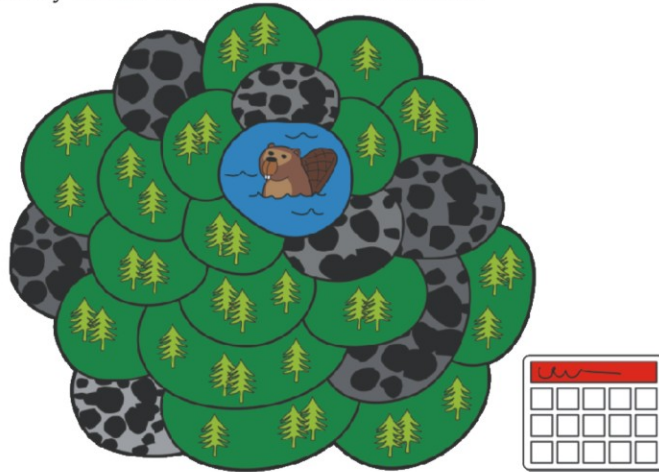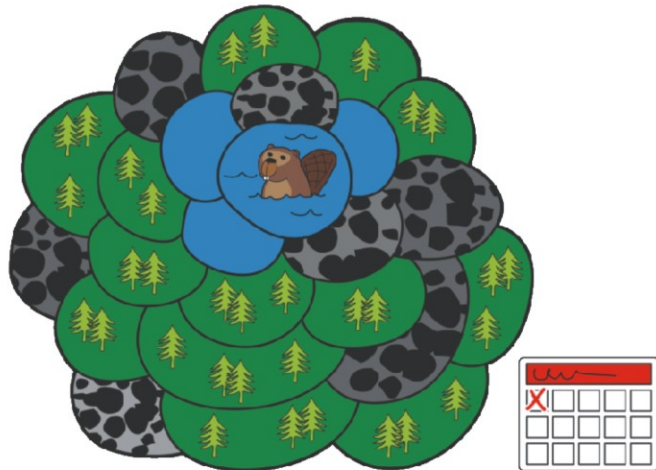## Tasks T1 – T10 carry 3 points each

T1. Beaver lake

Beavers live in a valley surrounded by mountains. In the valley, there is a lake. The lake is surrounded by fields with either trees or stones.

Every day, beavers flood all those fields with trees that are next to the lake or flooded fields.

For example, after one day, three fields will be flooded. Fields with stones are not flooded.

Question/Challenge:

After how many days in total will all the fields with trees be flooded?

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

T2. Keep, Bump, Drop

A coach created a qualification contest for his team to know who will participate in the next olympiad. He alters the scores of the players in an unusual way. He starts with a list of scores and he will then use any of these three operations:

- Keep *n* means that the coach keeps all those players' totals that are equal or greater than *n*
- Bump *b* means that the coach adds *b* to all the players' totals that he is currently keeping
- Drop *d* means that the coach subtracts *d* from the players' totals that he is currently keeping.

For example, if the coach has the following list of scores of 10 players:

90 43 12 7 63 56 12 19 4 86

and then performs Keep 50, he will have:

90 63 56 86

then performs Drop 10, he will have:

80 53 46 76

then performs Keep 47, he will have:

80 53 76

Question/Challenge:

If the coach starts with the list of scores of 9 players:

59 14 75 20 44 95 62 37 19

and performs the operations Keep **30**, then Bump **10**, then Keep **54**, then Drop **20**, then Keep **50**, what will the remaining list of scores look like?

A) 59 75 95 62   **B)** 65 85 52

C) 75 95 62   **D)** 65

T3. Computer Game

Andrea has programmed a computer game at school. The rules of the game are simple:

The game consists of a sequence of rounds. In one round, one leaf is falling. The beaver tries to catch the leaf before it reaches the ground. To win, the beaver has to catch 15 leaves before 4 leaves hit the ground.

The length of the game is measured in number of rounds.

In the following example the beaver loses after 6 rounds because the maximum of 4 leaves not caught is reached. The length of this example is 6 leaves.

Rounds	Result	Score – Total number of leaves	
		caught	not-caught
Round 1	caught	1	0
Round 2	not-caught	1	1
Round 3	caught	2	1
Round 4	not-caught	2	2
Round 5	not-caught	2	3
Round 6	not-caught	2	4

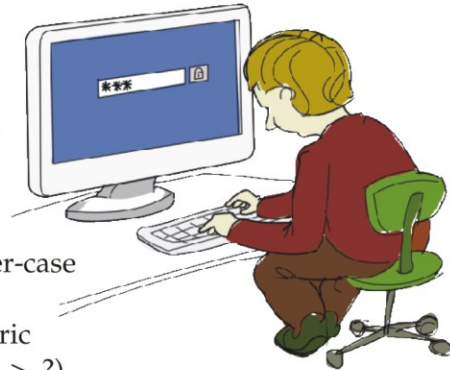### Question/Challenge:

How long is the longest possible game?

