	Utech
<i>Name</i> :	A
Roll No. :	To Spanning (N'S) sensings 2nd Explored
Inviailator's Signature :	

# 2011 DESIGN AND ANALYSIS OF ALGORITHMS

Time Allotted: 3 Hours Full Marks: 70

The figures in the margin indicate full marks.

Candidates are required to give their answers in their own words as far as practicable.

# GROUP - A ( Multiple Choice Type Questions )

- 1. Choose the correct alternatives for the following:  $10 \times 1 = 10$ 
  - i) The running time of an algorithm T(n), where 'n' is the input size is given by T(n) = 8 T(n/2) + qn, if n > 1 and T(n) = p, if n = 1, where p and q are constants. The order of this algorithms is
    - a)  $\Theta(n^2)$

- b)  $\Theta(n^n)$
- c)  $\Theta(n^3)$
- d)  $\Theta(n^{\log n})$ .
- ii) Which of the following algorithms solves the All-Pair Shortest Path problem?
  - a) Dijkstra's
- b) Floyd's Warshall's

c) Prim's

d) Kruskal's.

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iii) The minimum number of colors needed to color a graph having n > 3 vertices and 2 edges is

a) 2

b) 3

c) 4

- d) 1.
- iv) The diagonal of the adjacency matrix of a graph with a self-loop contains only
  - a) 1

b) 0

c) -1

- d)  $\infty$ .
- v) Which of the following design techniques is used in the quick-sort algorithm?
  - a) Dynamic programming b) Back tracking
  - c) Greedy method
- d) Divide and conquer.
- vi) The average number of comparisons performed by merge sort algorithm in merging '2' sorted lists of length '2' is
  - a) 8/5

b) 11/7

c) 11/6

d) 8/3.

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- vii) Which of the following is useful in traversing a given graph using BFS?
  - a) Stack

Linked list b)

c) Array

- d) Queue.
- viii) Which of the following can not be performed recursively?
  - a) Binary search
- b) Quick sort

DFS c)

- None of these. d)
- The time-complexity of TSP is ix)
  - a)  $O\left(n^2 \ 2^n\right)$  b)  $\Theta\left(n^2 \ 2^n\right)$
  - c)  $\Omega\left(n^2 \ 2^n\right)$
- d) none of these.
- In which sorting technique, is an element placed in its x) proper position at each step?
  - Bubble sort a)
- b) Quick sort
- Merge sort c)
- Heap sort. d)

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#### **GROUP - B**

### (Short Answer Type Questions)

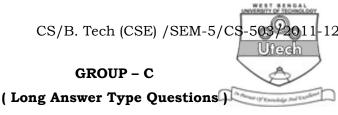
Write short notes on any three of the following.

$$3 \times 5 = 15$$

- 2. Find the best and worst case time complexity for merge sort.
- 3. Solve the following Knapsack problem with the given conditions: n=3 weight of the Knapsack M=20, Profits  $(p_1,\,p_2,\,p_3)=(25,\,24,\,15)$  and weight  $(w_1,\,w_2,\,w_3)=(18,\,15,\,10)$ .
- 4. Differentiate between divide-and-conquer and dynamic programming.
- 5. Solve the following recurrence relation using generating function:  $a_n=6\,a_{\,n-1}-11\,a_{n-2}\,+6\,a_{n-3}\ \, {\rm for}\,\,\,n>=3\,\,{\rm with\,\,initial\,\,condition}$
- 6. Define different asymptotic notation ( O,  $\Theta$ ,  $\Omega$  ) with suitable examples.

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 $a_0 = 1, a_1 = -1$  and  $a_2 = 1$ .

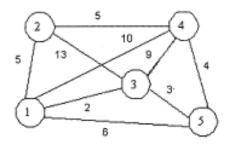


Answer any *three* of the following.  $3 \times 15 = 45$ 

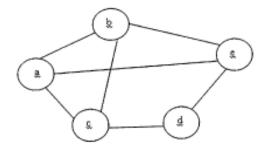
- 7. Answer the following questions with respect to divide-and-conquer:
  - a) Discuss the procedure for Strassen's matrix multiplication to evaluate the product of 'n' matrices. Find the resulting recurrence relation for the same and time-complexity. Is this method an analyze its improvement over the conventional multiplication method? If so, why? 7 + 1 + 2 + 2
  - b) The solution of recursive MAXMIN problem is based on some assumptions Briefly state the assumptions and its effect on the algorithm in comparison the reality.
- 8. Find the optimal parenthesization of a matrix-chain product whose sequence of dimensions is < 5, 10, 3, 12, 5, 50, and
  - 6 >. 5
  - a) Give an algorithm for the above procedure. 3
  - b) Analyze its complexity. 2
  - c) What is the union-find algorithm? Explain with an example.

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9. a) Solve the single source shortest path problem for the following graph considering '1' as the source vertex using Dijkstra's algorithm.



- b) Prove that the time complexity of Dijkstra's algorithm is O (  $n^2$  ).
- c) Describe the Floyd's algorithm for all pair shortest path problem. Prove that the time complexity of the algorithm is cubic.
   5 + 3 + 7
- 10. a) Describe the Breadth first search algorithm of a given graph and explain its time complexity.
  - b) Explain the graph coloring problem and write the algorithm.
  - c) Apply backtracking technique to solve the 3-colouring problem for the following graph



6 + 6 + 3

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- 11. a) What is Non-deterministic algorithm? Differentiate between Deterministic and Non-Deterministic algorithm.
  - b) Write algorithm to sort an; array using Deterministic and Non-Deterministic technique. Compare the two techniques and show that the time complexity of non-deterministic technique is better than Deterministic.
  - c) Describe P class, NP class, NP hard and NP complete class and describe their relationships. 3 + (6 + 2) + 4

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