Computational Thinking for Students: Day Three

Complete the following questions and submit the answer sheet.

Question One:
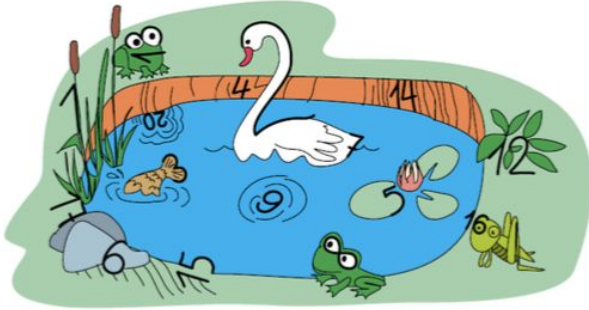
Abstraction

Missing numbers 23

In the picture there are numbers from 1 to 20.

Unfortunately, four numbers are missing. What are the missing numbers?
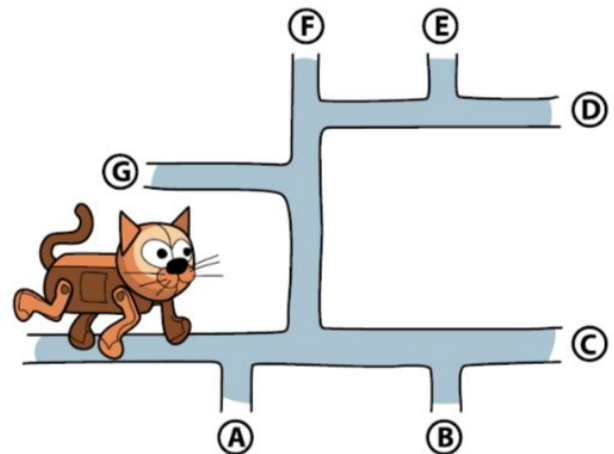
Question Two:

Algorithms

Every other turn 27

Beaver created a robot cat, which moves according to the following rules:

1) Move forward
2) Turn at every other turn

Where will cat exit?

Question Three:

Below is a map of the city of Königsberg, showing the river that runs through the middle, its two islands and the seven bridges that cross the river. The tourist information centre would like to publish a route that visits each part of the city (both banks and both islands) and that crosses each bridge once (and no more). It should start and end in the same place. You have been asked to advise them. Either provide a route or if you can't, explain why it is not possible
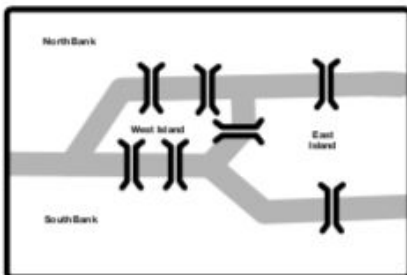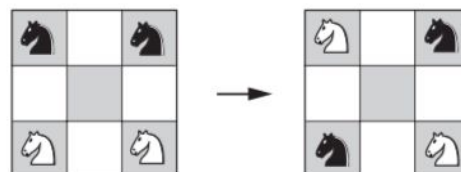
Question Four:

There are 20 gloves in a drawer: 5 pairs of black gloves, 3 pairs of brown, and 2 pairs of gray. You select the gloves in the dark and can check them only after a selection has been made. What is the smallest number of gloves you need to select to guarantee getting the following?
(a) At least one matching pair
(b) At least one matching pair of each colour

Question Five: -> Image in other column

There are four knights on a 3 × 3 chessboard: the two white knights are at the two bottom corners, and the two black knights are at the two upper corners of the board. Find the shortest sequence of moves to achieve the position shown on the right of the figure to prove that no such sequence exists. Of course, no two knights can ever occupy the same square of the board.

Computational Thinking for Students:
Answer Sheet: **Day Three**

File format: Name - Day Three

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

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

Question One
Answer: 1 = D, 2 = A, 3 = C

Explanation: In computing, pattern matching is the act of checking a sequence of items for the presence of the parts of some pattern. In contrast to pattern recognition, the match usually has to be exact. In image processing, pattern matching is used for locating a small image in a bigger one.

Question Two
Answer: TEAR.

Explanation: A binary tree is shown in the picture. A binary tree has many branches which can only have two branches attached to them. Data can be organised in this way for sorting and searching purposes.

Question Three
There are many solutions. One solution is:
Hotel – Science Museum – Toy Shop – Big Wheel – Park – Zoo – Aquarium – Art Gallery – Wax Works – War Ship – Castle – Cathedral – Hotel

Question Four
There are many solutions. One solution is:
1-9-3-11-5-7-12-4-10-2-8-6-1
In fact, this puzzle is actually the same as the the Question Three puzzle. If you draw a map showing which squares can be jumped between you get a picture that looks just like the Question Three map.

Question Five
Answer: The answer is 562 pages.
Let $D(n)$ be the total number of decimal digits in the first n positive integers (book pages). The first nine numbers are one-digit, therefore $D(n) = n$ for $1 \leq n \leq 9$. The next 90 numbers from 10 to 99, inclusive, are two-digits. Hence,

$$D(n) = 9 + 2(n - 9) \text{ for } 10 \leq n \leq 99.$$

The maximal value of $D(n)$ for this range is $D(99) = 189$, which means that some three-digit numbers are needed to reach the total digit count of 1578 given in the puzzle. There are 900 three-digit decimals, which leads to the formula

$$D(n) = 189+3(n-99) \text{ for } 100 \leq n \leq 999.$$

To answer the puzzle's question, we need to solve the equation

$$189 + 3(n - 99) = 1578.$$

Its solution is $n = 562$.

Comments The puzzle is included as an example of a simple algorithm analysis.