A) 4 Rounds   **B)** 15 Rounds   **C)** 18 Rounds   **D)** 19 Rounds

T4. Passwords

Carl uses the following three rules as a password policy for protecting his data:
1. A password must be at least eight characters long.
2. A password must contain at least one upper-case letter.
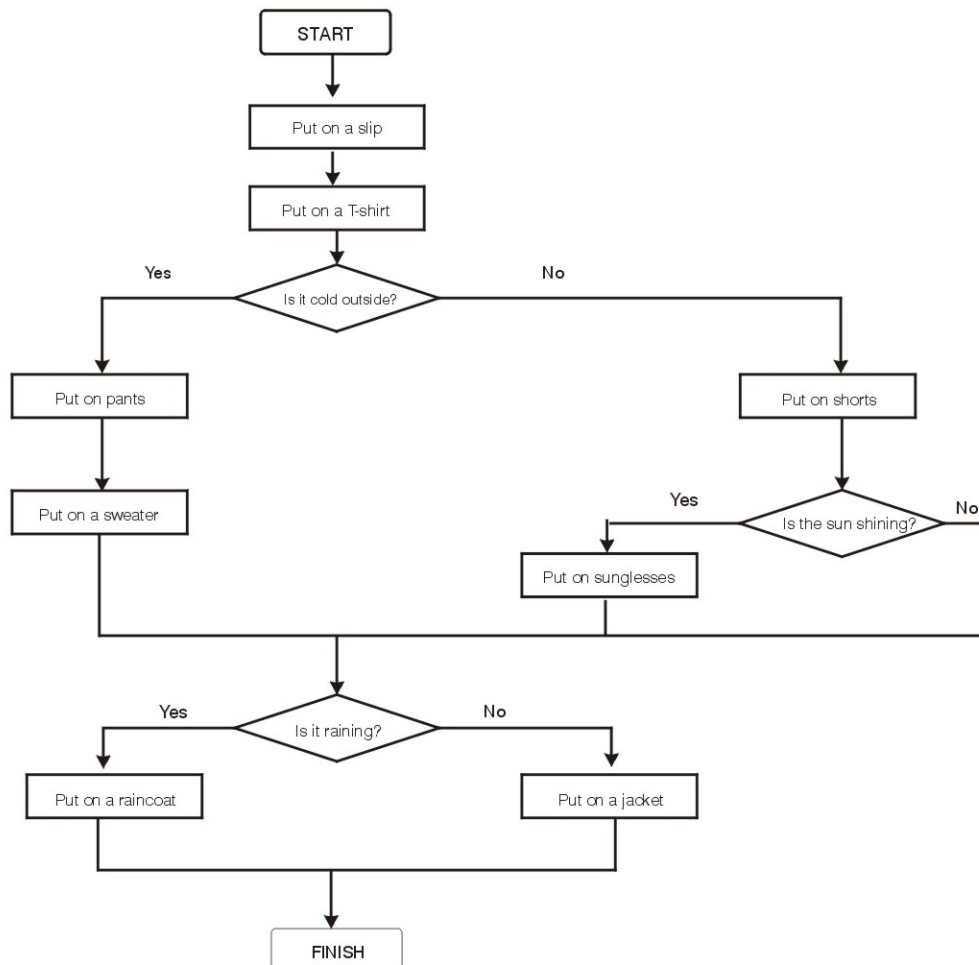3. A password must contain at least one numeric (0 … 9) or special character (!, #, %, &, *, +, <, >, ?).

Question/Challenge:

Which is the correct password that Carl should enter?

A) m1n2cr8fT

B) t?ps!cr!t

C) #imbbtwid

D) no6916489

T5. Getting dressed

Each morning Beaver gets dressed according to the flowchart below. Follow the arrows from START to FINISH.

Question/Challenge:

According to this flowchart, which combination of garments is not possible?

A) Shorts and sunglasses   **B)** A sweater and shorts
C) Shorts and a rain coat   **D)** Sunglasses and a jacket

