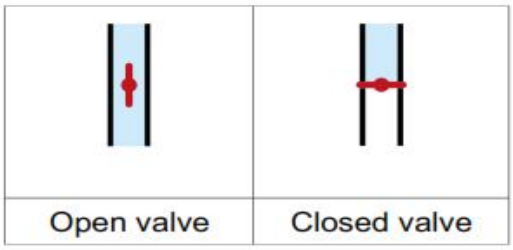
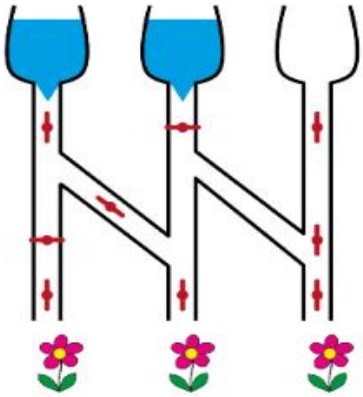
Tasks T1 – T10 carry 3 points each

T1: Watering





Which flowers will get the water?

A) 

B) 

C) 

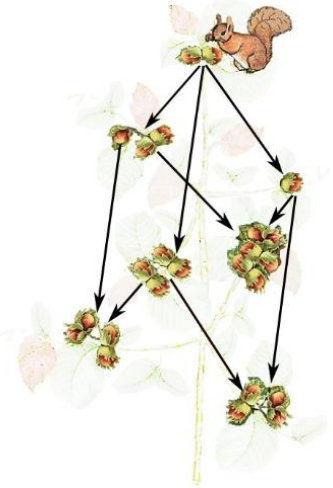
D) 

It's informatics!
Computers are composed of various chips and chips are made of smaller parts, electronic circuits which are in turn composed of logic gates. Logic gates act like valves, except that instead of water they conduct electricity and instead of pipes they have wires. This means that our modern electronic devices (including complex ones like computers and smartphones) are built up from simple logical operations.

Keywords
Logic gates

T2: Nuts

A squirrel picks two hazelnuts from the top of the hazel bush. She wants to collect as many hazelnuts as she can. To do this, she has to jump from one branch into another and pick them up, but she can only jump in the direction of the arrows.



How many hazelnuts can she collect after two jumps?

A) 9 nuts **B)** 10 nuts **C)** 11 nuts **D)** 12 nuts

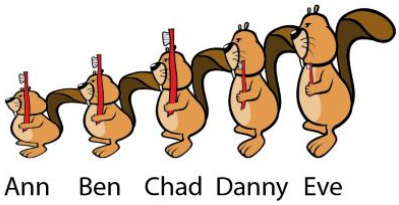
It's informatics!

The problem is reduced to a complete exhaustive search of all possible variants. It is important not to skip the correct answer. This develops skills in organizing a complete exhaustive search. With a large number of variants, one should be able to cut off obviously suboptimal branches. This problem can also be viewed as a dynamic programming problem.

Keywords

Exhaustive search
Dynamic programming

T3: Toothbrushes



"Not so fast!" says beaver Mom. "Eve and Chad, swap your brushes! Ann and Chad, swap your brushes, too!" And then she lost track.

Which pair still needs to swap their brushes so that each beaver will have its own brush?

A) Ben and Chad **B)** Ben and Danny **C)** Ann and Eve **D)** Nobody

It's informatics!
Computer programmers are often like moms, except that instead of ordering beaver kids to swap brushes, they move numbers through different cells in the computer memory. This is one base operation in programming. For instance, often we get some numbers we need to sort (like here with the size of the brushes). These numbers are stored in a group of memory cells. Sorting them consist of putting the smallest number in the first cell, the second smallest in the second cell, and so on, until the biggest number in the last cell. To do that we need to exchange several times the values contained is these cells.

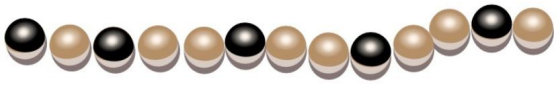
Keywords
Programming

T4: Pearl bracelet

For the grand ball, a princess put on the bracelet with dark and light pearls shown to the right. After the ball, she unfastened the bracelet between two pearls and put it in a chest. The next evening, she wanted to put on the same bracelet but there were many similar bracelets in the chest.

Which of the following bracelets did the princess wear to the grand ball?

A)



B)

C)

D)

It's informatics!

The bracelet is an example of a sequence of objects. The pearls are arranged in a certain pattern. When identifying the correct bracelet you have to look for properties of this pattern. In informatics, pattern matching means finding similar objects in different sources. In image processing, the pattern matching is used for locating a small image in a bigger one. Another example is searching for a word in text using a text processor.

Keywords

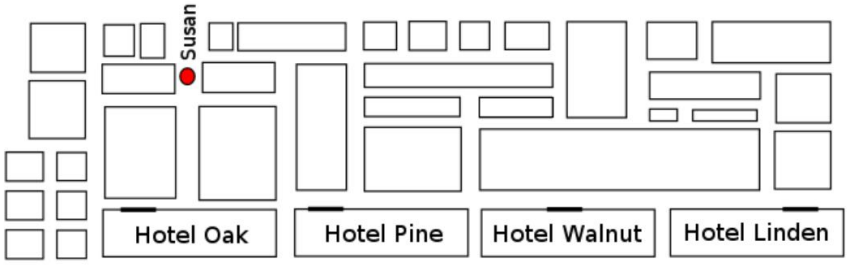
Sequences
Pattern matching

T5: Lost in a City

Susan is staying at a hotel in Beaver Town. She follows the directions below given by the hotel staff to get to the famous Beaver statue to take some pictures.

1. From the hotel's door, immediately turn to the left.
2. Go straight forward through two intersections.
3. At the third intersection, turn right.
4. Go straight forward. At the first intersection, turn left.
5. Go straight forward. At the first intersection, turn right.

A map showing the neighborhood of several hotels is given below.



In which hotel is Susan staying?

A) Hotel Oak **B)** Hotel Pine **C)** Hotel Walnut **D)** Hotel Linden

It's informatics!

