DESIGN AND ANALYSIS OF ALGORITHMS LABORATORY
(MA39203)
Department of Mathematics
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Assignment : 02
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1. Given a sorted array of integers arr[ ], and an integer x, write a function that returns index of x in arr[ ] if exists, otherwise, return -1.

Example 1: Input: N = 6, arr[ ] = {2, 3, 6, 8, 10, 11}, $x = 3$ Output: 1
Example 2: Input: N = 6, arr[ ] = {2, 3, 6, 8, 10, 11}, $x = 9$ Output: -1

2. Given an integer array arr[ ] sorted in ascending order, along with three integers: a, b, and c. The task is to transform each element x in the array using the quadratic function $ax^2 + bx + c$. After applying this transformation to every element, return the modified array in sorted order.

Example 1: Input: arr[ ] = {-4, -2, 0, 2, 4}, $a = 1$, $b = 3$, $c = 5$
Output: 3, 5, 9, 15, 33
Explanation: After applying $f(x) = x^2 + 3x + 5$ to each x, we get [9, 3, 5, 15, 33]. After sorting the array becomes [3, 5, 9, 15, 33].
Example 2: Input: arr[ ] = {-3, -1, 2, 4}, $a = -1$, $b = 0$, $c = 0$
Output: -16, -9, -4, -1

3. A *Rotated sorted integer array* is an array that was originally sorted in ascending order, but then a portion of the array was "rotated" or shifted to the front, creating two sorted subarrays. Given such an array with *distinct* integers, search for an element in it and return its index.

Example 1: Input: arr[ ] = {8, 9, 10, 2, 5, 6}, $x = 10$ Output: 2
Example 2: Input: arr[ ] = {6, 1, 2, 3}, $x = 5$ Output: -1

4.(a) Given an array prices[ ] of length N, representing the prices of a stock on different days, your task is to maximize your profit by choosing a single day to buy one stock and choosing a different day in the future to sell that stock. Find the maximum profit you can achieve from this transaction.

Example 1: Input: prices = [7, 1, 5, 3, 6, 4] Output: 5
Explanation: Buy on day 2 (price = 1) and sell on day 5 (price = 6), profit is 6-1=5.
Example 2: Input: prices = [7, 6, 4, 3, 1] Output: 0
Explanation: In this case, no transactions can be made to gain any profit.

(b) Now you are allowed to make at most **two** transactions. Find the maximum profit (Note: you must sell the stock before you buy for the second time).

Example 1: Input: prices = [3, 3, 5, 0, 0, 3, 1, 4] Output: 6
Explanation: Buy on day 4 and sell on day 6, profit =3-0=3. Then buy on day 7 and sell on day 8, profit =4-1=3. Total profit 6.
Example 2: Input: prices = [1, 2, 3, 4, 5] Output: 4
Explanation: Buy on day 1 and sell on day 5, profit = 5-1 = 4.