T6. Folders

Marek collects photos of sport celebrities. He stores the photos on his computer in different folders that are shown in the diagram. An arrow from folder A to folder B means that folder A contains folder B. For example, folder Sport contains the folders Water Sport and Land Sport.
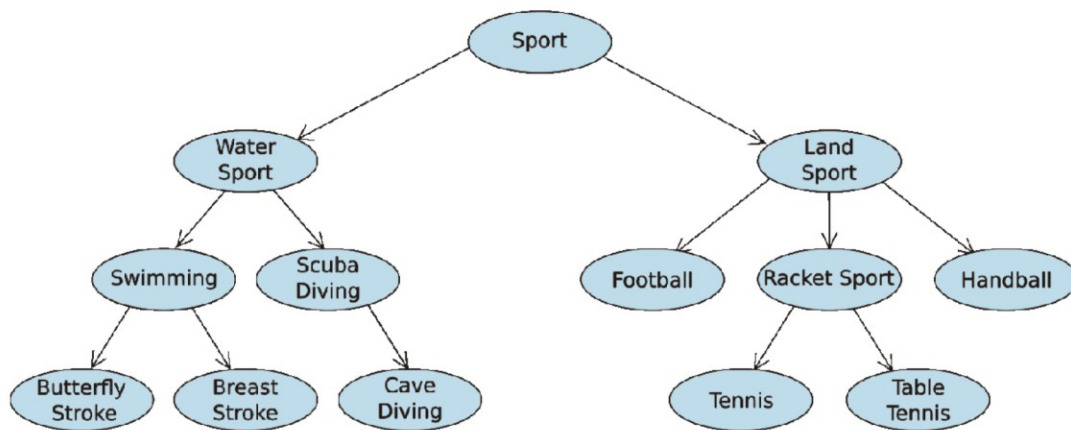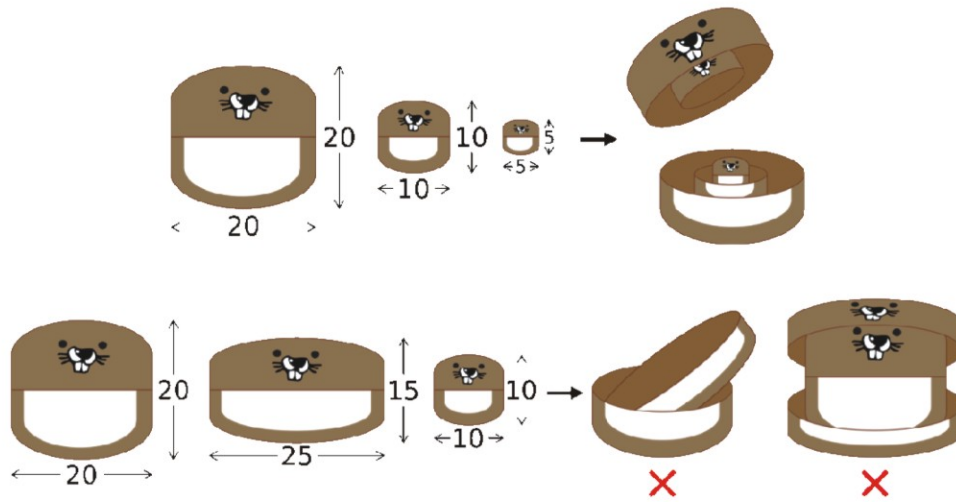

Question/Challenge:

The file manager shows the folders that are stored within a folder. Which of these option is **not** possible?

A) Butterfly Stroke, Cave Diving, Breast Stroke
B) Water Sport, Land Sport
C) Swimming, Scuba Diving
D) Handball, Football, Racket sport

T7. Beaver nesting doll

A beaver nesting doll is a set of wooden dolls that all fit inside each other. Each doll can be opened from the middle to show another doll with smaller width and smaller height inside.

Emily has many similarly designed beaver nesting dolls. She wants to organize her dolls.

Question/Challenge:

The following picture shows all the dolls Emily has. What is the fewest number of dolls that could be sitting on Emily's shelf after nesting?
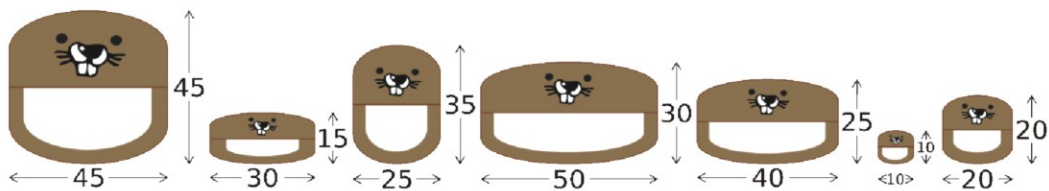
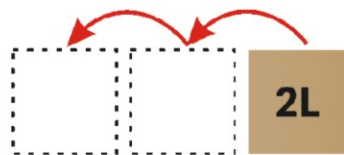**A)** 1   **B)** 5   **C)** 2   **D)** 6

T8. Board Jump

There are 8 boxes on the board. The positions of the boxes are labelled from 1 to 8. One of three types of movement rule is placed in each box. An example of each rule type is given below:
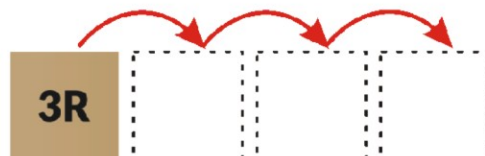
1. Movement to the Left
   e.g. 2L means move two boxes to the left:

2. Movement to the Right
   e.g. 3R means move three boxes to the right:

3. Do not move
If the rule says "0", do not move from this box at all.

Consider this board:

1R	3R	2L	0	3R	1R	3L	2L
1	2	3	4	5	6	7	8

Question/Challenge:

Which box should you start in so that, by following the rules, every box is visited?

A) 2   **B)** 3   **C)** 5   **D)** It is not possible to visit every column.

T9. Trees in a Circle

Joni Beaver is mapping out trees that she wants to use for her dam. She must put some wrapping around the trees, and all trees that are inside the wrapping will be available to her. For example if the trees, when viewed from above, are arranged as follows, then Joni can wrap them in the following way:
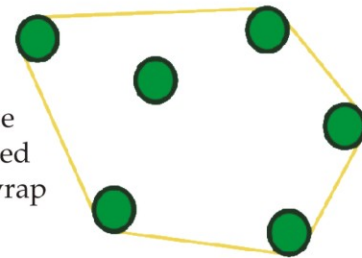
There are 6 trees in total inside the wrapping, but only 5 trees are touched by the wrapping.

Question/Challenge:

If the trees, when viewed from above, are arranged as follows:
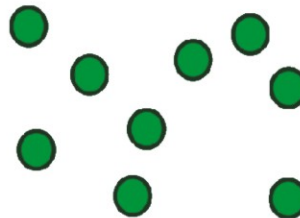
how many trees are touched by the wrapping?