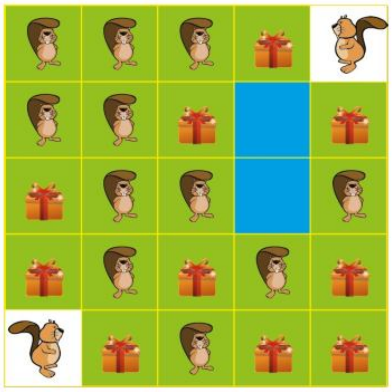
In this task Susan is given a set of instructions in order to reach a given goal. This is the basic idea of algorithms, which make up an essential part of informatics. An algorithm is a step-by-step solution to a problem. The steps involved should be as precise as possible and there needs to be a way to reach the solution. Algorithms can then be translated into computer programs by implementing them in a given programming language. As the task shows, we also deal with algorithms in our everyday life as well. Cooking recipes are a typical example. For instance, a recipe for baking a cake includes a list of steps that you need to follow in order to end up with a tasty dessert. When we read an instruction such as “pour the flour and the sugar into a bowl and stir”, we understand that we need to get a bowl from the cupboard, something to stir with and also make sure we use the correct amount of each ingredient. When we, on the other hand, create an algorithm that should be understandable by a computer, all steps need to be very precise and detailed. Everything needs to be explicitly mentioned so that there is no source for confusion or interpretation – you cannot assume that the computer has some “background” knowledge as we humans have. For instance, the instruction “pour the flour and the sugar into a bowl and stir”, would need to be divided into a list of instructions, e.g. 1) go to the cupboard to the left, 2) open the door, 3) grab the yellow bowl on the third shelf from below, 4) open the top-most drawer, 5) pull out a large spoon, … And still, this would not be detailed enough. What if we are not in the kitchen? What if there are two yellow bowls? What is a large spoon?

Keywords

Find the path
Algorithms

T6: Beavers and Gifts

Beaver Nick is traveling from the bottom left region of the forest to his friend Ann at the top right. He only moves up and right, never down or left. Today the temperature is very cold, so he must also avoid the lake. On his way he encounters gifts and beavers. When he finds a gift, he picks it up. When he meets a beaver, he gives him a gift. He must choose a path so that he always has gifts for the beavers he meets, and in the end he must also have a gift (that is, just one gift) to give it to Ann.



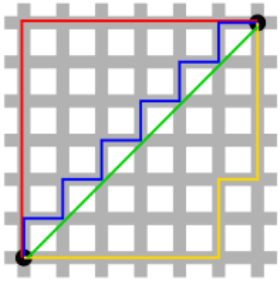
How long is the shortest valid path to Ann, counted in the number of steps (up, right) he will make?

A) 8 **B)** 9 **C)** 10 **D)** 12

It's informatics!

To determine the distance between two points we most of the time measure the length of the straight line between them. In some cases, however, we must define the distance in a different way.

Imagine a city with perfect perpendicular streets. Unless you are a bird, the minimal distance you need to cover to get from one point to another equals the number of horizontal plus the number of vertical blocks you need to pass, in whatever order. Such distance is called “Manhattan distance”.

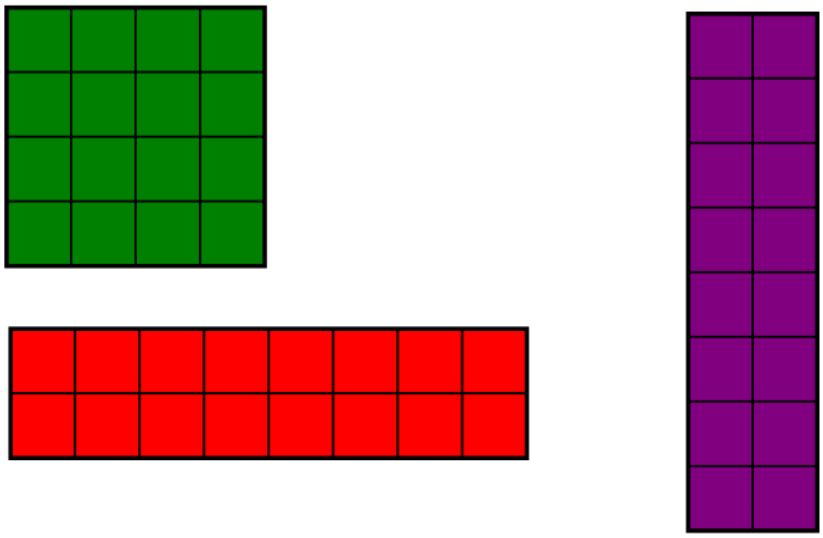


Keywords

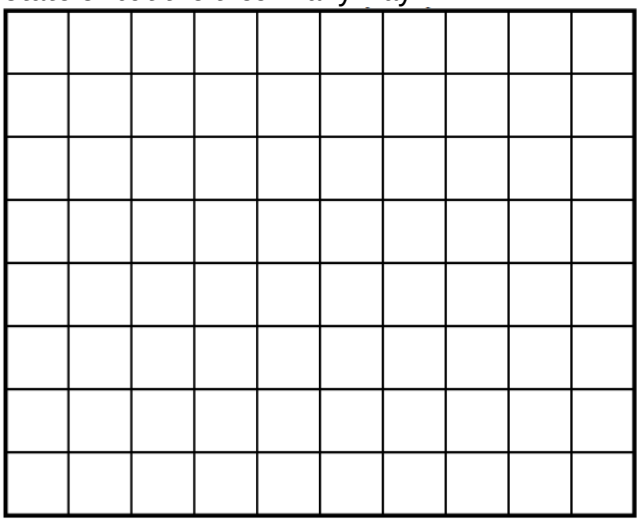
Manhattan distance

T7: Colourful Table

A little beaver would like to pave his new room with different coloured tiles:



He decided that he will not rotate or cut the tiles in any way.



He wants to make his room as colorful as possible.

What is the maximum number of different colors he can use to pave the room in the picture?

A) It is impossible **B)** 1 **C)** 2 **D)** 3

It's informatics!
The partition on the subsets of given sizes is one of the classical problems in the Algorithms theory. It is packing problem, where we have an area and we decide how to cover the area with certain shapes.

Keywords
Partition
Graphical algorithm

T8: Non-ordered stars

Lucy has 4 plastic stars. Every star has its own **size, colour, thickness of contour** and **number of corners** and she likes to order them by these properties. Stars on the picture above are ordered from thickest contour line to thinnest one.

