No. of Printed Pages : 4

MCS-031

MCA (Revised)

Term-End Examination

December, 2012

13465

MCS-031 : DESIGN AND ANALYSIS OF ALGORITHMS

Time : 3 hours *Maximum Marks : **100***

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

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1. (a) (i) Prove that function $f(x) = 5x^4 + 7x + 3$ is $0(x^4)$. Is $f(x)$ also $0(x^4)$? Explain. **5+2=7**

(ii) Arrange the following growth rates in increasing order of time : **3**

$0(x^3)$, $0(2^x)$, $0(x^2)$, $0(\sqrt{x} \log x)$, $0(x \log x)$, $0(x^2 \log x)$

(b) (i) Differentiate between dynamic programming and greedy approach to solve different problems. **5**

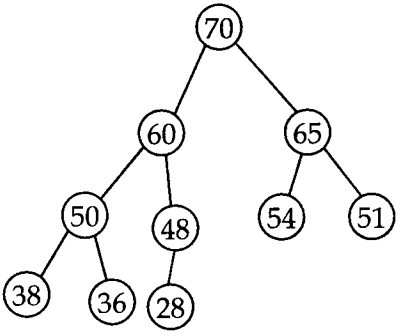
(ii) Write a recursive function to multiply two natural numbers. **5**

(c) (i) Define a Kleene Star (*) of a language L. Prove that if L is context free then L* is also context free. **7**

(ii) Explain the difference between Push Down Automata (PDA) and Finite Automata (FA). 3

(d) (i) Define 'Halting Problem" of Turing Machines. 5

(ii) Show stepwise sorting of elements using Heapsort algorithm to the following max heap. 5

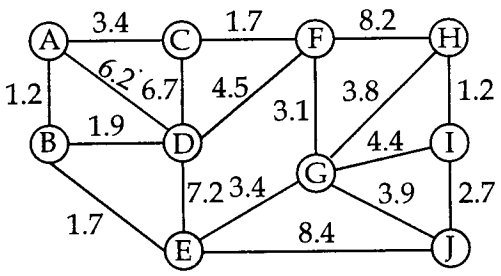


2. (a) (i) Define ambiguity in Context-Free Grammar (CFG). Show that the grammar : 4

$E \rightarrow E+E/E*E/a$ is ambiguous.

(ii) If L_1 and L_2 are two Context-Free languages, then show that $L_1.L_2$ is also Context - Free language. 3

(b) Use Prim's algorithm to construct a minimum spanning tree from the following graph (by using starting node A). 8



(c) Write a short note on NP-hard problems. 5

3. (a) Explain the complete steps of Strassen's algorithm for multiplying two $(n \times n)$ matrices. 10

Show that the Running time of Strassen's Algorithm is $0\ (n^{2.81})$.

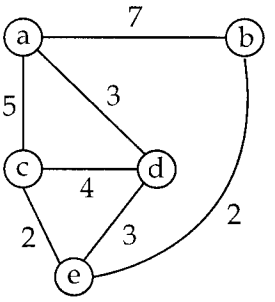
(b) Build regular grammar and corresponding finite automata (FA) for the following languages over the alphabet $\Sigma = \{a, b\}$. 10

(i) Language in which words do not end with ab.

(ii) Language having even number of a's.

4. (a) Describe 0-1 Knapsack problem. Which approach among greedy algorithm or dynamic programming is applicable for this problem ? 7

(b) Write a Dijkstra's algorithm for single source shortest path problem. Apply Dikstra's Algorithm for the following graph : 10



(c) What is the best case, average case and worst case running time of merge sort ? 3

5. (a) (i) Explain the purpose of randomization of quicksort. 4

(ii) What is the best case running time of quicksort ? In which situation does it occur ? 4

(b) Why do we perform amortized analysis of a problem ? 5

(c) Define θ notation and 0 notation. Explain, how these two notations are different. 7