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

T10. Clara likes Flowers

Clara likes colorful bouquets of flowers and visits a flower shop. In there are the following types of flowers:

gladiolus   lily   tulip   rose

Time Allowed: 150 minutes

Every flower is available in the colors: | white | blue | yellow |

Clara wants a bouquet with six flowers satisfying the following conditions:

1) each of the colors yellow, white and blue should occur exactly twice,
2) flowers of the same type should not have the same color,
3) every type of flower should only occur at most twice.

Question/Challenge:

Which of the following bouquets satisfies all the conditions 1), 2) and 3)?

A)

B)

C)

D)

Tasks T11 – T20 carry 4 points each

T11. Bulbs

Bob is an amateur electrician. He connected 6 bulbs with 6 switches. Every switch operates only one bulb, but we don't know which one. Nor do we know the position of the switch when it is turned on or turned off.

To know which switch is connected to which bulb we experimented with the switches. You can see the result of our four experiments (i.e., the positions of the switches and the on/off status of the bulbs) in the following picture:
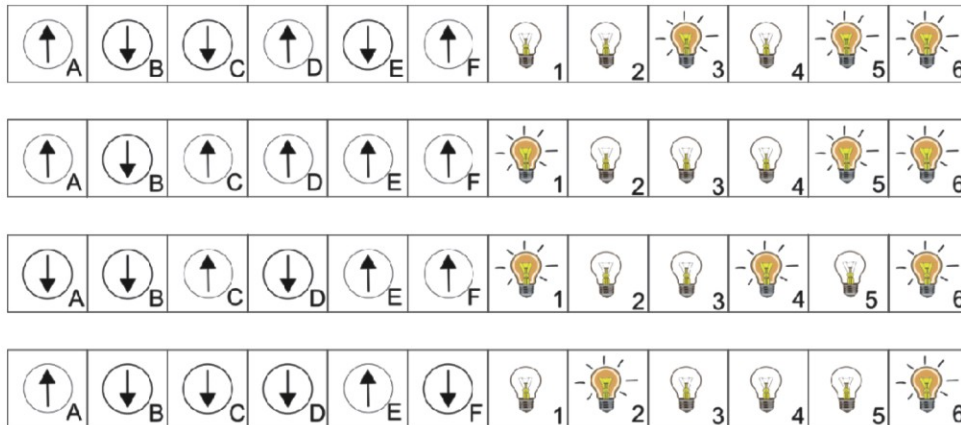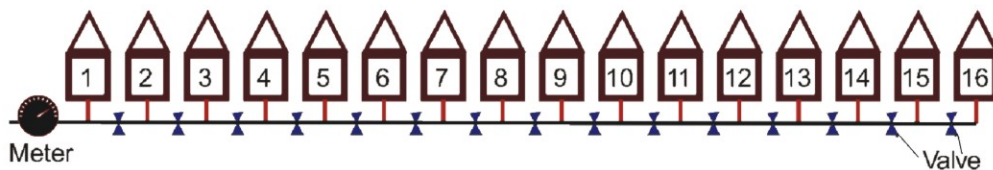
Question/Challenge:

Which switch is associated to which bulb?

A) 1 – C, 2 – F, 3 – E, 4 – A, 5 – D, 6 – B
B) 1 – C, 2 – E, 3 – D, 4 – A, 5 – F, 6 – B
C) 1 – C, 2 – F, 3 – D, 4 – E, 5 – A, 6 – B
D) 1 – C, 2 – F, 3 – B, 4 – A, 5 – D, 6 – E

T12. Find the leaks

A water pipe connection to one of 16 houses along the same street has a leak. The officials are trying to find where the leak is. To help in the search, all households on the street have turned off their water.

To trace the leak, officials will close a valve between two houses and see if the meter on the pipe still shows water being used. If they start, for example, by closing the valve between No 8 and No 9, and the meter shows that water is still being used, they know the leak is between No 1 and No 8 (and there is no leak between No 9 and No 16).
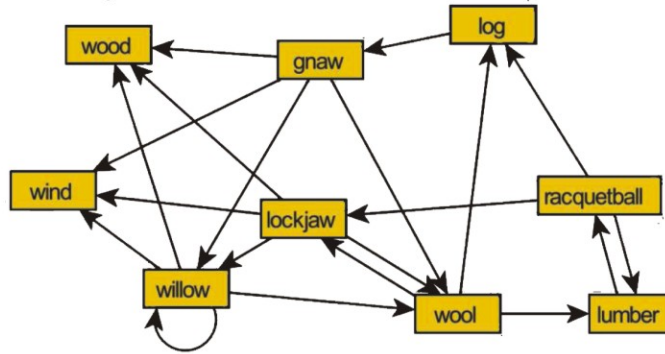
Question/Challenge:

Assume there is only one leak in the pipe connections (the vertical red segments in the picture). What is the least number of valves they have to close to make sure they have identified the leaking pipe?