Order stars so that they were **not ordered according to any of the described properties.**

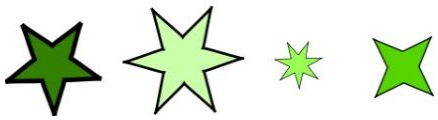
For example, they should not be ordered neither from the lightest to the darkest one nor from the darkest to the lightest one.

A)

B)

C)

D)



It's informatics!

Sorting objects according to their properties is using in databases. For example, school inventory could be sorted by age, place in different rooms, its function or price. Computers can work with database very quickly. Databases are core of normal shops and e-shops, lists of patients in hospitals and lists of bus stations and connections in timetables. Even search services as Google must use huge databases. Using best searching algorithms brings big advantage. Arrangement of things in database could help to effectivity of searching. e. g. It is easier to find the name in a list of pupils when they are sorted by alphabet.

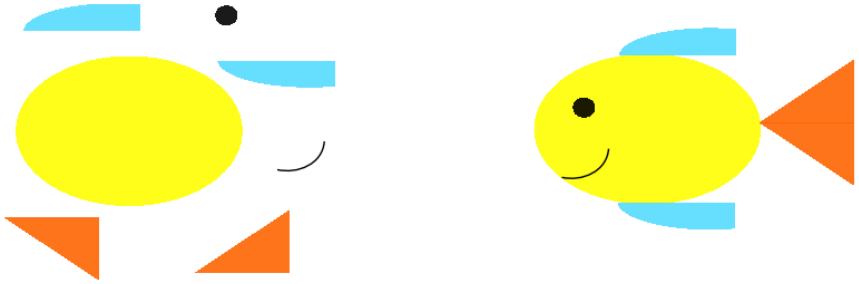
Keywords

Database
Sorting

T9: Assemble the Fish

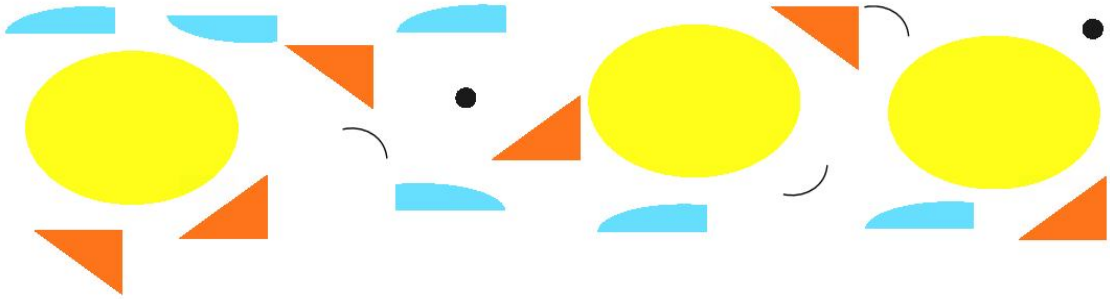
Students were learning how to use a graphics editor. They learned how to cut parts off a picture, copy them and move the copies to different places.

They used the seven parts shown in the picture on the left to assemble the fish in the picture to the right.



In the next lesson, pupils will be introduced to flipping parts of a picture horizontally and vertically.
From which set of parts will the students be able to assemble the same fish as above during the next lesson by using the skills learnt in both lessons?

A) B) C) D)



It's informatics!
The basic operations of a graphics editor is part of school informatics (in many countries). The operations involved when cutting, copying and assembling pictures from parts can also be considered as a type of logical puzzles that enhance algorithmic thinking (finding the sequence of operations that results in solving a task).

Keywords
Graphics Editor
Sequence of operations

T10: Mega Wood Land discount

Mega Wood Land is making discount on all of their products. Beaver Dylan is going to buy new stuff for his home, but he cannot carry more than 15 kg in his backpack. Here is a list of all the available products, with their weight and the value of the discount:

Product	Weight	Discount
Log	10 Kg	$ 11
Statuette	8 Kg	$ 10
Book	3 Kg	$ 3

Which of the following choice of products to buy will induce the greatest discount for Beaver Dylan?

A) 3 books and 1 statuette
B) 5 books
C) 1 statuette and 2 books
D) 1 log and 2 books

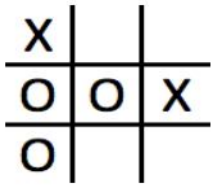
It's Informatics!
The knapsack problem is a well-know problem in combinatorial optimisation. Such problems are difficult to solve, but for small instances it is possible to explore that whole state space to find the best solution.

Keywords
Optimisation
Combinatorics
States' exploration

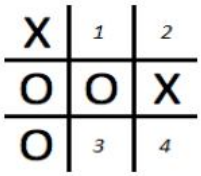
Tasks T11 – T20 carry 4 points each

T11: Tic-tac-toe

You are playing a Tic-tac-toe game with your friend on a 3×3 grid. First, your friend has to place "O", then it is your turn to put "X". You continue playing this way. The player who succeeds in placing three respective marks in a horizontal, vertical or diagonal row wins the game. Here is a picture of the actual board:



It is your turn to put "X". At which position would you put it, in order to be sure to win the game?



A) The 1st position **B)** The 2nd position **C)** The 3rd position **D)** The 4th position

It's informatics!

In the artificial intelligence domain, it is often necessary to explore a states space, a numerous ways to perform actions. From a current state, the strategy is to find the succession of states which will lead to the goal. The program has then to consider several states in advance, in order to make the right choice in the current state.

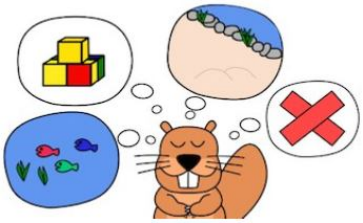
Keywords

Optimisation
Logic
State space exploration

T12: Beaver's playing places

A beaver decides where to play according to the weather.
The rules are as follows:

- If it is sunny today, but yesterday it was rainy, he will swim in the river.
- If it is sunny today and yesterday it was also sunny, he will play in the sand on the bank of the river.
- If it is rainy today, but yesterday it was sunny, he will play with toy blocks in his house.
- If it is rainy today, and yesterday it was also rainy, he will not play.



The following table is the weather history during November 1st - 8th.

