

JK LAKSHMIPAT UNIVERSITY, JAIPUR

INSTITUTE OF ENGINEERING AND TECHNOLOGY

End Term Examination (Regular), Nov.-Dec. 2015
M. Tech in Computer Science & Engineering, Semester I Sem

Roll No.....

MTCS101: Analysis & Design of Algorithm

Time: 3 hours

Max. Marks: 100

Instructions to students:

1. Do not write anything other than your roll number on question paper.
2. Assume suitable data wherever required and mention it clearly.
3. Writing appropriate units, nomenclature, and drawing neat sketches/schematics/ flow chart wherever, required are an integral part of the answer.

Q.1A	Objective type multiple choice questions (10 questions @ 1 mark)	10
i.	Sorting is not possible by using which of the following methods? (A) Insertion (B) Selection (C) Deletion (D) Exchange	
ii.	For 0/1 KNAPSACK problem, the algorithm takes _____ amount of time for memory table, and _____ time to determine the optimal load, for N objects and W as the capacity of KNAPSACK. (A) $O(N+W)$, $O(NW)$ (B) $O(NW)$, $O(N+W)$ (C) $O(N)$, $O(NW)$ (D) $O(NW)$, $O(N)$	
iii.	Choose the correct answer for the following statements: I. The theory of NP-completeness provides a method of obtaining a polynomial time for NP algorithms. II. All NP-complete problems are NP-Hard. (A) I is FALSE and II is TRUE (B) I is TRUE and II is FALSE (C) Both are TRUE (D) Both are FALSE	
iv.	the total running time of optimal binary search tree of n nodes (A) $O(n^2)$ (B) $O(n)$ (C) $O(n^3)$ (D) $O(n \log n)$	
v.	The logical or mathematical model of a particular organization of data is called a (A) Data structure (B) Data arrangement (C) Data configuration (D) Data formation	
vi.	A does not keep track of address of every element in the list. (A) Stack (B) String (C) Linear array (D) Queue	

vii.	Which of the following sorting algorithm is of divide-and-conquer type? A. Bubble sort B. Insertion sort C. Quick sort D. All of above	
viii.	The data structure required for breadth first traversal on a graph is A. Queue B. Stack C. Array D. Tree	
ix.	If there is an NP complete language L whose complement is in NP, then complement of any language in NP is in A. P B. NP C. Both A and B D. None of these	
x.	Let A be an adjacency matrix of a graph G. The th ij entry in the matrix $K A$, gives A. The number of paths of length K from vertex V_i to vertex V_j . B. Shortest path of K edges from vertex V_i to vertex V_j . C. Length of a Eulerian path from vertex V_i to vertex V_j . D. Length of a Hamiltonian cycle from vertex V_i to vertex V_j .	

Q.2	Short answer type questions (4 questions @ 2.5 marks)	10
a.	Differentiate between Greedy method and Dynamic programming.	
b.	Explain the classes of NP-hard and NP-complete.	
c.	Discuss Zero-One principle in flow networks.	
d.	Illustrate Greatest Common Divisor algorithm using suitable example.	

Q.3A	Consider the following recursion algorithm Min1(A[0 -----n-1]) If n=1 return A[0] Else temp = Min1(A[0...↓...n-2]) If temp <= A[n-1] return temp Else Return A[n-1] What does this algorithm compute? How many times is the basic operation executed?	05
Q.3B	Write an algorithm for Fibonacci numbers generation and compute the following a) How many times is the basic operation executed? b) What is the efficiency class of this algorithm?	05

Q.4A	What is the largest number of key comparisons made by binary search in searching for a key in the following array? 2,11, 25, 29, 33, 40, 57, 60, 76, 83, 87, 91, 96	05																																
Q.4B	Apply Strassen's algorithm to compute. <table><tr><td>1</td><td>2</td><td>1</td><td>1</td></tr><tr><td>0</td><td>3</td><td>2</td><td>4</td></tr><tr><td>0</td><td>1</td><td>1</td><td>1</td></tr><tr><td>5</td><td>0</td><td>1</td><td>0</td></tr></table> * <table><tr><td>2</td><td>1</td><td>0</td><td>2</td></tr><tr><td>1</td><td>2</td><td>1</td><td>1</td></tr><tr><td>0</td><td>3</td><td>2</td><td>1</td></tr><tr><td>4</td><td>0</td><td>0</td><td>4</td></tr></table>	1	2	1	1	0	3	2	4	0	1	1	1	5	0	1	0	2	1	0	2	1	2	1	1	0	3	2	1	4	0	0	4	05
1	2	1	1																															
0	3	2	4																															
0	1	1	1																															
5	0	1	0																															
2	1	0	2																															
1	2	1	1																															
0	3	2	1																															
4	0	0	4																															