A) 3   **B)** 10   **C)** 1   **D)** 4

T13. Correct word chain

Beavers like to play a game called word chain. One beaver starts by saying a word. The other beaver must come up with another word, which begins with the last letter of the previous word. Then the first beaver finds another word (which was not used yet), and so on. Sadly, these beavers do not know many words. In fact, they can draw their entire vocabulary like this:

Question/Challenge:

Which of the sequences below represents a correct word chain game?

A) log→gnaw→window→wool→lockjaw→wood
B) racquetball→lumber→wool→lockjaw→willow→wood
C) lumber→racquetball→lockjaw→wool→log→gnaw→wind
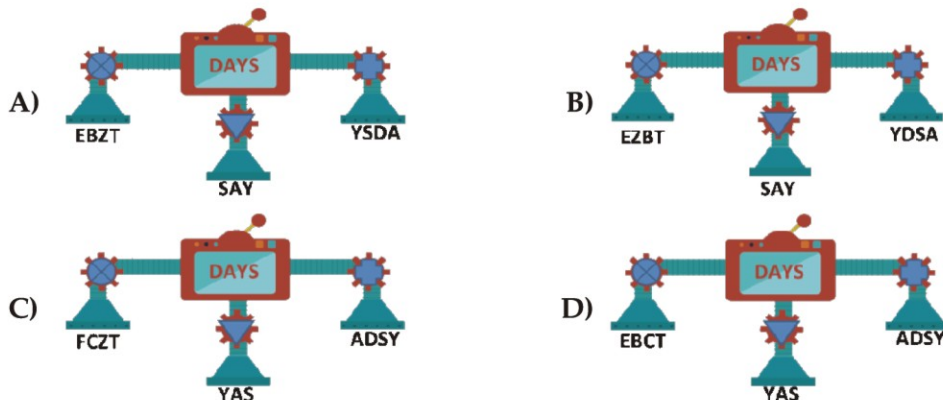**D)** willow→wool→log→gnaw→wool→lumber→racquetball→lockjaw→wind

T14. Converting Tool

Bebras invested a converting tool which makes certain changes via ⊗, ▼, ✚ in a given 4 digit word as shown below.
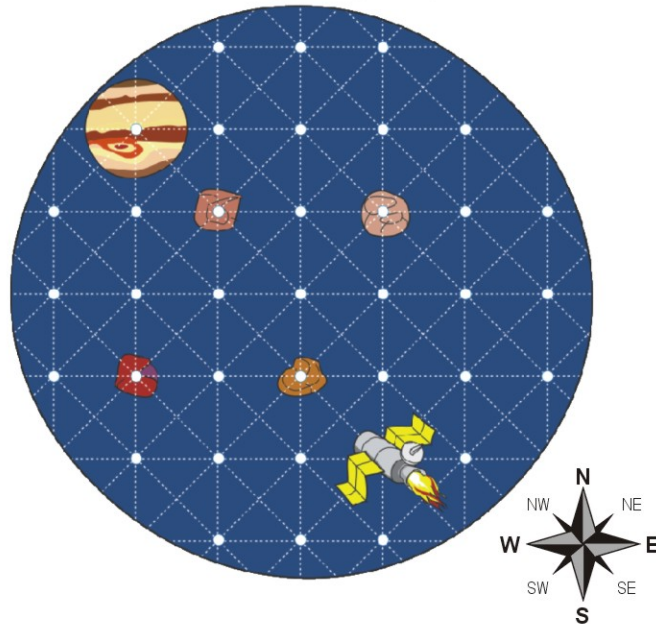

Question/Challenge:

According to these examples what could be the result for the word "DAYS"?

A) EBZT / YSDA / SAY
B) EZBT / YDSA / SAY
C) FCZT / ADSY / YAS
D) EBCT / ADSY / YAS

T15. Spaceship Juno

A spaceship Juno is aiming to reach the Jupiter. The autopilot can lead Juno from point to point in 8 different directions. For example a command 1N means 1 step in North direction, and 2NE means 2 steps diagonally in North-East direction.

Question/Challenge:

Which of the following set of commands complete a shortest path to the Jupiter avoiding collision with the asteroids?

A) 3NW 1N   **B)** 1NE 3NW   **C)** 2N 3W 2N   **D)** 1W 3NW 1NE

T16. Beaver's code

In order to protect themselves from predators, beavers invented a method to communicate!

On one line, beavers write down the alphabet with the letters in the normal order. The next line starts with letters based on a *keyword* with the rest of the letters of the alphabet following in alphabetical order. Each letter appears exactly once.

They keyword "BEAVER" has the letter 'E' twice in it. You then only keep the first 'E' in the secret code, so you write down "BEAVR" followed by the rest of the unused alphabet in normal order. This gives the following result:

alphabet

A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X	Y	Z

alphabet for secret code

B	E	A	V	R	C	D	F	G	H	I	J	K	L	M	N	O	P	Q	S	T	U	W	X	Y	Z

You can change a word using the alphabet for the secret code by replacing each letter with the letter written below it. For instance the word "EXAM" would be coded as "RXBK".

If you receive a secret message and you want to understand it, you reverse the process.

Question/Challenge:
If the keyword is ZAPPY, how would you encode the word FOXES ?