Date	1 Nov.	2 Nov.	3 Nov.	4 Nov.	5 Nov.	6 Nov.	7 Nov.	8 Nov.
Weather								

Where does he play on 7th Nov.?

A) in the river **B)** on the bank of the river **C)** in his house **D)** will not play

It's informatics!

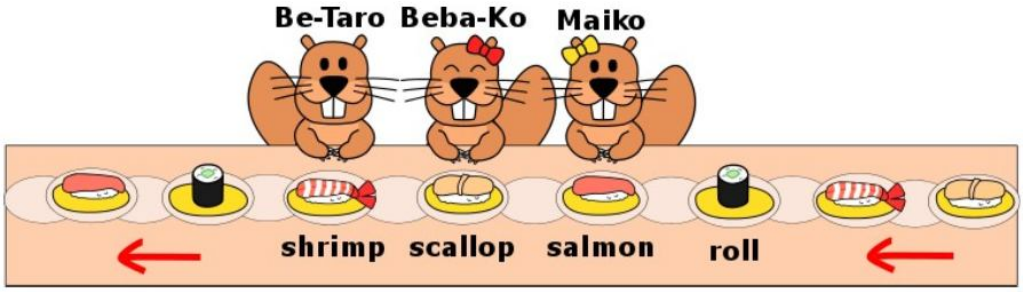
This is a problem for questioning the thinking logical. As the condition 3 and 4 are exclusive for each other, so that playing place is clearly determined. However, condition 1 and 2 are not exclusive. For example, if it was fine yesterday, both condition 1 and 2 are satisfied. This is a Finite-State Automata problem. In this problem, even if today is rainy, playing place depends on the weather "state" of the previous day. This means that two certain rainy days may be in the different states. By this problem, the idea of "state transition" will be noticed. The approaches of the state transition is an important concept that is used in the design of programs, such as a vending machine.

Keywords

Probability
Exclusive event
Finite-State Automata

T13: Conveyor Belt Sushi

Be-taro, Beba-ko and Maiko go to a sushi restaurant. At the restaurant, plates of sushi pass in front of customers on a conveyor belt. Customers pick plates from the conveyor belt.
There are four kinds of sushi: shrimp, scallop, salmon and roll, that repeatedly appear in the same order.



- Be-taro picks shrimp.
- Beba-ko picks the next plate.
- Maiko picks the next plate.
- After that, they continue to pick plates each turn
- They pick only one plate at a time and do not skip any plates on the conveyor belt.

What kinds of sushi does Maiko get on her first three plates?

A) shrimp, roll, salmon
B) scallop, shrimp, roll
C) salmon, scallop, shrimp
D) shrimp, scallop, roll

It's informatics!
This is an example of an assignment with given rules. Such situations often occur, e.g. “data striping” in computer data storage. Data striping is the technique of segmenting data, such as a file, so that consecutive segments are stored on different storage devices and improve performance of the data processing. Interleaving of data access requires fewer data accesses for each storage device and reduces access conflicts by different processes. In this question, each customer is used to describe a file and each kind of plate is used to describe a storage device.

Keywords
Rules
Assignment

T14: Broken Clock

A beaver has a digital clock which uses a seven-segment display for each of four digits. Each seven-segment display represents decimal numerals as shown below:

He breaks his clock and realizes that one of segments does not light up.

Which is a possible time that the above display represents?

A)

B)

C)

D)

It's informatics!

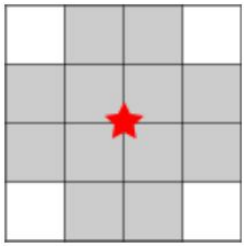
This task expects logical thinking ability. Digital clocks use seven-segment displays which are concerned with internal representation of numerals. This task is also concerned with error correcting methods.

Keywords

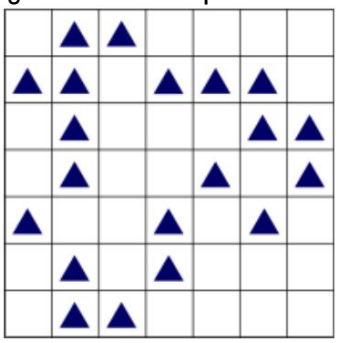
Numeric representation
Error correcting

T15: Loudspeakers in a village

In Beaver Village, loudspeakers are set up in order to announce information to the villagers. As illustrated below, each speaker should be located on a point which two lines cross each other and reaches the twelve gray squares.



The below figure is a map of Beaver village where ▲ represents a location of a house.



What is the fewest number of speakers such that announcement reach to all houses?

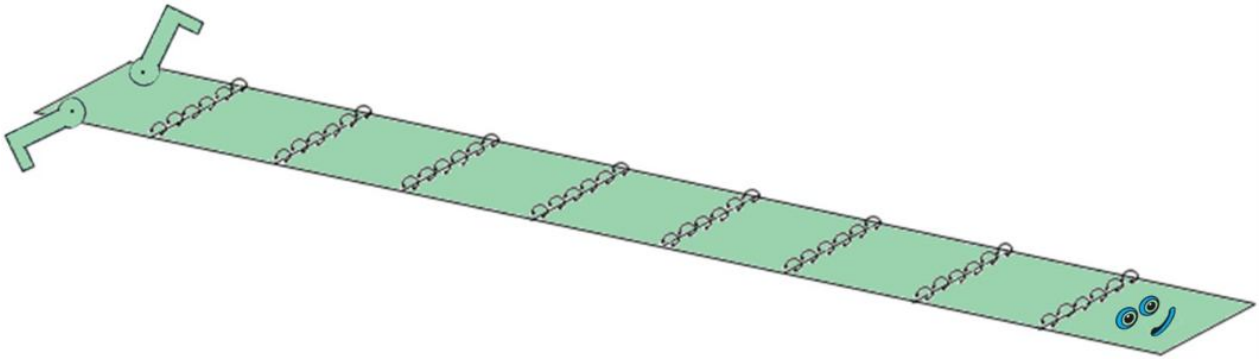
A) 2 **B)** 3 **C)** 4 **D)** 5

It's informatics!
Similar to dividing space into a number of regions, covering space with figures is applied to various uses. For example, mobile communication base stations cover efficiently wide area.