- Q.5A Solve the linear programming problem geometrically
 Maximize $3x+y$
 Subject to $-x+y \leq 1$
 $2x+y \leq 4$
 $x \geq 0, y \geq 0$ 05
- Q.5B Describe activity selection problem under greedy approach using suitable example. 05

- Q.6A Write and explain the control abstraction for Divide and conquer. Suggest refinements to merge sort to make it in-place. 05

- Q.6B Describe the concept of inversion counting using suitable example. 05

OR

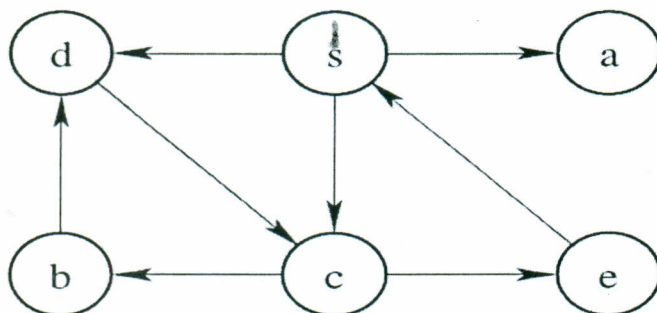
- Q.6B Apply the bottom up dynamic programming algorithm to the following instance of Knapsack Problem 05

Item	Weight	Value
1	7	\$42
2	3	\$12
3	4	\$40
4	5	\$25

Capacity $W=10$

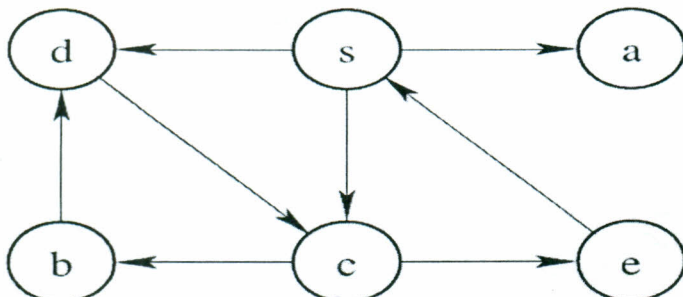
- Q.7A Differentiate time and space complexity. Describe different notations used to represent these complexities. 05

- Q.7B Perform Depth First Search on the following graph, begin at vertex s. 05



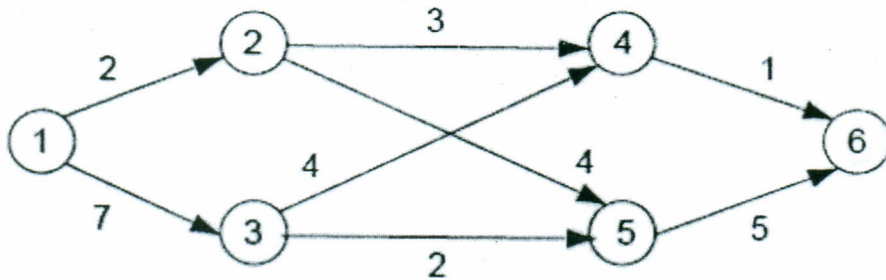
OR

- Q.7B Perform Breadth First Search on the following graph, begin at vertex s. 05

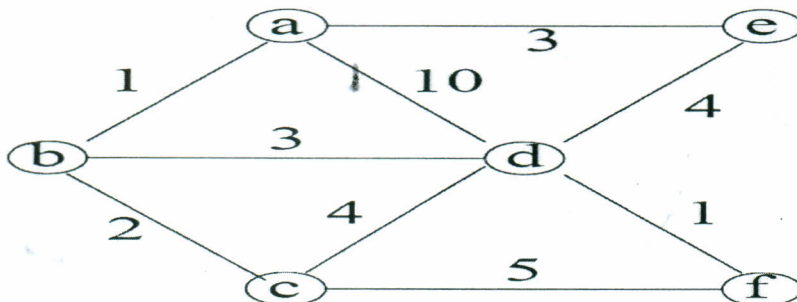


- Q.8 State whether the following statements valid or invalid. Justify the answer. 10
- (a) If e is a minimum weight edge in a connected weighted graph, it must be among edges of at least one minimum spanning tree of the graph.
 - (b) If e is a minimum weight edge in a connected weighted graph, it must be among edges of each minimum spanning tree of the graph.
 - (c) If edge weights of a connected weighted graph are all distinct, the graph must have exactly one minimum spanning tree.
 - (d) If edge weights of a connected weighted graph are not all distinct, the graph must have more than one minimum spanning tree.

- Q.9A Apply the shortest augmenting path algorithm to find a maximum flow and minimum cut in the following network. 10



- Q.9B Use Kruskal's algorithm to find a minimum spanning tree in the following weighted graph. 10



OR

- Q.9B Use Prim's algorithm to find a minimum spanning tree in the following weighted graph. 10

