 C) Car C fails to recognize the fifth sign it encounters.
 D) Car D fails to recognize the sixth sign it encounters.

T11. Curd snack

Days	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	
Alma	[4 snacks]																					
Bruno	[4 snacks]																					
Charles	[2 snacks]																					
Paula	[6 snacks]																					

Four beavers, Alma, Bruno, Charles, and Paula are going on a 3 week hike. Each beaver carries their favorite curd snack and eats a specific amount over consecutive days. On each day, a beaver will either eat no snack or one snack. As the chart shows, Alma eats 4 snacks every 8 days, Bruno eats 4 snacks every 7 days, Charles eats 2 snacks every 4 days, and Paula eats 6 snacks every 9 days.

Question / Challenge

If we don't know on which days the beavers will eat their snacks, what will be the maximum number of snacks eaten during hike?

- A) 20 B) 35 C) 40 D) 50

T12. Downtown

Beaver Ben has to do some shopping. The numbers on the roads show for how long Ben needs to walk from one place to another. He starts and ends at his home, marked with the red arrow.



Question / Challenge

What is the shortest amount of time Ben needs to visit all four shops and come back home?

- A) 25 B) 30 C) 55 D) 75

T13. Ordering the Liquids

Beaver Mark wants to give a surprise gift to his friend who has his birthday tomorrow. He wants to make layers of liquids in a tube as a surprise for his friend. The tube will be filled with various types of liquids.

Beaver Scientiae, his Science Teacher, explained that a liquid with higher density will go under a liquid that has a lower density.

Beaver Scientiae gives Beaver Mark 3 examples of tubes made with liquids available in the laboratory, such as the ones in the pictures below:



Example 1



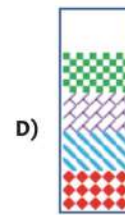
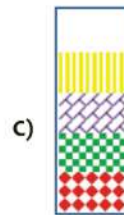
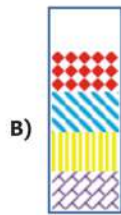
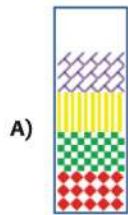
Example 2



Example 3

Question / Challenge

Beaver Mark intends to make a tube, which filled with 4 layers of liquids. Which order could Beaver Mark have made correctly?



T14. Cuckoo Birds

Spotted cuckoo birds don't build nests. Instead, they move into empty nests.

When a spotted cuckoo bird finds a tree with empty nests, it moves into a nest as follows: It starts at the bottom of the tree. It repeats the following steps until it finds an empty nest:

1. It goes up until it encounters a nest.
2. If the nest is empty, it moves into the nest. Done.
3. If the nest is occupied, the bird looks at the cuckoo bird in the nest:
 - o has more spots, the bird continues to the left.
 - o has the same number or fewer spots, the bird continues to the right.

There is a tree with five empty nests, and there are five cuckoo birds. The birds move into the empty nests in order from left to right; the bird with four spots is the first.



Question / Challenge

Which bird will move into the highest nest?



Tasks T15 – T21 carry 5 points each

T15. Wrestling Holds

John Beava is training to become a professional wrestler. He knows that during a match, he can be in the ring in any of the six different **positions** listed below:

- Lying (P1)
- Standing (P2)
- Running (P3)
- Against the ropes (P4)
- In the corner (P5)
- Top Rope (P6)



His wrestling trainer can teach him a set of **moves**, and each move has a list of positions that it can be performed from. John wants to make sure that he learns a move for every **position**, but wants to learn the fewest number of **moves** possible, to make sure that he has more time to practice each one. The **moves** that his trainer can teach him and the **positions** they can be used from are as follows:

- M1. Crossbody – Running, Top Rope (P3, P6)
- M2. Suplex – Standing, Top Rope (P2, P6)
- M3. Clothesline – Standing, Running, Top Rope, Against the ropes (P2, P3, P4, P6)
- M4. Back Elbow – Standing, In the corner, Against the ropes (P2, P4, P5)
- M5. Armbar – Standing, Lying (P1, P2)
- M6. Running Splash – Running (P3)

Question / Challenge

What is the minimum number of **moves** John needs to learn to make sure that he can perform a move from any **position**?

