(Please write your Exam Roll No.) Exam Roll No. .....

END TERM EXAMINATION

SIXTH SEMESTER [B.TECH] MAY - JUNE 2019

Paper Code: IT-306 **Subject: Algorithm Analysis and Design**

Time: 3 Hours **Maximum Marks: 75**

Note: Attempt five questions in all including Q no.1 which is compulsory. Select one question from each unit.

Q1 (a) Suppose we need to sort a list of employee-records in ascending order, using the social security number (a 9-digit number) as the key (i.e., sort the records by social security number). If we need to guarantee that the running time will be no worse than n log (n), which sorting methods could we use? Why? **(5)**

(i) Merge sort
(ii) Quicksort
(iii) Insertion sort
(iv) None of these sorting algorithms guarantee a worst-case performance of n log n or better.

(b) Define a spanning tree of a graph. Does every graph have a spanning tree? **(5)**

(c) Define matroids and discuss its relationship with greedy strategy. **(5)**

(d) Explain time complexity of Strassen matrix multiplication algorithm. **(5)**

(e) Give one example of sorting method having $o(n^2)$ complexity, o(n logn) complexity and o(n) complexity. **(5)**

UNIT-I

Q2 Let's say there are 5 people A, B, C, D and E. A is B's friend, B is C's friend, and D is E's friend therefore, the following is true:

(a) A, B and C are connected to each other **(6)**

(b) D and E are connected to each other **(6.5)**

With the help of union-find disjoint set, check each friend is connected to the other directly or indirectly. Also determine the two different disconnected subsets in the above set-up using Union and Find.

Q3 (a) Write the counting sort algorithm in pseudo code. Determine the time complexity of it. **(6)**

(b) Consider the modified binary search algorithm; it splits the input not into two sets of almost-equal sizes, but into three sets of sizes approximately one-third. Write down the recurrence for this ternary search algorithm and the asymptotic complexity of this algorithm. **(6.5)**

UNIT-II

Q4 (a) Upon which algorithmic approach determination of Huffman code is based? What do you understand by prefix code? Is Huffman code a prefix code? Justify your answer. **(6)**

(b) Find an optical Huffman code for the following set of frequencies:
a:50 b:25 c:15 d:40 e:75
Determine the code for abbabbced. **(6.5)**

Q5 (a) State shortest path problem and write Dijkstra algorithm to find a shortest path from node 1 to all others. **(6)**

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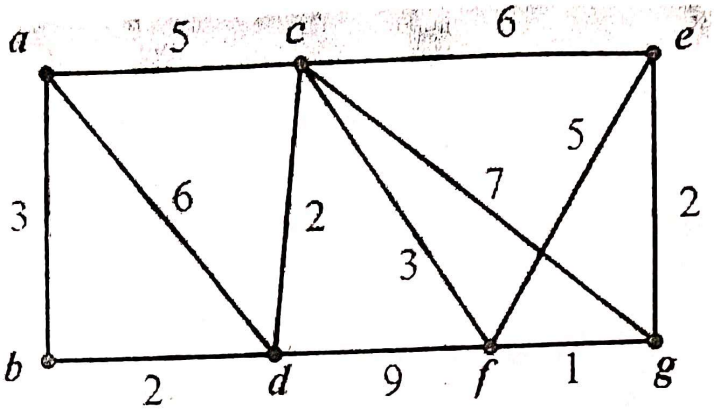
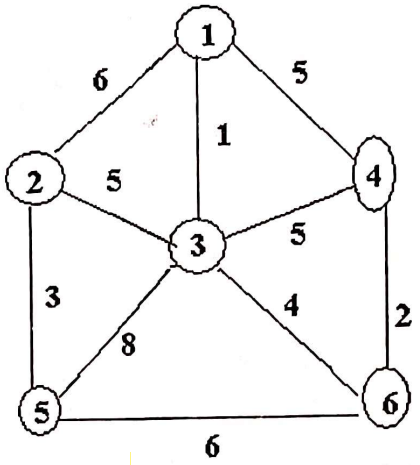
(b) Using Dijkstra Algorithm find the shortest path in the following graph. Make assumptions if required regarding the source node. **(6.5)**



UNIT-III

Q6 (a) Differentiate between Spanning tree and minimum spanning tree (MST). **(6)**

(b) Apply Prim's algorithm to find MST for the following graph. **(6.5)**



Q7 (a) Explain why Bellman algorithm can determine the presence of any negative cycle reachable from source node. **(6)**

(b) What is topological sort? What are the applications of this sort? Write an algorithm for it. **(6.5)**

UNIT-IV

Q8 (a) What is a non deterministic algorithm? Give an example. How the time complexity of such algorithms are determined. Discuss the relationship among the classes P, NP, NP complete, NP hard problems. **(6)**

(b) Give five example of NP complete problems. Also explain reducibility. **(6.5)**

Q9 (a) State Robin Karp string matching algorithm. Find its complexity. **(6)**

(b) Suppose, t=2359023141526739921 and p=314, perform the string matching using Robin Karp algorithm. **(6.5)**

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