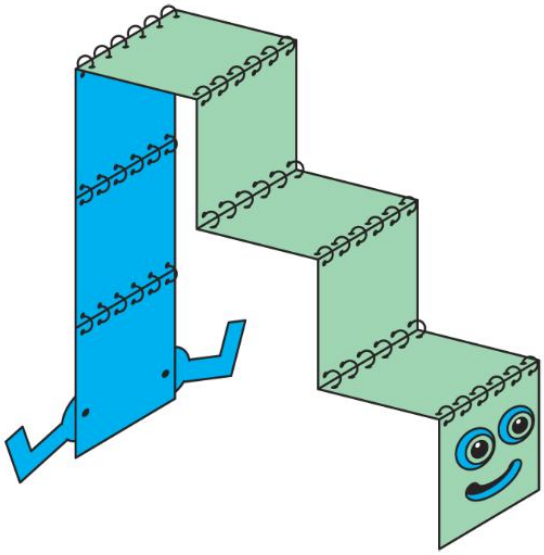
Keywords
Covering

T16: Stairs Robot Snake

Bob the Beaver is making a robot snake. The robot snake is constructed from identical square panels. Initially, Bob constructs the snake by laying out a row of square panels and connecting adjacent ones with hinges as shown in the picture below:



Bob can change the shape of the robot snake by bending it at its hinges. For example, Bob can transform the robot snake into some stairs. The stairs with 3 steps composed of a robot snake made from 9 square panels, is shown below:



How many square panels do we need to build stairs with height 7?

A) 21 **B)** 14 **C)** 7 **D)** 27

It's informatics!
You need to find an algorithm to count the steps. Also transformation and visualisation is needed. There is a repeated pattern, and many algorithms in computer science involve repeating a process many times, usually by way of "looping" constructs in programming languages.

Keywords
Simple algorithmic
Simple computing

T17: Trees

Beaver's family is building a dam from lots of trees. Every tree should be prepared by following a special sequence of three steps. At first, father gnaws a tree (which takes 30 minutes), then mother hauls that tree toward the bank (which takes 30 minutes), and little beavers gnaw all branches from the tree (which takes 30 minutes).

		
Father gnaws the tree	Mother hauls the tree	Little beavers gnaw all branches

What is the shortest time required to prepare three trees?

A) 90 minutes **B)** 120 minutes **C)** 150 minutes **D)** 270 minutes

It's informatics!

CPUs are working in a similar way as the tree preparation. If every device is used as soon it is free, computation becomes faster. Pipelining is an important idea for constructing CPUs. It's a cheap way to speed up computation. This task also deals with parallel processing, where tasks which do not conflict can be run simulatenously. Most of today's CPUs are multi-core machines, which can accomplish some of this parallelism. Parallel processing is an important algorithmic technique, which can be applied Something about factories producing cars.

Keywords

Preparation/prepare

T18: Family Tree

The beaver brothers want to draw the family tree. They talk to older beavers of the family and write down what they learn about relationships. When they write parent (A,B) they mean that A is the parent of B. Here is the list they got:

Parent (Thomas, Peter).
Parent (Ann, Eve).
Parent (Reka, George).
Parent (Margaret, Ann).
Parent (Ann, Zoltan).
Parent (Peter, George).
Parent (Charles, Zoltan).
Parent (Margaret, Peter).
Parent (Thomas, Ann).
Parent (Charles, Eve).

Find all grandparents of Zoltan among beavers mentioned in the list.

A) Ann and Charles. **B)** Eve and Thomas. **C)** Margaret and Thomas. **D)** Only Margaret

It's informatics!
Information coding for computer can be on different level in different forms. The languages of artificial intelligence have back step logic what ensures to find right answer if it is exists.

Keywords
AI
Prolog
Backstep
logic

T19: Image Decoder

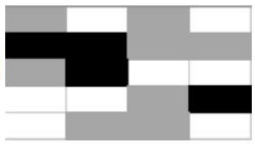
Beaver Paul-Henri is trying to send an image to his friend. To do this, he used a special program which encodes the image in a special way. The image is cut in small areas called pixels, each pixel having a unique colour. Three colours are possible: black (B), white (W) and grey (G).

An image is encoded as a sequence of numbers followed by a letter, representing consecutive pixels. For example, "2B 3W" means 2 black pixels followed by 3 white ones.

Moreover, all the pixels at the end are considered as white. For example, if the image has a total of 20 pixels, the code "4G" means that the 4 first pixels are grey, and the 16 remaining ones are white.

Which one of the following image corresponds to the following code "1B 2G 1W 4G 2W 1G 3W 3B 2W 1G"?

A)



B)

C)

D)

It's Informatics!
Representation of information and encoding is important in informatics. This question can also be related to the compression of information.

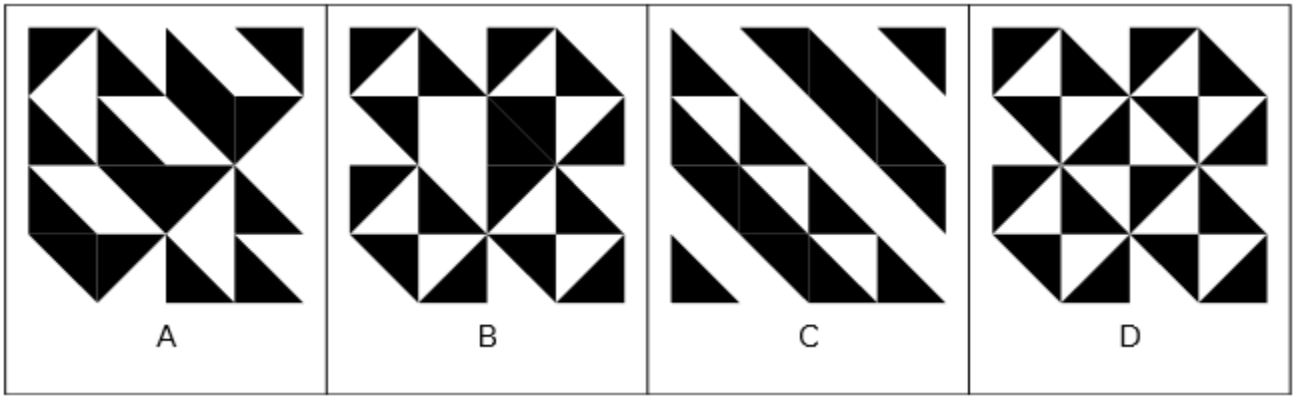
Keywords
Image
Coding
Modular arithmetic

T20: Truchet

A beaver has 16 tiles of the same type. By rotating them he can form different looks.