A) CLVBQ   **B)** CLVQB   **C)** CLQZB   **D)** CLQBZ

T17. Soundex

Bob wants to know how different words sound. He does the following steps in order to generate a 4-digit code for each word:

1. Retain the first letter of the word.
2. Drop all occurrences of 'A', 'E', 'I', 'O', 'U', 'H', 'W', 'Y'.
3. Change letters to numerals as follows:

Letters	Numerals
B, F, P, V	1
C, G, J, K, Q, S, X, Z	2
D,T	3
L	4
M, N	5
R	6

4. Replace two or more identical numerals occurring together with the same single numeral.
5. Use only the first four digits of the resulting word, adding zeros at the end as necessary.

For example

Word	Code
BOB	B100
BEAVER	B160
HEILBRONN	H416
ESSAY	E200

Question/Challenge:
What code will be generated by the word "HILBERT"?

A) H410   **B)** B540   **C)** H041   **D)** H416

T18. Timetabling

Four beavers take evening classes at Bebras Tech. There are five subjects available:

Science (S)
Technology (T)
Engineering (E)
Art (A)
Maths (M)

They are very enthusiastic students and all of them want to take more than one subject:

Alfie wants to study *E, A* and *T*
Brenda wants to study *S, T* and *A*
Callum wants to study *M* and *A*
Dianna wants to study *E, M* and *A*

So that the teachers time is not wasted, Bebras Tech wants to squeeze these courses into as few evenings as possible, however, they can only have one of each course running, at most, each night.
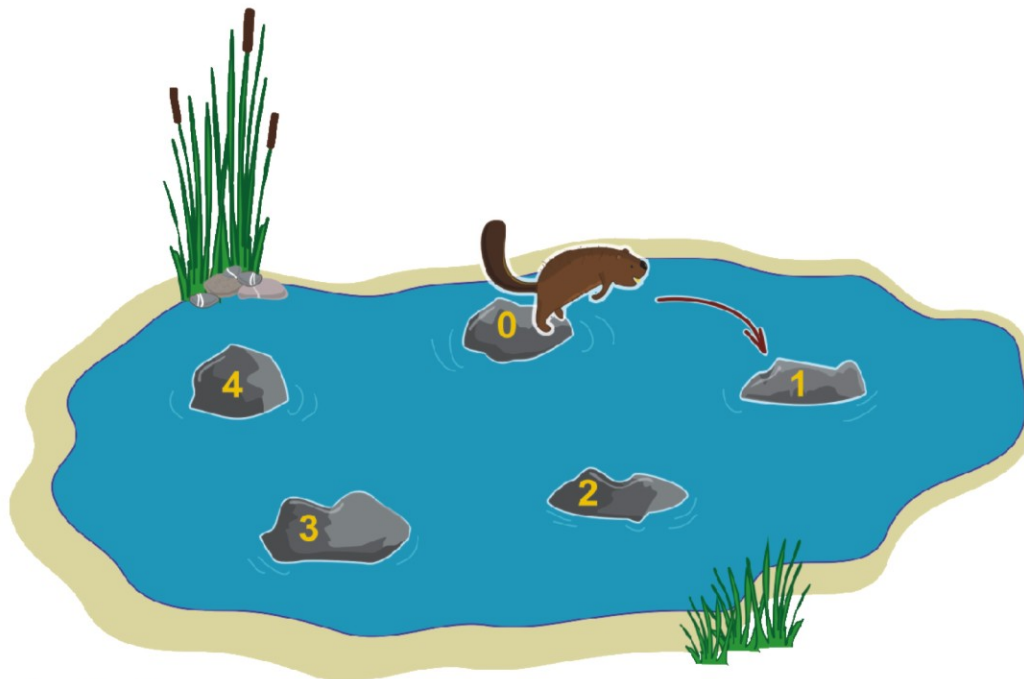
Question/Challenge:

What is the least number of evenings Bebras Tech can schedule the courses so that all the beavers can attend their chosen courses?

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

T19. Beaver-Modulo

Some beavers took part in the annual beaver challenge. Their first task was to jump from rock to rock in a clockwise direction, as shown by the arrow, starting from rock number 0. So, if a beaver jumped 8 times, he will end up on rock number 3:
$$0 \rightarrow 1 \rightarrow 2 \rightarrow 3 \rightarrow 4 \rightarrow 0 \rightarrow 1 \rightarrow 2 \rightarrow 3.$$


Question/Challenge:

One of the beavers showed off and jumped an astonishing 129 times. On which rock did he end up?

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

T20. Crypto-Beaver

To accomplish safe data transmission the beavers developed the following encryption system. They use two rings, each of which contains all characters of the alphabet.

