Computational Thinking for Students: Day Five

Complete the following questions and submit the answer sheet.

Question One:

Logic

44 Beaver's House

Beaver house windows are marked by row & column numbers, e.g. windows on the door's right: [1, 3] and [2, 3].

Beaver replaced windows: [1, 2]; [1, 6]; [2, 2]; [2, 5] last year.

This year he wants to replace other windows, but only those, which have 4 "neighbours": to the left, right, above & below.

How many windows Beaver is going to replace this year?

Question Two:

Algorithms

37 Swap

Beaver's and kangaroos' cards are in an order:

You can swap two cards next to each other.

How many swaps are needed to swap cards to get all beavers at the beginning of the row and kangaroos at the end? Use the minimum number of swaps.

Question Three:
One day you are shown the four cards below. You are told that each card has a number on one side and a letter on the other. You are also told that every card that has a vowel on one side has an even number on its opposite side: a nice and simple fact, but is it true?

Which card or cards must you turn over to prove whether or not the vowel/even rule is true? Explain why.

Card A	Card B	Card C	Card D
E	G	2	3

Question Four:
On another day, you are shown a different set of four cards as below. This time each card has the details of a person in a shop on it. On one side is their age and on the other is what they are buying. If a person is buying fireworks then they must be over 18.

Which cards should you turn over to check everyone is shopping legally.

Card A	Card B	Card C	Card D
Age 25	Buying Rockets	Age 16	Buying Milk

Question Five:
The eight queens puzzle is the problem of placing eight chess queens on an 8×8 chessboard so that no two queens threaten each other; thus, a solution requires that no two queens share the same row, column, or diagonal. Can you come up with a solution?

Computational Thinking for Students:

Answer Sheet: Day Five

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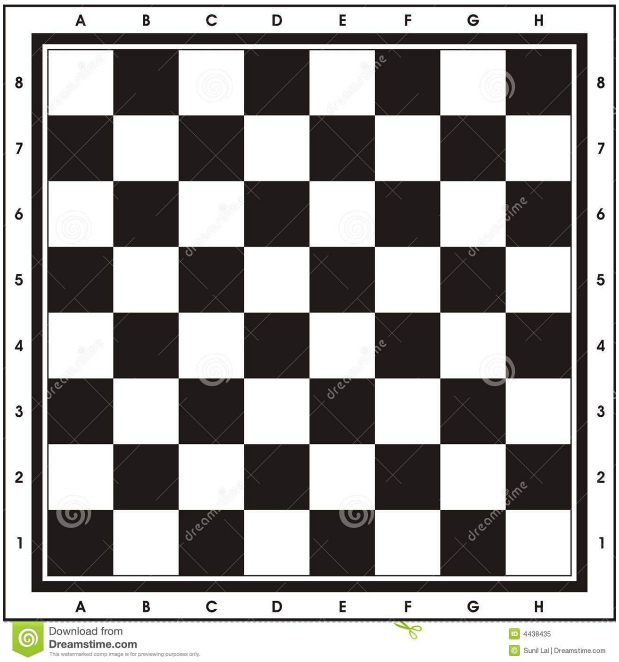
File format: Name - Day Five

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

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

Question One
Answer: 90 minutes.
Explanation: This task deals with parallel processing, where tasks which do not conflict can be run simultaneously. Most of today's CPUs are multi-core machines, which can perform parallel processing. Parallel processing is an important technique, which can be applied to factories producing cars and many other areas.

Question Two
Answer: Crater.
Explanation: Using a grid makes it possible to work out the path the rover has taken. The numbers that are used to represent each point are called coordinates. Coordinates are used a lot in maths and computing when drawing graphs and processing digital images.

Question Three
Solution

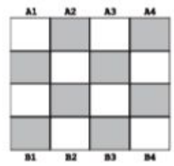
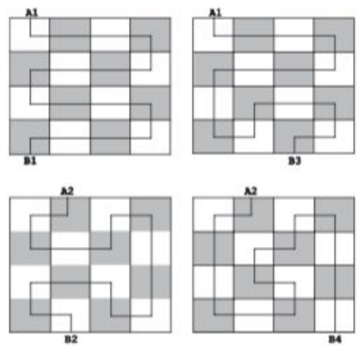


FIGURE 4.33 Sixteen-room plan colored as a chessboard.

a. Since a path through the exhibition must visit each room exactly once, it will have to enter and leave each room through different doors. This implies that the minimum of 17 doors need to be open, including one entrance door and one exit door.
b. On coloring the rooms as squares of a 4 × 4 chessboard (Figure 4.33), it becomes obvious that any path through the exhibition will have to pass through squares of alternating colors. Since the total of 16 rooms have to be visited, the first and last squares must be colored in the opposite colors. The possible outside door pairs that need to be open are (A1, B1), (A1, B3), (A2, B2), (A2, B4) and, symmetrically, (A4,B4), (A4, B2), (A3, B3), (A3, B1). Figure 4.34 shows one path (of the several possible) for each of the first four pairs listed above. Of course, all the room doors indicated by the path intersection with the square boundaries on the floor plan are assumed to be open as well.



Question Four
Answer is 17 paths.
The easiest way to get it is to apply dynamic programming—one of the algorithm design strategies discussed in the first tutorial. This approach finds the number of shortest paths from A to every intersection in the grid outside the fenced-off area (see Figure 4.7). Starting with the assignment of 1 to intersection A, these numbers can be computed row by row and left to right within each row. If an intersection has both the left and upper neighbors, its number is computed as the sum of the neighboring numbers; if an intersection has just one of such neighbors, it gets the same number as that of the neighbor.

Question Five
Solution The minimum number of moves is 66.
Although the knight cannot move along the straight line toward its goal, it can stay on the main diagonal after every pair of its moves. Thus, if its start and finish squares are (1, 1) and (100, 100), respectively, a sequence of 66 moves such as
(1,1)−(3,2)−(4,4)−...−(97,97)−(99,98)−(100,100)
solves the problem. (The number k of two-move advances can be obtained from the equation $1 + 3k = 100$.)
Given the nature of the knight's moves, it is convenient to measure the distance between two squares on the board by the so-called Manhattan distance, which is computed as the number of rows plus the number of columns between two squares in question. Here the Manhattan distance between the start and finish squares is $(100 - 1) + (100 - 1) = 198$. Since one knight's move can decrease this distance by no more than 3, the knight will need at least 66 moves to reach its destination. This proves that the sequence of moves given above is indeed optimal.

Comments The solution to the puzzle can be considered "greedy" since on each step the algorithm decreases the Manhattan distance to the destination square as much as possible.