

Leading University, Sylhet
Department of Computer Science & Engineering
Midterm Exam, Fall-2016

Course Title: Computer Algorithms and Complexity

Course Code: CSE-2117

Full Marks: 30

Time: 1:30 Hours

Answer any 3(3x10=30) questions from the following.

[Each question carries equal marks]

1. (a) What is the worst case running time of the following?
 i) Binary Search ii) Insertion Sort iii) Heap Sort iv) Bubble Sort

[1]

- (b) What is Loop Invariant Property? Explain its properties with the example of Insertion Sort.

[2]

- (c) Sort the following sequence of numbers using Insertion Sort and Merge Sort. You need to write down each step while sorting.

8,3,2,1,4,6,8,9,5

[2+2]

- (d) i) Suppose, you want to search a number in a sorted array. The Array consists of billions of data. You know **Linear Search & Binary Search** algorithm. Which searching algorithm will you use to search the number in the array? Justify your answer.

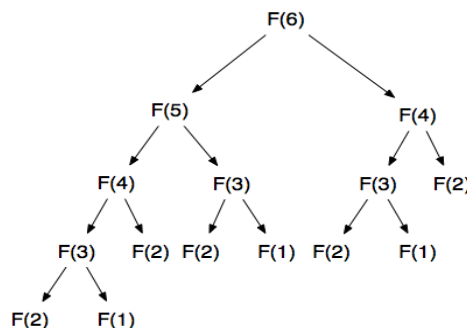
- ii) Can you apply Binary Search in an unsorted array? Explain your answer.

[3]

2. (a) Suppose, you are doing research on Bio-Informatics. Given two strings $X = \text{'ACBAED'}$ and $Y = \text{'ABCADF'}$, compute the LCS using tabulation implementation of bottom up Dynamic Programming.

[4]

- (b) Following diagram is the recursion tree to compute the 6th Fibonacci number using recursion. Do you think Dynamic programming is applied here? If so, then explain how is dynamic programming applied here. If not, then explain why?



[2]

- (c) Calculate the length of Longest Increasing Subsequence(LIS) of the following sequence using bottom up DP table.

9,6,5,7,2,0,29,11,2

[2]

- (d) Explain the two approaches of Dynamic Programming.

[2]

3. (a) Write down the differences between Dynamic Programming and Greedy Algorithm.

[3]

- (b) How is the worst-case time complexity of merge sort $O(n \cdot \log n)$?

[2]

- (c) Write short notes on **Big(Oh)**, **Big(Theta)** and **Big(Omega)**.

[1.5]

- (d) Here are a set of start and finish times of online contests organized by different online judges like Topcoder, Codeforces, Uva, etc. (i denotes the online judge's id, Si and Fi denote the start and finish times of the contest of i'th online judge.)

i	1	2	3	4	5	6	7	8	9	10	11
Si	1	3	2	5	3	5	6	8	8	5	12
Fi	5	6	4	8	6	8	11	11	15	7	15

What will be the best strategy/algorithm so that the programmers can participate in maximum number of contests? Also, write the pseudocode of your solution. (They can only participate in a contest when it begins, it is not allowed to start from the middle of a contest)

[3.5]

4. (a) Explain with an example why optimal parenthesization is important for matrix chain multiplication. Explain for the multiplication of A1.A2.A3 with dimensions 10×100 , 100×5 , 5×50 .

[3]

- (b) Explain how the following equation is derived in matrix chain multiplication:

$$m_{i,j} = \min_{i \leq k < j} \{m_{i,k} + m_{k+1,j} + p_{i-1}p_kp_j\}$$

What is i, j, k here? Why min? Why $p_{i-1}p_kp_j$?

[4]

- (c) Suppose, there is a rod of length n inches and a table of prices p_i , $i=1,2,\dots,n$, in order to find the maximum revenue obtainable by cutting up the rod and selling the pieces, why do you need to apply **Dynamic Programming** to compute the maximum revenue? What would be the problem if you don't apply **Dynamic Programming**?

[2]