For encoding the character of a message, the character is located in the outer ring and replaced by the corresponding character of the inner ring. After encoding a character of the message, however, the inner ring is turned clockwise, by one character. That is:
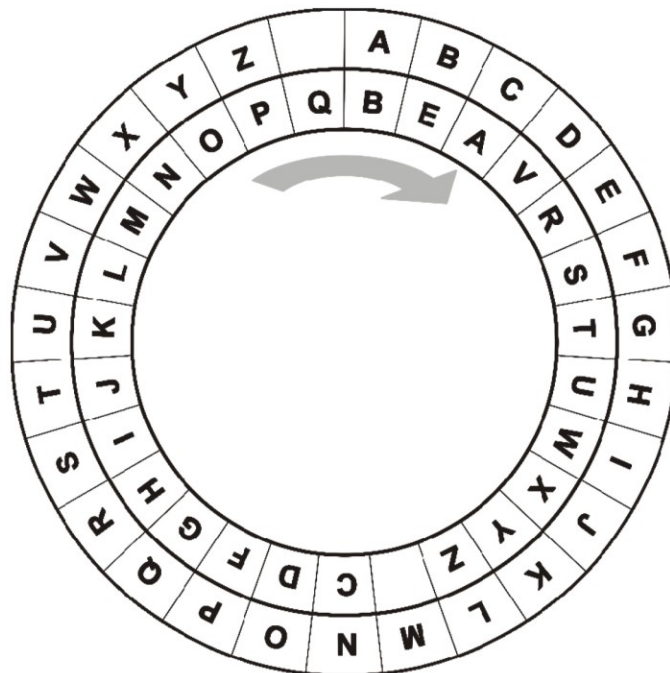
The first letter of a message is replaced according to the initial positions of the rings (see figure). For instance, a first letter 'H' is encoded by 'U'. A second letter 'H' is replaced by 'T', a second letter 'N' is replaced by ' '. A third letter 'H' is replaced by 'S', a third letter 'N' is replaced by 'Z'). An example: The message *YES* is encoded by *OVG*.

Question/Challenge:

This message:

COME AT THREE

is encoded by one of these strings. By which one?

A) ACYEMMCJZPUKJ
B) AFDUVSPTBGBFG
C) AD RQBJQJUHRR
D) NZYEQHMTO OMN

Tasks T21 – T30 carry 5 points each

T21. Dinner Time

Cindy, Dennis, Eric, Frank and Gloria met in a restaurant. We know a few facts about their orders:

- Each item in the menu has been ordered at least once;
- Every person has ordered a soup, a main dish, and a drink;
- Eric, who has ordered the same soup as Frank, has chosen pasta as main dish;
- Two persons, who ordered vegetable soup, selected chicken respectively beef as the main dish;
- Gloria ordered orange juice and salad;
- Coke has been ordered only by Cindy and Dennis.
- A person who ordered tomato soup also selected pizza and orange juice;
- Cindy ordered chicken as main dish.

Question/Challenge:

According to this information, what is ordered by Dennis?

A)	Vegetable soup	Chicken	Coke
B)	Vegetable soup	Beef	Coke
C)	Tomato soup	Pasta	Water
D)	Tomato soup	Pizza	Coke

T22. Dark and stormy

Jana and Robin play outside with their toy glider airplane. One of them stands on a small hill and the other one collects the airplane after each landing. Since the grass was not mowed for some time the landed model plane is only visible when looking from the hill, but not from close. Jana and Robin brought along a signaling disc and they both have worked out the following code to signal to the person picking up the plane:

Left   **Right**   **Towards the hill**   **Away from the hill**
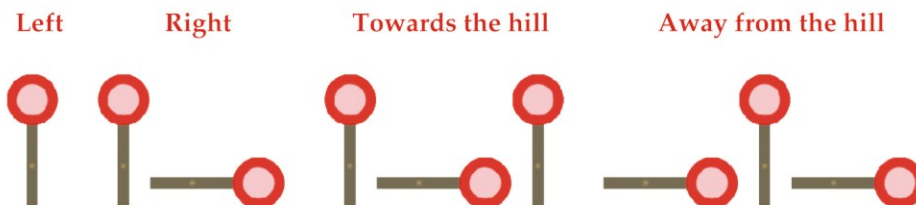
Unfortunately there is a problem with this code when the commands are sent without pause. So for example, if the following commands are sent:
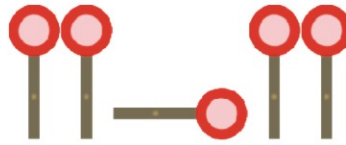
this could mean: Left, Towards the hill, Left but could also mean:
Left, Right, Left, Left

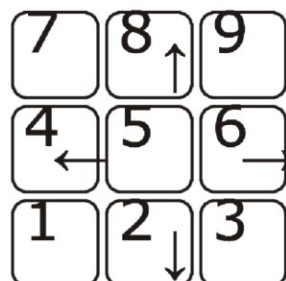Jana and Robin have to revise the code to fix this problem.

Question/Challenge:

Only one of the following codes is a good code - a code that never allows a sequence of signals to be understood in two different ways. Which code is correct ?
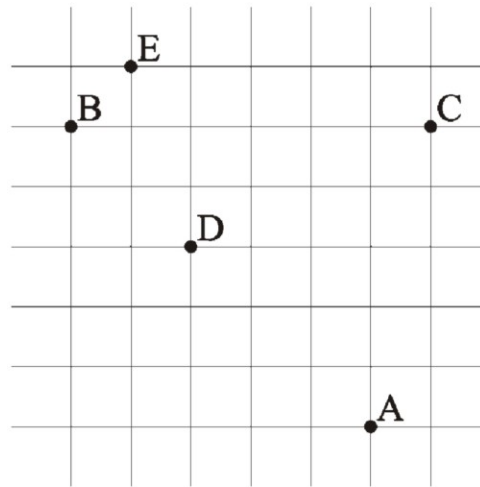

T23. Double mode keyboard

Beavers use one keyboard to both enter numbers 1 through 9 in a table, and to move the pen writing these numbers. To achieve this, keyboard can be switched between two operating modes: the Enter mode and the Move mode.

