Computational Thinking for Students: Day Four

Complete the following questions and submit the answer sheet.

Question One:

Logic

Laundry 39

Beaver has a laundry with two separate machines for washing and drying. Both machines have an half hour operating cycle, so each customer needs 60 minutes.

Two beavers arrive in a hurry. They need to wash and dry their clothes as quickly as possible.

How many minutes it is going to take to wash and dry clothes for two beavers?

Question Two:

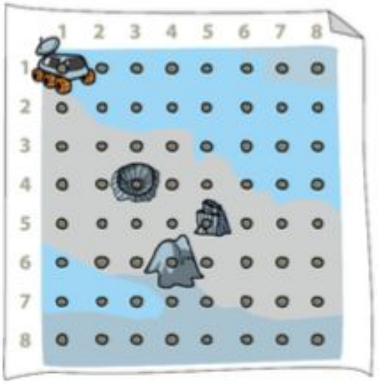
Algorithms

Lunar rover 31

The beaver controlled lunar rover is moving from one point to another using the map below. Lunar rover's path is:

(1, 1) (1, 3) (4, 3) (4, 6) (5, 6)

The first number is the row, the second – is the column number.



Which one of these objects will be encountered by the lunar rover: hill, crater or rocks?

Question Three:

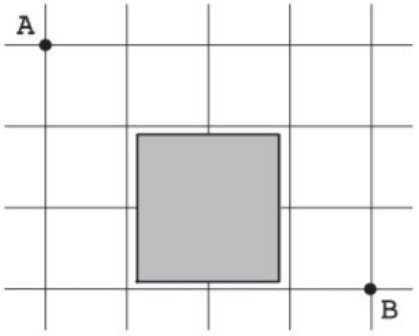
A museum has an exhibition space made up of 16 rooms. Its floor plan is presented in the answer sheet. There is a door between every pair of horizontally or vertically adjacent rooms. In addition, each room on the north and south side of the building (the top and bottom lines of the plan) has one door to the outside. In planning a new exhibition, the curator has to decide which of the doors need to be open so that a visitor can enter the exhibition through a door on the north side, visit each and every room exactly once, and get out through a door on the south side. Of course, the curator also wants to have as few doors open as possible.

(a) What is the minimum number of doors that need to be open for the exhibition?

(b) What entrance and exit doors need to be open for the exhibition? Indicate all the entrance-exit pairs that can be open for the exhibition.

Question Four:

Find the number of different shortest paths from point A to point B in a city with perfectly horizontal streets and vertical avenues as shown below. No path can cross the fenced off area shown in grey in the figure.



Grid of city streets with a fenced off area (shown in gray)

Question Five:

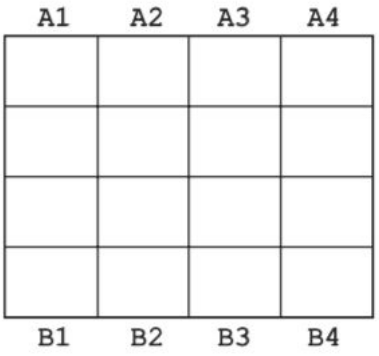
What is the minimum number of moves needed for a chess knight to go from one corner of a 100 × 100 board to the diagonally opposite corner?

Computational Thinking for Students:

Answer Sheet: Day Four

Take a photo or scan this page

File format: Name - Day Four

Name:	
School:	
Question:	**Answer:**
One	
Two	
Three	
Four	
Five	
Rating	☆ ☆ ☆ ☆ ☆

Computational Thinking for Students: Previous Days Answer Sheet: Day Three

Question One

Answer: 10, 11, 18, 19

Explanation: When there is too much information it is beneficial to analyse the situation and identify whether this information is necessary or not. Removing unnessecary information is called abstraction. It is especially hard to analyse when we do not know how much information is missing - like in this task.

Question Two

Answer: Exit D.

Explanation: The command is a core concept in program development. The command is a clear instruction, which can be carried by a computer or robot. Commands can be written in different ways, e.g., by using words, abbreviations, symbols, arrows, but a very important thing is to strictly define the rules you use to write the commands (what each command means and what it does). In programming languages, commands are usually written using word abbreviations.

Question Three

There is no solution. It is impossible to create such a tour without going back over the same bridge twice. Any suitable route must visit every land area (islands and the two banks). It must also involve every bridge but only once. Let's suppose there is such a route and we draw a red line over the map to show it. All the bridges must be on the route so should be coloured red. Now think about a land area on that route. It must have a red line in to it for every red line out from it. Otherwise, the route will get stuck when it arrives on that extra bridge. There will be no way out without going back over a bridge already crossed. The same reasoning applies to every land area. That means all land areas must have an even number of bridges connected to them if there is such a route. All the land areas on the Königsberg map have an odd number of bridges, so there is no such tour possible.

Question Four

Solution The answers are 11 and 19 gloves for parts (a) and (b), respectively.

a. In the worst case, before you get at least one matching pair, you will select 5 black gloves, 3 brown gloves, and 2 gray gloves—all for the same hand. The next glove will have to yield a matching pair. Thus, the answer is 11 gloves.

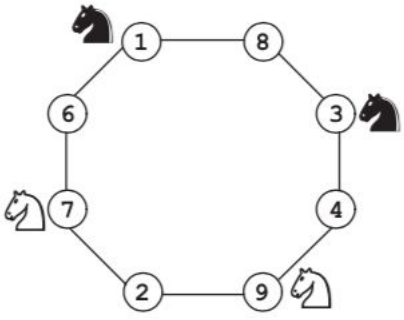
b. In the worst case, before you get one matching pair of each color, you will select all 10 black, all 6 brown, and 2 gray gloves for the same hand. The next gray glove will have to yield a matching pair. Thus, the answer is 19 gloves.

Comments The puzzle provides a simple example of the worst-case analysis of an algorithm efficiency.

Question Five

Solution The puzzle has no solution.

The initial state of the puzzle can be conveniently represented by a graph.



The knights can move only to adjacent vertices of that graph preserving their clockwise (and counterclockwise) order: the two knights of one color followed by the two knights of the other color. Since the objective configuration of the puzzle requires the four knights of different colors alternate, the puzzle cannot be solved.

Comments The puzzle's solution exploits two themes in algorithmic problem solving: representation change (the board's graph and its unfolding) and invariant (the knights' clockwise order).