USN ☐☐☐☐☐☐☐☐☐☐ 13MCA41

Fourth Semester MCA Degree Examination, June/July 2017
Analysis and Design of Algorithms

Time: 3 hrs. Max. Marks:100

Note: *Answer any FIVE full questions.*

1 a. Define algorithm. Explain the steps involved in algorithm design and analysis process with neat diagram. **(10 Marks)**
   b. Write formal definitions of asymptotic notations with graph representation. **(06 Marks)**
   c. List the steps involved in analyzing the time efficiency of non-recursive algorithms. **(04 Marks)**

2 a. Solve the recurrence relation and draw a tree of recursive calls for tower of Hanoi problem. **(07 Marks)**
   b. Write an algorithm for bubble sort and obtain an expression for number of times basic operation is executed. **(06 Marks)**
   c. Sort the list E, X, A, M, P, L, E in an alphabetical order by using selection sort. Discuss whether selection sort satisfies stable and inplace properties of sorting algorithms. **(07 Marks)**

3 a. Write algorithm for merge sort. Find the time complexity of merge sort using master's theorem. **(08 Marks)**
   b. Apply Strassen's algorithm to multiply the given two matrices:
   $$A = \begin{bmatrix} 1 & 2 \\ 5 & 6 \end{bmatrix} \text{ and } B = \begin{bmatrix} 8 & 7 \\ 1 & 2 \end{bmatrix}.$$ **(07 Marks)**
   c. Discuss when best, worst and average case situations arise in binary search program with their time efficiencies. **(05 Marks)**

4 a. Write an algorithm for insertion sort, and find the time complexity of insertion sort in worst case situation. **(05 Marks)**
   b. Discuss similarities and dissimilarities of Breadth-first-search and Depth-First-Search methods of traversing a graph. **(04 Marks)**
   c. Apply Breadth-First-Search (BFS) traversal method for the following graph:
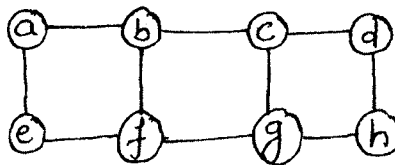

Fig. Q4 (c)

Consider 'a' as source node, find with what distance rest other nodes can be reached. **(06 Marks)**

   d. What do you mean by topological order of a graph? Find the topological order of the given graph using source removal method. **(05 Marks)**
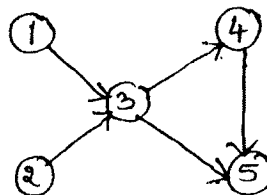

Fig. Q4 (d)

5 a. Write an algorithm for sorting by distribution counting. Apply the same algorithm to sort the elements :
   12, 13, 10, 12, 10, 12, 11, 10, 13   **(10 Marks)**

    b. Apply Horspool's algorithm to search a pattern PAPPAR in the text,
   PAPPAPPAPPARRASSAN
   Compare Bruteforce method and Horspool's algorithm of string matching.   **(10 Marks)**

6 a. Write an algorithm for computing binomial co-efficient C(n, K). What is the time-efficiency of this algorithm?   **(05 Marks)**

    b. Find the transitive closure for the graph whose adjacency matrix is,

$$\begin{bmatrix} 0 & 1 & 0 & 0 \\ 0 & 0 & 0 & 1 \\ 0 & 0 & 0 & 0 \\ 1 & 0 & 1 & 0 \end{bmatrix}$$
     (05 Marks)

    c. Apply the bottom up dynamic programming algorithm to the following instance of a knapsack problem. Capacity of knapsack W = 5.   **(10 Marks)**

Item	1	2	3	4
Weight	2	1	3	2
Value	42	12	40	25

7 a. Write an algorithm to find minimum spanning tree using prim's algorithm.   **(04 Marks)**

    b. Obtain the shortest distance and shortest path from node a to all other nodes in a graph.   **(08 Marks)**
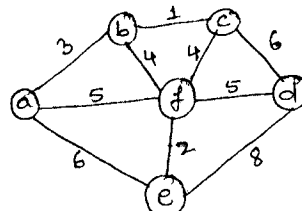

Fig.Q7 (b)

    c. Construct Huffman code for the following data:

Character	A	B	C	D	- (underscore)
Probability	0.4	0.1	0.2	0.15	0.15

Encode the text ABCABC – AD
Decode the string whose encoding is 11111001010101   **(08 Marks)**

8 a. Write a note on NP-complete problems.   **(03 Marks)**

    b. Find the subsets from the given sum using backtracking method.
   S = {3, 5, 6, 7} and d = 15   **(07 Marks)**

    c. Write a problem statement for the assignment problem, and find the optimal solution for the following instance with the construction of state-space tree.   **(08 Marks)**

	Job1	Job2	Job3	Job4
A	9	2	7	8
B	6	4	3	7
C	5	8	1	8
D	7	6	9	4

    d. Differentiate Branch-and-Bound and Back tracking techniques.   **(02 Marks)**

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