Name: _____ **ID:** _____

Desgn and Analysis of Algorithms (IT216 & IT1216)
First In-semester Exam
DA-IICT, Gandhinagar, Gujarat, India

Date: 14/09/2022 Total Marks: 30 Duration: 90 Mins.

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1. **[10 points]** A **sorted** binary array A is given. Find the number of 1's present in A.
   For example, let $A = [0, 0, 0, 0, 1, 1, 1]$. Then the maximum number of 1's is 3.

   (a) Design a trivial algorithm and describe its time complexity.

   (b) Design an efficient algorithm for this problem. Find the time complexity of your algorithm.

2. **[10 points]** Given an array $A[1...n]$ with n elements, describe in simple English an efficient algorithm to find two indices i and j such that $i < j$ and it is the case that $A[i] - A[j]$ is maximum.

3. **[10 points]** Given an array $A[1...n]$ with n integers, return *true* if A can be partitioned into three non-empty parts $A[1...i]$, $A[i+1...j]$, $A[j+1...n]$ with equal sums.

   For example, let $A = [1, 5, -3, 3, 1, 1, 1]$, then the algorithm returns true as $A[0] + A[1] + A[2] = A[3] = A[4] + A[5] + A[6]$.

   (a) Design an efficient algorithm for this problem.

   (b) Find the time complexity of your algorithm.