In Enter mode, each key enters (or overwrites) the corresponding number in the current cell and then moves the pen one cell to the right.

In Move mode, keys with arrows move one cell in the direction of the arrow. Keys without arrows do nothing in this mode.

Starting from an empty table, beaver Tammy pressed keys marked 1, 2, 3, 4, 5, 6, 7, 8, and 9, in that order. She also changed keyboard modes a few times and ended up with these numbers in the following table:

1		9	
	6	7	

Question/Challenge:
Which keys were pressed in the Enter mode?

A) 1, 5, 7 and 9   **B)** 2, 3, 6 and 9
C) 1, 3, 6, 7 and 9   **D)** 1, 2, 4, 5, 6 and 9

T24. Coins

There are 9 bags of gold coins in the bank vault. All the coins are identical in size and shape. You have just been informed by The Mint that one bag contains coins with a different alloy of gold that makes them a little bit heavier than coins in 8 other bags. All the regular coins weigh 100 grams each while the defective ones weigh 101 grams. There is no information on the bags regarding weigh or alloy.

It is 10 minutes before closing time and the defective bag has to be found so it isn't shipped tomorrow morning. You have very precise digital scales with battery left for 1 weighing and no way to replace the battery today.

Question/Challenge:
What is the minimum number of coins to be put on the scale to find out which bag has different alloy?

A) 9   **B)** 27   **C)** 36   **D)** 45

T25. Five Friends

Five friends Alice, Bobby, Carrie, Danny and Emma live at the locations marked by letters A, B, C, D and E on the map below. They want to set up a meeting place at an intersection to study together.

They walk to the meeting point via streets, and thus each friend will measure the distance by the total number of blocks horizontally and vertically from their own home. For example, the distance from Alice's home to Emma's home is 10 blocks.

Question/Challenge:

What is the minimum total distance from the five homes to the meeting place?

A) 17 blocks   **B)** 18 blocks   **C)** 19 blocks   **D)** 20 blocks

T26. Bank Queue

There are 3 cashiers in Beaver Bank: Alice, Beatrice and Claire. Beatrice works 2 times slower than Alice and Claire works 3 times slower than Alice.
Now in the queue there are.........

- 5 Fast beavers whose tasks would take 1 minute each if they would go to Alice,
- 2 Normal beavers whose tasks would take 2 minutes each if they would go to Alice,
- 6 Slow beavers whose tasks would take 3 minutes each if they would go to Alice.

Question/Challenge:

What is the minimum time required for all the tasks in the queue to be done by 3 cashiers?

A) 15 minutes   **B)** 14 minutes
C) 10 minutes   **D)** 16 minutes

T27. Atomic shelters

A beaver family has five different food locations on various parts of the river. The travel times (in minutes) from one food location to the next are shown in the picture. The family will build lodges in two of the food locations.

When the weather gets bad, a beaver travels from a food location to the nearest lodge. The time to do this trip is called the escape time.

The beavers wish to build their lodges so that the longest escape time is as small as possible.

Question/Challenge:
Which two locations must they choose to build their lodges?

A) (1, 5)   **B)** (2, 5)   **C)** (3, 4)   **D)** (2, 3)

T28. Passcode
Beaver Daniel received a chest of gold that is locked with an electronic lock. The lock can be opened by entering a code of 9 digits.
Danial has received the following hints about the code:

- The only digits in the code are 2, 6, 7 and 9
- The digit with the highest value is used the lowest number of times in the code.
- The digit with the lowest value is used the highest number of times in the code.
- The code looks the same in reverse.
- All consecutive digits are different.
- The last digit entered is odd.

Question/Challenge:
With the information given above, can you determine the pass code?

   A) 627292729   **B)** 226292927   **C)** 926762927   **D)** 726292627

T29. Happy Binary Cake
Beavers are decorating cakes. They want to make each cake different. Therefore they will place a different combination of candles on each cake. They have two colors of candles, red and yellow. All cakes must have at least one candle, and the order of the colors of the candles does matter. For example the combination red-yellow is different from yellow-red, even though they each have one red and one yellow candle.

Examples:

The beavers want to use the lowest total number of candles possible, so they start decorating cakes with 1 candle first, then move on to cakes with two candles, then cakes with three candles, etc.

Question/Challenge:

If the beavers have 14 cakes to decorate, how many candles will they need to use?

A) 14 **B)** 24 **C)** 34 **D)** 36

T30. Wizard Beaver's Alchemy

The wizard beaver has a magic box that melts 2 pieces of different colors from 3 basic jewellery (△, □, ⬠) to make a new one. The wizard beaver always uses his magic box to make the jewellery needed. The new jewellery is made by the following rules:

- Only two different shapes and colors of jewellery can be melted in the magic box at the same time.
- Different shapes and colors of jewellery are formed after the melting process according to the following rules of the magic box.
- Melting process can be done more than one time.

Rules of Magic Box for Shapes of Jewellery

Rules of Magic Box for Colors of Jewellery

Question/Challenge:

Which of the following item CANNOT be made from the four pieces of jewelry shown below?

A)   B)   C)   D)