Fourth Semester MCA Degree Examination, June/July 2019
Analysis and Design of Algorithms

Time: 3 hrs.

Max. Marks:100

Note: *Answer any FIVE full questions.*

1 a. Define an algorithm? Explain the fundamentals of algorithm for problem solving. **(10 Marks)**

   b. Consider if $t_1(n) \in O(g_1(n))$ and $t_2(n) \in O(g_2(n))$ then prove that
   $$t_1(n) + t_2(n) \in O(\max\{g_1(n), g_2(n)\})$$
   (10 Marks)

2 a. Explain the Brute Force String matching algorithm and analyse time efficiency for worst case and average cases. **(08 Marks)**

   b. Define Brute Force? Apply bubble sort algorithm for the following numbers and also write time efficiency.
   89   45   68   90   29   34   17   **(08 Marks)**

   c. ALGORITHM SUM(n)
   // Input a nonnegative integer n
   $s \in 0$
   for $i \in 1$ to n do
   $s \in s + i$
   returns s
   (i)   What does the algorithm compute?
   (ii) What is the basic operation?
   (iii) How many times is the basic operation executed?
   (iv) What is the efficiency class of this algorithm? **(04 Marks)**

3 a. Write and analyse the algorithm for merge sort by using master theorem with an example. **(10 Marks)**

   b. Explain Strassen's matrix multiplications (2×2 matrix) with an example. **(10 Marks)**

4 a. What is decrease and conquer? Write an algorithm for insertion sort. **(08 Marks)**

   b. Apply DFS algorithm and write the spanning tree for the following graph in Fig.Q4(b).
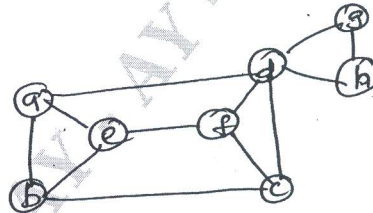

Fig.Q4(b)   **(08 Marks)**

   c. Write short notes on topological sorting. **(04 Marks)**

5 a. Write Horspools algorithm for input enhancement in string matching and apply it to search for the pattern "BARBER" in the below text
   JIM_SAW_ME_A_BARBERSHOP   **(10 Marks)**

   b. Explain open hashing and closed hashing with an example. **(10 Marks)**

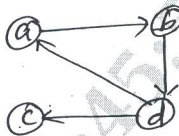**6** a. Write the Warshals algorithm. Apply Warshals algorithm for the following graph in Fig.Q6(a). **(10 Marks)**

Fig.Q6(a)

b. Solve the knapsack problem for the following inputs.

Item	1	2	3	4
Weight	2	1	3	2
Value	$12	$10	$20	$15

Capacity of knapsack, w = 5. **(10 Marks)**

7 a. What is spanning tree? Apply prisms algorithm for the following graph in Fig.Q7(a) and write its applications. **(10 Marks)**
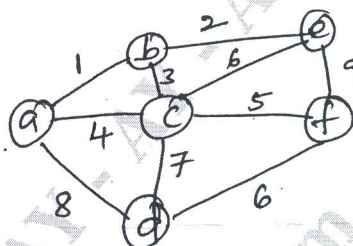

Fig.Q7(a)

b. Construct a Huffman tree for the following data and obtain its Huffman code.

Character	A	B	C	D	-
Probability	0.35	0.1	0.2	0.2	0.15

(i) Encode the text BAD_AD
(ii) Decode the text whose encoding is
    011011001101 **(10 Marks)**

8 a. Explain P, NP, and NP complete problem with an example. **(10 Marks)**

b. Solve the following assignment problem :

$$
\begin{array}{cccc}
\text{Job1} & \text{Job2} & \text{Job3} & \text{Job4} \\
\end{array}
$$

$$
C = \begin{bmatrix} 9 & 2 & 7 & 8 \\ 6 & 4 & 3 & 7 \\ 5 & 8 & 1 & 8 \\ 7 & 6 & 9 & 4 \end{bmatrix}
\begin{array}{l} \text{person a} \\ \text{person b} \\ \text{person c} \\ \text{person d} \end{array}
$$

(10 Marks)

* * * * *