No. of Printed Pages : 4

MCS-031

MCA (Revised)

Term-End Examination

December, 2018

04363

MCS-031 : DESIGN AND ANALYSIS OF ALGORITHMS

Time : 3 hours *Maximum Marks : 100*

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

1. (a) Differentiate between P and NP class of problems with example of each. *5*

(b) Write an algorithm that finds the real roots, if any, of a quadratic equation $ax^2 + bx + c = 0$, where $a \neq 0$, b and c are real numbers. *5*

(c) By using Principle of Mathematical Induction, show that $n^3 - n$, is divisible by 6, where n is a non-negative integer. *5*

(d) Sort the following sequence of numbers using Bubble sort :

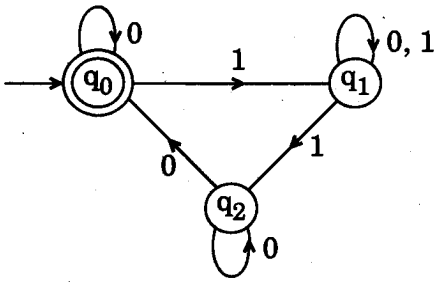
15, 10, 13, 9, 12, 17.

Find the total number of comparisons required by the algorithm in sorting the list. *6*

(e) Explain the "Principle of Optimality" in dynamic programming with suitable example. *6*

(f) Compute x^{29} by using divide and conquer technique. *5*

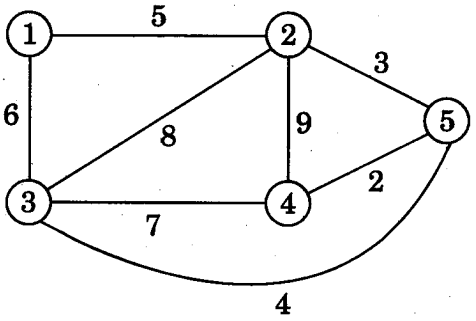
(g) Define Regular Expression. Find the Regular Expression for the following Finite Automata : *8*



2. (a) Apply Dynamic programming to multiply the following chain of matrices :

M_1, M_2, M_3 and M_4 with respective dimensions (5×10), (10×3), (3×7), (7×15). *10*

(b) Differentiate between Kruskal's and Prim's algorithms. Apply Prim's algorithm to find the minimum spanning tree for the following graph : *10*



3. (a) Write Euclid's algorithm to find the GCD of two natural numbers m and n. *5*

(b) Write Merge Sort Algorithm. Apply the same to sort the array of elements

15, 10, 5, 9, 7, 20, 25, 18, 16. *10*

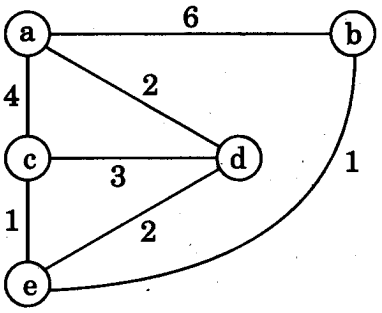
(c) Show that the context-free grammar $S \rightarrow S + S \mid S * S \mid a$ is ambiguous. *5*

4. (a) Define Θ-Notation. Show that

(i) $3x^2 + 2x + 1 = \Theta(x^2)$

(ii) $2x^3 + x + 5 \neq \Theta(x^4)$ *10*

(b) Write Dijkstra's Algorithm. Using Dijkstra's Algorithm, find the minimum distances of all the nodes from starting node a. *10*



5. (a) Write short notes on any ***three*** of the following : *3×5=15*

(i) Kleene Closure

(ii) Push-down Automata (PDA)

(iii) Chomsky's Classification of Grammar

(iv) Amortize Analysis

(b) Find context-free grammar for the following : *5*

(i) $L = \{a^m b^n \mid m, n \in N,\ n > m\}$

(ii) $L = \{a^m b\, c^n \mid n \in N\}$