No. of Printed Pages : 4

MCS-031

MCA (Revised)

Term-End Examination

June, 2016

08022

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. Parts of the same question may be attempted together.*

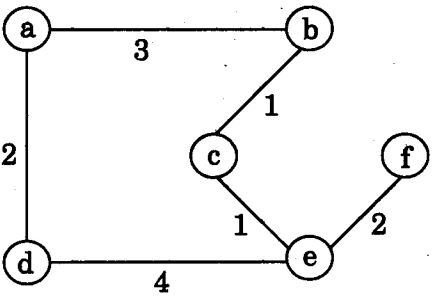
1. (a) Explain five characteristics of an algorithm briefly. *5*

(b) Write and explain recursive algorithm to find the factorial of any given number $n \geq 0$. *5*

(c) Explain the importance of asymptotic analysis for running time of an algorithm with the help of an example. *5*

(d) Briefly describe Chomsky classification for Grammars. *5*

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



(f) "The best-case analysis is not as important as the worst-case analysis of an algorithm." Yes or No ? Justify your answer with the help of an example. 10

2. (a) Explain how greedy approach is useful to find the solution to fractional knapsack problem. 7

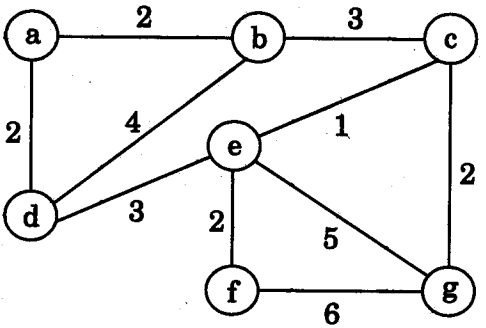
(b) Solve the following recurrence relation : 5

$$f_n - f_{n-1} - f_{n-2} = 0$$

such that $f_0 = 0$ and $f_1 = 1$.

(c) Explain Turing Machine (TM) as a computer of functions, with the help of an example. 8

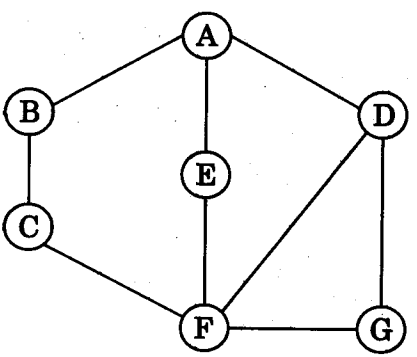
3. (a) Using Prim's algorithm, find a minimal spanning tree for the graph given below : *10*



(b) Sort the following sequence of numbers, using Selection Sort. Also find the number of comparisons and copy operations required by the algorithm in sorting this list : *10*

20 5 15 8 6 28

4. (a) Using Depth First Search (DFS) traverse the following graph by using A as the starting node : *5*



(b) Define Ω notation used for comparing two functions.

For $f(x) = 2x^3 + 3x^2 + 1$

$h(x) = 2x^3 - 3x^2 + 2$

show that

(i) $f(x) = \Omega(x^3)$

(ii) $x^2 \neq \Omega(h(x))$ 5

(c) What is dynamic programming ? Explain briefly the optimal substructure property of a dynamic programming problem. 5

(d) What is NP-complete problem ? Is it necessary that every NP-complete problem must also be a NP-hard problem ? Justify. 5

5. (a) Write an algorithm for Heap Sort and analyse its Best and Worst run time complexity. 10

(b) Define a Turing Machine. 5

(c) Consider the CFG :

$S \rightarrow SS/XaXaX/\wedge$

$X \rightarrow bX/\wedge$

Find the language generated by this CFG. 5