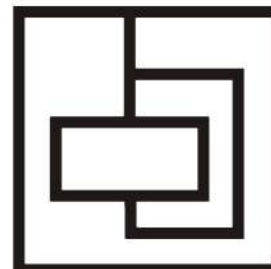
- A) 2 B) 3 C) 4 D) 5

T16. Flooding

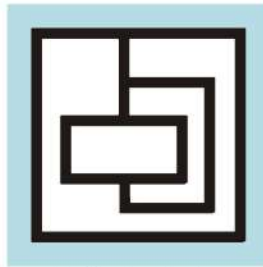
In ancient times there was a small castle with thick black walls. One day, it was destroyed by a big flood.

When a flood destroys a castle it happens in the following way:

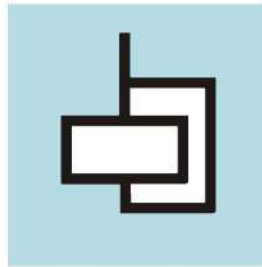
- First, the water floods the exterior of the castle.
- After exactly one hour, every wall with water on one side and air on the other side breaks under the pressure of water.
- Water then floods the new area not bounded by any remaining walls.
- Now, there may be new walls having water on one side and air on the other. After another hour, these walls also break down and water floods further. This procedure repeats until water has flooded the entire area.



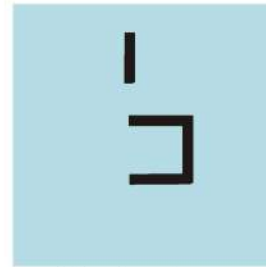
This process can be seen in the following figures:



At the beginning



After one hour

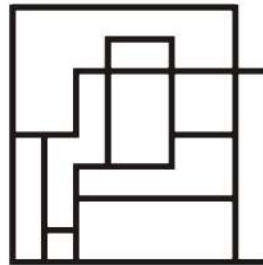


After two hours

It took two hours to flood the entire castle. But what about the new castle that currently exists?

Question / Challenge

How many hours would it take to flood the entire area of this castle?



A) 1 hours

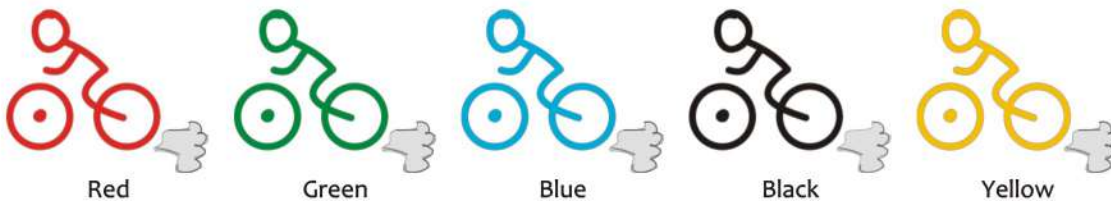
B) 2 hours

C) 3 hours

D) 4 hours

T17. Race Time!

Five cyclists wearing different colours race together as a team in one line. They begin in this order:



Every 15 minutes, the front cyclist moves to the back of the line. So after the first 15 minutes of the race, the order of the cyclists becomes:







The front cyclist in the team crosses the finishes line after racing for a total of 8 hours and 39 minutes.

