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MCS-031

MCA (Revised)

Term-End Examination, 2019

MCS-031 : 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) Illustrate the heap sort algorithm on the sequence < 151, 98, 138, 76, 99, 200, 16 >. [5]

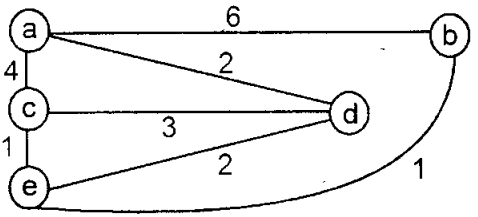
(b) Give an analysis of Merge-sort. For simplicity assume that the number of elements i.e. n is an exact power of two. [5]

(c) Solve the recurrence equation : [5]

$$T(n) = \begin{cases} 2T\left(\frac{n}{2}\right) + 0(n^2) & , \quad n > 1 \\ 1 & , \quad n \leq 1 \end{cases}$$

(d) List and explain any five properties of regular expressions. [5]

(e) Using Dijkstra's algorithm, find the minimum distance of all the nodes from node b which is taken as the source node, for the following graph : [10]



(f) Using Dynamic programming technique, find out minimum number of coins required to collect Rs. 8 out of the coins of denominations 1, 4, 6. [5]

(g) Explain Halting problem of Turing Machine with an example. [5]

2. (a) Multiply 10752×5318 using Karatsuba's method. Analyse the running time of the algorithm used. [10]

(b) Define Turing Machine. Design a Turing Machine which accept the Language $L = \{a^n b^n \mid n \geq 1\}$. [10]

3. (a) Explain the following problems together with their respective significance : [5+5=10]

(i) Undecidable problem

(ii) NP-Hard problem

(b) What is MinMax Algorithm ? Explain how Alpha-Beta pruning helps in improving MinMax Algorithm. [10]

4. (a) Explain the Kruskal-algorithm for Minimum Spanning Tree (MST) construction. [5]

(b) Show the MST corresponding to the following adjacency matrix representation of a graph : [5]

	a	b	c	d	e
a	-	1	15	-	5
b	1	-	2	-	10
c	15	2	-	8	6
d	-	-	8	-	3
e	5	10	6	3	-

(c) Differentiate between NP-Complete and NP-Hard problem. Show that CLIQUE problem is NP-Complete. [10]

5. (a) Explain the Meaning and the language describe by each of the following regular expression : [6]

(i) $(a+b)^*$

(ii) $ab^*a^*(a+b)$

(iii) $ab(a+b)^*$

Where '$*$' is a Kleen closure.

(b) Show that : [8]

(i) $2^n = 0(5^n)$

(ii) $\lfloor n = 0(n^n)$

(c) Explain limitations of Strassen's algorithm for matrix multiplications. [6]

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