Design and Analysis of Algorithms
End Semester Laboratory Examination

Duration: 90 Mins

Write the program to implement the following scenarios.

1. **Find missing term in a sequence in log(n) time :** Given a sequence of numbers such that the difference between the consecutive terms is constant, find missing term in it in O(log (n)) time. (Sample Input : [5, 7, 9, 11, 15], Output: 13)

2. **Maximal Rectangle:** Given a 2D binary matrix filled with 0's and 1's, find the largest rectangle containing only 1's and return its area.
   Sample Input :

0	1	1	0	1
1	1	0	1	0
0	1	1	1	0
1	1	1	1	0
1	1	1	1	1
0	0	0	0	0

   Output: 9

3. **Fitting Shelves Problem:** Given length of wall w and shelves of two lengths m and n, find the number of each type of shelf to be used and the remaining empty space in the optimal solution so that the empty space is minimum. The larger of the two shelves is cheaper so it is preferred. However cost is secondary and first priority is to minimize empty space on wall. **(**Sample Input : w = 24 m = 3 n = 5, Output : 3 , 3 , 0 We use three units of both shelves and 0 space is left.)

   Note: The input will be given by the user at the time of execution for all the questions.