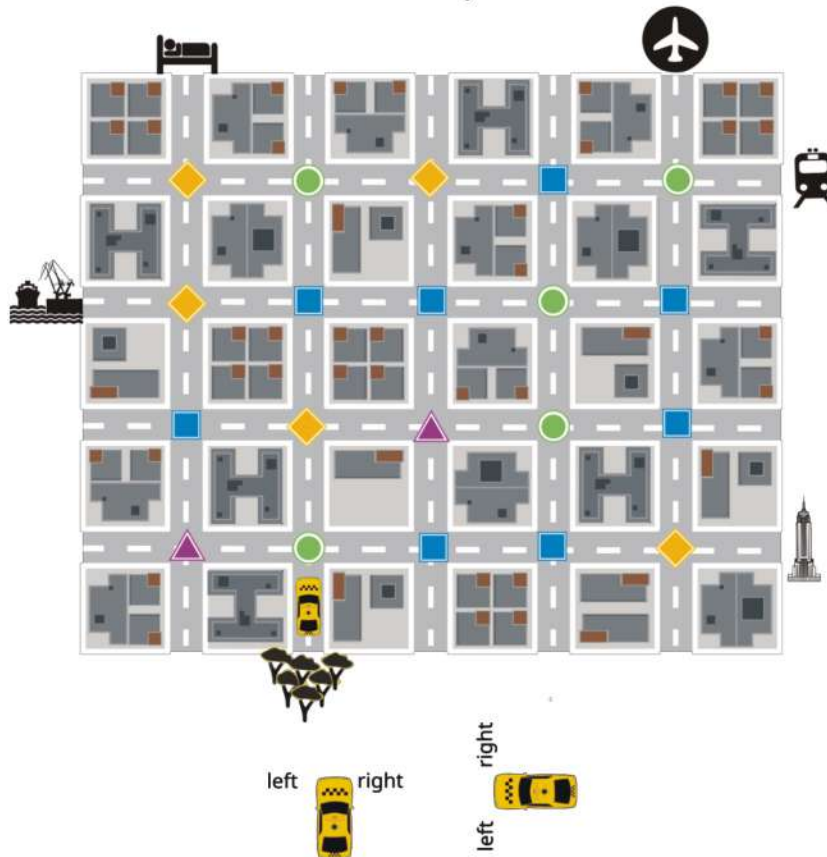
Question / Challenge

Which team member was the first to cross the finish line?



- A) Red B) Green C) Blue D) Yellow

















T18. Hey Taxi!

In the smart city of Bebrasopolis, the traffic signs know where the self-driving taxi should go and gives them directions using these symbols:    . Each symbol has one of these meanings: move forward, turn left, turn right or turn back. The directions make the taxi move 1 block at a time and are always relative to the taxi's orientation.



Question / Challenge

The traffic symbols in this picture direct the taxi from the park  to the airport . What is the meaning of each traffic symbol?

- | A | B | C | D |
|--|--|--|--|
|  forward |  forward |  turn right |  turn left |
|  turn right |  turn left |  turn left |  turn right |
|  turn left |  turn right |  forward |  forward |
|  turn back |  turn back |  turn back |  turn back |

T19. Ada's Marble Machine

Ada the engineer has marbles with following characteristics:

- size (small, medium, or large)
- colour (red, blue, or yellow)
- material (stone, glass, or metal)
- decoration (plain, glitter, or mosaic).

Ada knows the following restrictions on the marble designs:

1. each marble can only be of one size, one colour, one material, and one decoration
2. marbles made of metal cannot be large-sized
3. marbles made of stone cannot be red or yellow
4. the glitter decoration cannot be applied to marbles made of stone or metal
5. the mosaic decoration cannot be applied to marbles made of metal



Question / Challenge

If a large, blue marble is plainly decorated, what is the marble made from?

- A) Metal or stone B) Stone or glass
 C) Glass D) Any of the given materials

T20. Painting the fence

Beaver John wants to paint his 12-picket fence. He wants to paint the fence red, orange, yellow, green, blue and violet, where each colour is assigned to two fence pickets.



R = red O = orange Y = yellow G = green B = blue V = violet

He has three buckets full of red, yellow and blue paint, and three empty buckets for mixing. The empty buckets are marked with three lines. Each line indicates one quarter of the bucket:



With one full bucket he can paint four fence pickets. To get orange, green and violet, he can mix the paint by following these rules:

- Red + Yellow = Orange
- Yellow + Blue = Green
- Red + Blue = Violet



Question / Challenge

How many fence pickets can beaver John paint according to his wishes?



A) 3

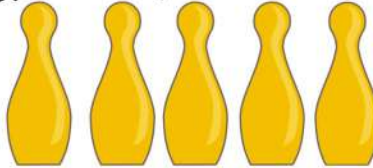
B) 6

C) 8

D) 12

T21. Kayles pins

Ann and Bob put five bowling pins in a row, beside each other.



On their turn, they can either drop a single pin or two adjacent pins in one shot (they can always choose which pin(s) to knock down). Whoever drops the last pin wins. Both Ann and Bob can ensure their victory if they always choose well.

Question / Challenge

Considering that Ann plays first, which pin or pins should she drop first to ensure her victory?

