

## MCA (Revised)

## Term-End Examination

June, 2018

00835

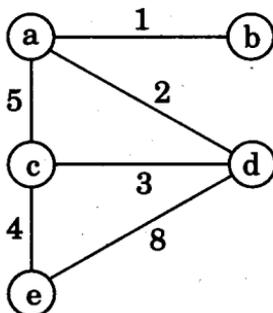
## MCS-031(S) : DESIGN AND ANALYSIS OF ALGORITHMS

Time : 3 hours

Maximum Marks : 100

**Note :** Question no. 1 is **compulsory**. Attempt any **three** from the remaining questions.

1. (a) Define an Algorithm. Explain five characteristics to define an algorithm. 6
- (b) Sort the following sequence of input using merge sort : 5  
 {10, 2, 1, 5, 3, 8, 11, 24, 7}
- (c) What is Greedy Algorithm ? Explain with an example. 6
- (d) Define minimum cost spanning tree. Write Prim's Algorithm to generate a minimum cost spanning tree for the following graph : 7

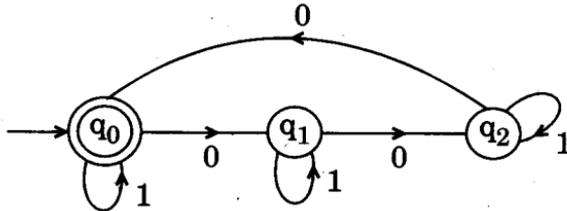


(e) Define Turing Machine (TM). Construct a TM for the Language ODD PALINDROME over input alphabet  $\Sigma = \{a, b\}$ . 8

(f) Explain "Principle of Optimality" w.r.t. dynamic programming. Solve the following chain-matrix multiplication problem using dynamic programming : 8

( $M_1, M_2, M_3, M_4$ ) with dimensions  
 $(5 \times 10, 10 \times 50, 50 \times 9, 9 \times 13)$

2. (a) Find the Regular Expression for the following Finite-Automata : 6



(b) Write Quicksort Algorithm. Sort the following sequence of array elements using Quicksort : 6

7, 9, 5, 10, 20, 13, 15, 12

(c) Given two matrix A and B, each of dimensions  $(n \times n)$ . Discuss V. Strassen's matrix multiplication method of multiplying A and B. Also show that this multiplication takes  $O(n^{\log_2 7})$  to multiply A and B. 8

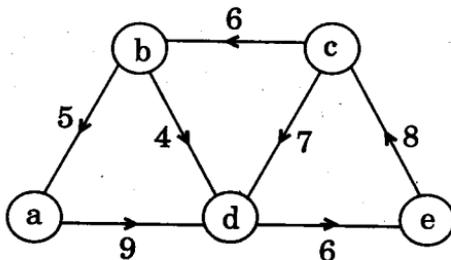
3. (a) Solve the following recurrence relation of Fibonacci series :

6

$$f_n = \begin{cases} 0 & \text{if } n=0 \\ 1 & \text{if } n=1 \\ f_{n-1} + f_{n-2} & \text{if } n \geq 2 \end{cases}$$

- (b) Write Dijkstra's Algorithm to find single source shortest path problem. Apply Dijkstra's Algorithm on the following graph :

7



- (c) Suppose  $L_1$  and  $L_2$  are context-free languages. Show that their Union ( $L_1 \cup L_2$ ) and Concatenation ( $L_1 \cdot L_2$ ) is also a context-free language.

7

4. (a) For the function  $f(x) = 7x^4 - 5x^2 + 11$ , show that

9

- (i)  $f(x) = O(x^5)$
- (ii)  $x^5 \neq O(f(x))$
- (iii)  $f(x) = \Theta(x^4)$

- (b) Sort the following elements using merge sort : 5  
{28, 13, 15, 17, 9, 56, 4, 46, 39, 64}
- (c) Discuss the best case and average case time complexity of quick sort algorithm by writing their recurrence relation. 6
5. (a) Differentiate between P, NP, NP-Complete and NP-Hard problems. 8
- (b) Explain undecidable problems of context-free language. 4
- (c) Differentiate between the following : 8
- (i) Deterministic Finite Automata (DFA) and Non-deterministic Finite Automata (NFA)
- (ii) Deterministic PDA and Non-deterministic PDA.
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