He wants to decorate his bathroom wall by filling a square area with these 16 tiles. Now he is planning the design.

Which of the following patterns can NOT be made with these tiles?



It's informatics!

Information can not only be represented by bits or letters. You can use pictures too. The tile is the basic form of Truchet tiles. These are square tiles decorated with patterns that are not rotationally symmetric. When placed within a square tiling of the plane, they can form varied patterns, and the orientation of each tile can be used to visualize information associated with the tile's position within the tiling. There are more kind of Truchet tiles.

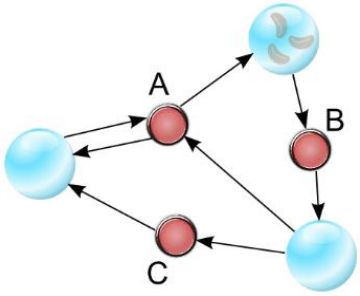
Keywords

Pattern
Visualisation

Tasks T21 – T30 carry 3 points each

T21: The magic machine

Beaver Dylan is playing with a very strange machine. The machine is composed of glass bubbles containing beans. Those bubbles are connected together with big push buttons. Here is a picture of the game:



When you press on a button, two things are happening successively:

- The machine checks that there is at least one bean in all the bubble that are linked to the button (that is, there is an arrow from the bubble to the button)

- If the check is successful, one bean disappear from all the source bubbles, and one bean is added to all the destination bubbles (that is, there is an arrow from the button to the bubble).

For example, pressing B will remove one bean from the top bubble and create one bean in the bottom bubble.

Which of the following sequence of button presses leads the machine in a situation where it is not possible to change anything to the machine, no matter what button is pressed?

A) B – B – C – A – B – A
B) B – C – B – C – B – A
C) B – B – C – B – C – C
D) B – C – B – B – A – A

It's Informatics!
This problem is an illustration of Petri nets, a formalism that is used to describe concurrent reactive systems and that can be used to simulate their behaviour or to perform analyses on them. Being able to simulate a Petri net helps to understand how the behaviour of complex concurrent reactive systems can be modelled.

Keywords
Petri net
Graph
Algorithm

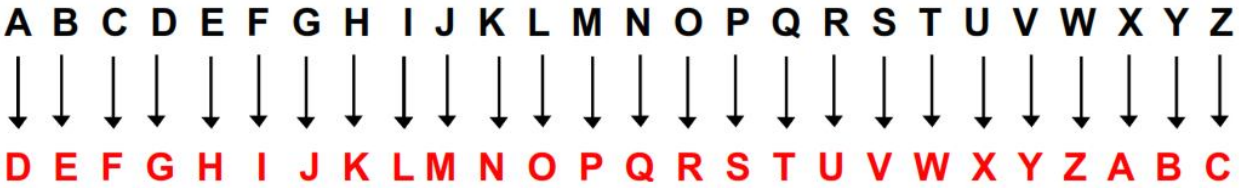
T22: John's Secret Message

Beavers have a method for sending secret messages on the Beavernet. To make a message unreadable to others, each letter in the message is replaced with another letter further along in the alphabet. A number is used to decide how far along in the alphabet you need to look for a given letter.

For instance, Anna Beaver has the number 3. When she wants to send a secret message, she replaces each letter in the message with the letter that comes 3 steps further along in the alphabet. So every A is replaced by a D, every B by an E, etc.

If she needs to replace a letter at the end of the alphabet and there are not enough letters further along, she continues from the beginning of the alphabet. So every Y would be replaced by a B, since Y → Z → A → B.

For Anna, who is using the number 3 to create secret messages, the alphabet thus looks as follows (original letters in black and the corresponding secret letters in red):



You and John Beaver are good friends, and he just sent you a secret message. You are very eager to find out what he wants, but you have forgotten what number he uses. The only thing you remember is that the word USE became BZL in his earlier messages.

What does John want you to do in his secret message "WHYAFHAZPE"?

A) Play games throughout the night
B) Go to a soccer game with him
C) Attend a party in the evening
D) Go out running with him on Friday

It's informatics!

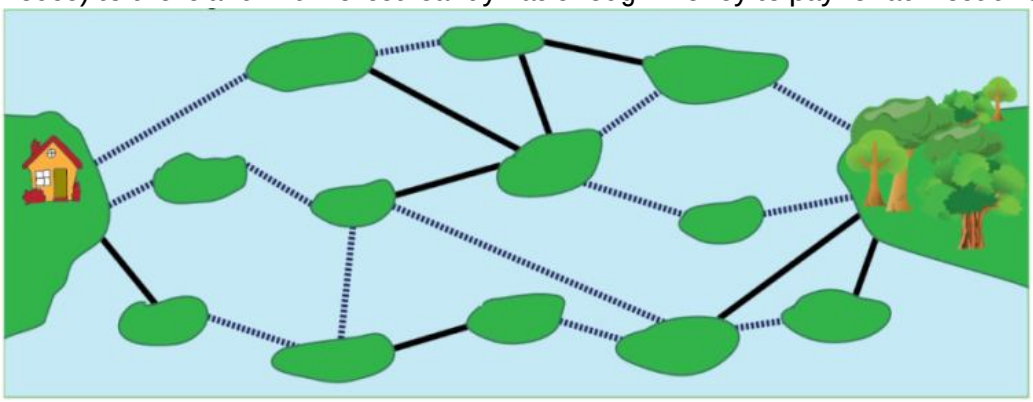
Being able to keep messages secret has always been important, for instance to send sensitive information between different cities and countries. Today, being able to protect digital information is very important, as more and more data is transmitted using the Internet and other networks. Cryptography is a field of informatics, which deals with techniques for encrypting messages so that only the sender and the intended receiver can read the content. Clearly, we do not want for instance our e-mail messages, credit card information or other private data to be readable to anyone. The encryption technique used in this task is called a shift cipher, since it shifts every letter in the alphabet a given number of positions. The method is also called Caesar cipher, as Julius Caesar used this particular approach for protecting his communication. The activity of making a message unreadable is called "encrypting" it. As a result, the original message ("plaintext") is transformed into an unreadable version ("ciphertext"). If you want to make the message readable again, you have to "decrypt" it, i.e. transform the ciphertext back to the orginal plaintext. The number used for encryption and decryption is called the "key".

