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**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:

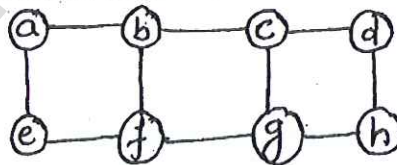


Fig. Q4 (c)

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)

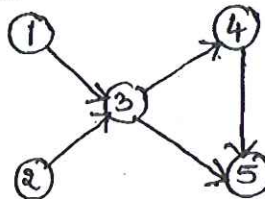


Fig. Q4 (d)

- 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)

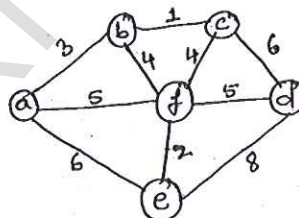


Fig.Q7 (b)

- 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)