DAA Practice Questions (These questions are from placement question papers; questions appeared in Amazon, Intel, Microsoft)

For all questions, you are expected to present an efficient algorithm with a detailed complexity analysis. Answers must be complete in all aspects. While reading/understanding the questions, you may give importance to semantics and not just syntax.

1. Given a string, find the minimum number of partitions (substring) such that each partition is a palindrome.
   Sample input and output:
   $ABAC \implies$ Partition-1 = ABA, Partition-2 = C. Minimum number of partitions are 2
   $ABAABAAC \implies$ Partition-1 = $ABAABA$, Partition-2 = B, Partition-3 = C. Minimum number of partitions are 3.

2. Consider a game called gold rush. Gold rush game has n pots, pots are arranged in a line, each containing some gold coins. Assume that you and your friend are playing this game. Both of you can see how many coins are there in each pot, and each player gets alternating turns in which the player can pick a pot from either end of the line. The winner is the player who has the highest number of coins at the end. Your objective is to "maximize" the number of coins, assuming your friend also plays "optimally". Assume that you got the opportunity to start the game.

   Sample input and output:

	Player A	Player B
5, 7, 3, 4	4	
5, 7, 3		5
7, 3	7	
3		3
	11 coins	8 coins

3. Consider a ternary array A with elements 0, 1, and 2. The objective is to sort the array A in linear-time in place (no additional array).

4. **Input :** An integer x and $n \times n$ integer matrix M in which the entries of each row and each column are in increasing order.
   Question : Find the position of x in M if exists.

5. **Input :** Two arrays A, B.
   Question : Find two indices i, j such that swapping $A[i]$, $B[j]$ makes the total sum of arrays equal, if exists.

6. There are n people standing in a circle in an order 1 to n. Assume that person i has a sword. He kills the next person $(i + 1)$ and gives the sword to the next $(i + 2)$. All people do the same until only 1 person survives. Which number survives at the last ? Present an efficient solution which will return the 'survivor'

7. Write an efficient algorithm to find the third maximum element in an array of size n. Also, print the number of comparisons incurred by your algorithm.

8. Given an array of N non-negative integers array A representing an elevation map (bar chart) where the width of each bar is 1, compute how much water it can store.

   Example: Input arr[] = 0, 1, 0, 2, 1, 0, 1, 3, 2, 1, 2, 1, Output: 6.
   Trap "1 unit" between first 1 and 2, "4 units" between first 2 and 3 and "1 unit" between second last 1 and last 2