Keywords

Caesar cipher
Cryptography
Decryption
Encryption

T23: Bridges

A city park has a big lake with many islands. The islands are connected by two types of bridges as shown below. The bridges are either public (solid line) or toll (dashed line). Sandy wants to travel from home (the island with a house) to the island with forest. Sandy has enough money to pay for at most two toll bridges.



What is the fewest possible total number of bridges that she crosses?

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

It's informatics!

The picture in this problem is a graph. We are asked to find a path from one vertex (Sandy's home) to another (the forest). In particular, we restrict the number of bridges of a certain type and we look for the cheapest possible path. There are many well known ways to solve such problems; one of the most interesting and challenging aspects of computer science is that we often face variations on well-known problems.

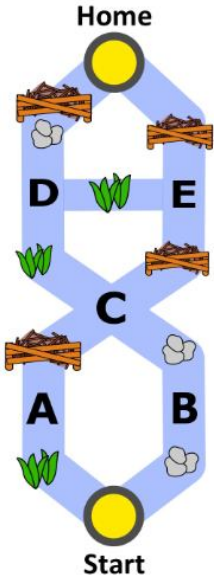
Keywords

Graph
Shortest paths

T24: Traveling upriver

To reach home, a beaver has to make a trip through a system of creeks. To have energy for the trip the beaver eats 15 twigs. On its trip, the beaver must get across some obstacles. This consumes energy corresponding to the following amount of eaten twigs:

Obstacle	Consumes Energy
	2
	3
	5



On the right, you see the system of creeks and the locations of the obstacles. The locations A, B, C, D, and E are used to describe routes through the creeks.

Which of the following routes can the beaver take?
Remember it starts with an energy of 15 twigs.

A) Start → A → C → E → Home
B) Start → A → C → E → D → Home
C) Start → B → C → D → E → Home
D) Start → B → C → D → Home

It's informatics!

The system of creeks is like a network, with the locations A to E plus Start and Home as nodes that are connected. The energy consumption of the obstacles on the connections can be regarded as a distance between connected nodes. Then, the beaver is looking for a shortest path from node „Start“ to node „Home“. In informatics, the mathematical construct „graph“ is often used to represent such networks with distances. Many algorithms have been developed for graphs. For the „shortest path problem“, several efficient algorithms have been invented, e.g. by Dijkstra and (together) by Floyd and Warshall. You may have seen the application of such algorithms already, for instance in route planning services like car navigation systems. So the next time you reach your goal thanks to computer software, you may think of Dijkstra and all the other computer scientists that have improved the finding of shortest paths.

Keywords
Graph
Shortest path problem
Dijkstra

T25: Abacus Factory

Beavers like to compute. As the tasks get more and more difficult, they start using simple computers: abaci. Ann, Kate and Philip established an abaci factory.

Making one abacus takes three steps:
1. Put rods into the left part of the frame.
2. Add the beads on the rods.
3. Add the rest of the frame.

Ann, Kate and Philip are not equally fast. The table below gives the times (in minutes) that they need for each operation.

	Putting rods into the left part of the frame	Putting beads on the rods	Adding the rest of the frame
Ann	10	15	15
Kate	10	20	10
Philip	15	10	15

If they have only two hours, how should they organize to assemble as many abaci as possible?

A) Each of them makes abaci alone.
B) Ann puts rods into the left part of the frame, Philip adds beads, Kate adds the rest of the frame.
C) Philip puts rods into the left part of the frame, Kate adds beads, Ann adds the rest of the frame.
D) Ann and Kate put rods into the left parts of the frames, Philip adds beads and the rest of the frame.

It's informatics!
These kinds of pipelines, where the output from one worker or machine or factory is input for another one and work is done parallel, are common in many areas of everyday life: factories, offices, transport systems, etc. It is important to optimize these processes to get best results. Often the processes are too complicated to be optimized by hand and computers must be used. Also note that (just like in this task), a process may have a start-up delay where the time from beginning to the first output is much longer than the time between subsequent outputs. Computer chips are also often composed of multiple units that can work in parallel, but need input from each other, much like Ann, Kate and Philip. Nowadays, when the actual speed of processors mostly stopped increasing, we make them faster by introducing more parallelism and better constructed "pipelines".

Keywords
Pipeline

T26: Bagels

Two friends have opened a bakery. Sue bakes three bagels (one of each shape A, B and O) and hangs them together on a stick, placing A on first, then B on second, and O third. She then repeats this process. Peter is selling the bagels and takes always the right-most bagel from the stick. Sue is baking faster than Peter can sell the bagels.

What is the fewest number of bagels sold by Peter if the bakery looks like the above picture?

A) 9 bagels **B)** 7 bagels **C)** 11 bagels **D)** 5 bagels

It's informatics!

The management of a data structure, namely a stack, is shown. When using a stack, elements can be stored only at the uppermost position and can be taken only from the uppermost position. That is, a stack is a LIFO data structure: last-in, first-out, meaning the most recently placed item into the stack will be the first item removed from the stack.

Keywords

Stack
Data structure

T27: Mobile phones

The beaver family has three mobile phones with empty batteries.
It takes 1 hour to fully recharge a mobile.
The beaver family has only two sockets and two mobile phone chargers in the house to charge the mobiles.

What is the shortest time they need to fully recharge the three mobiles?

A) 3 hours **B)** 2 hours **C)** 1 hour and half **D)** 1 hour

It's informatics!

This is a scheduling problem. Scheduling is used in computer science when tasks may be performed faster by dividing them among many CPUs: we choose which CPU will work on which task, when, and for how long. There are many different algorithms for scheduling. The most simple one is "first come, first served": you perform the tasks in the order they arrived. Here it would be to fully charge mobiles 1 and 2, and then charge mobile 3. But here this is not optimal as to the date of end for the whole work. When we need to divide tasks, it is important to choose carefully the way we assign them, so as to optimize one particular objective (date of end for instance). Scheduling is also used in disk drives (I/O scheduling), printers, net routers etc. Usually scheduling problems are very hard problems. We do not know how to solve them efficiently, or even if it is possible to do so.

Keywords

Scheduling

T28: Truth

Beaver Bob only tells the truth on Monday, Wednesday and Friday and always lies on all other days. Today he says: "Tomorrow I'll tell the truth." **What day is it?**

A) Tuesday **B)** Friday **C)** Saturday **D)** Sunday

It's informatics!
Logic is fundamental in computer science. When designing computer programs, careful thought has to go into logic structures. So complex computations can be made much more efficient, like instead of trying every possible way, one can exclude beforehand much useless computations (like trying all weekdays).

Keywords
Algorithm
Logic programing
Prolog

T29: Ladybug

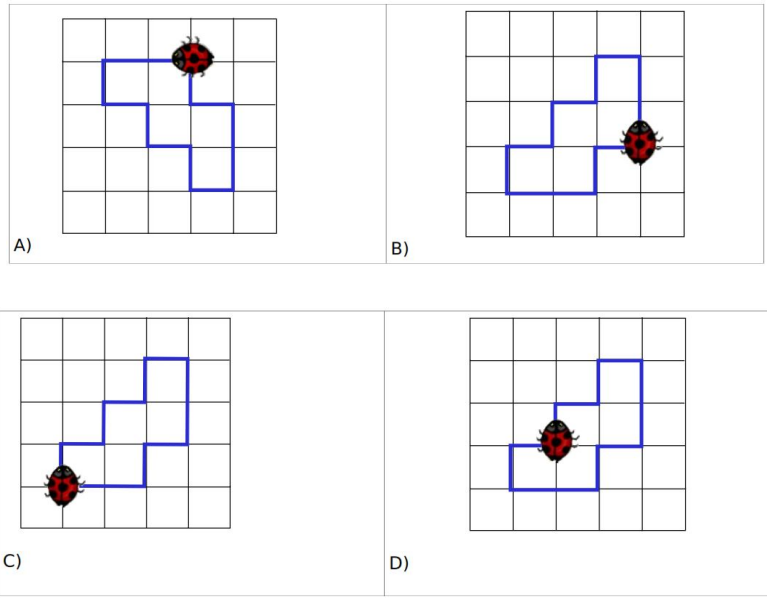
The Ladybug is a robot and it can be controlled by these commands:

- Forward N - the ladybug moves N steps (N is a number) forward in the direction where it is heading.
- Left - The Ladybug turns to the left without moving forward.
- Right - The Ladybug turns to the right without moving forward.
- Repeat R (some commands) - The Ladybug repeats the commands in parentheses R times (R is a number).

Each forward movement of the Ladybug paints a track (a straight line) on the floor on which it moves.
Bart gave this sequence of commands to the Ladybug:

Repeat 2 (Forward 1, Right, Forward 1, Left) Repeat 2 (Forward 1, Right) , Forward 2, Right, Forward 1, Left, Forward 1, Right, Forward 2, Right
The Ladybug executed the commands.

Which of the following tracks was obtained as a result of Bart's sequence of commands?



It's informatics!
The order of actions and what happens if a computer or a robot executes the actions in a specific order are among the basic things which informatics deals with.

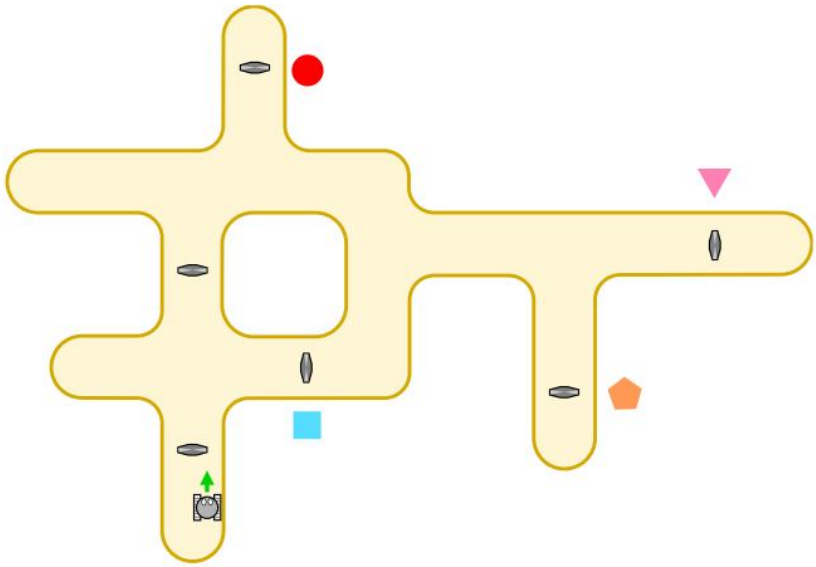
Keywords
Order of actions
Programming a robot

T30: The Clinging Robot

The clinging robot walks along the road clinging at one of the sides. The clinging robot knows four commands:
START means: Start walking along the side you are clinging to.
STAY means: Keep on walking at the side you are clinging to.
SWITCH means: switch to the other side and keep on walking.
STOP means: Stop walking.

The START command is executed at any place, wherever the robot happens to be. Each of the other commands is executed exactly when the robot walks over one of the dark magnetic control devices on the road.

The clinging robot executes this program: START SWITCH STAY STAY STAY STOP



Where does the robot stop?

A) At the pink triangle.
B) At the orange pentagon.
C) At the blue square.
D) At the red circle.

It's informatics!
Automatically moving vehicles are found at many places including tunnel systems, airports and factories. These machines are controlled by computer programs. Basically a computer program is a sequence of commands. The commands are related to physical sensors and means of maneuvering available to the vehicle.

Keywords
Robot
Program

CORRECT ANSWERS

Task #	Answer	Task #	Answer	Task #	Answer
1.	**B**	11.	**B**	21.	**C**
2.	**C**	12.	**D**	22.	**C**
3.	**B**	13.	**C**	23.	**B**
4.	**B**	14.	**A**	24.	**C**
5.	**C**	15.	**B**	25.	**B**
6.	**A**	16.	**A**	26.	**A**
7.	**D**	17.	**C**	27.	**C**
8.	**D**	18.	**C**	28.	**C**
9.	**D**	19.	**C**	29.	**C**
10.	**C**	20.	**B**	30.	**A**