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

END TERM EXAMINATION

FIFTH SEMESTER [B.TECH] NOVEMBER-DECEMBER 2018

Paper Code: ETCS-301 **Subject: Algorithm Design and Analysis**

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

Note: Attempt all questions as directed. Internal choice is indicated.

Q1 (a) Define Big O, Small O and Small w notation with examples? **(2.5)**
(b) Define iteration method with example? **(2.5)**
(c) Explain hashing and elaborate its advantages over linear and binary search? **(2.5)**
(d) What do you mean by optimality and correctness of algorithm? **(2.5)**
(e) Compare knapsack problem in Greedy, Dynamic and any other approach (backtracking) and give the different perspectives? **(2.5)**
(f) Explain polynomial time verification problems with an example? **(2.5)**
(g) Compare MCM problem with memorization and recursive MCM? **(2.5)**
(h) Define binomial Coefficient? **(2.5)**
(i) Define NP hard and NP complete with example? **(2.5)**
(j) Which string matching algorithm is better and when? **(2.5)**

Q2 (a) Let N is number of guests attending party. If each of guests shakes hand with everyone else only once. How many handshakes will take place? Write recursive definition and algorithm? **(4)**
(b) Quick sort is not a stable sorting algorithm. If key in a[i] is changed to a[i]*n+i-1, then new keys are all distinct. After sorting which transformation will restore the keys to their original values? **(4.5)**
(c) Sort the following numbers using Merge sort? The set is (50,10,20,30,15,70,35,55) **(4)**

OR

Q3 (a) Let S be a sample of s elements from X. If X is partitioned into s+1 parts as in algorithm Rsort given below. Then show that size of each part is Big-O(n/s log n)

Algorithm Rsort(a,n)
{randomly sample s elements from a[];
Sort this sample;
Partition input using sorted samples as partition key;
Sort each part separately;} **(6.5)**

(b) Solve recurrence **(3)**
$T(n) = 1 \quad n<=4$
$T(n) = T(n^{1/2})+c \quad n>4$

(c) Prove by induction **(3)**
$\sum i=0...n \; xi=(x^{n+1}-1)/x-1 \quad x<>1 \text{ for } x>=0$

Q4 (a) Find optimal binary Merge pattern for 10 files whose lengths are given in the set S, (28,32,12,5,8,4,53,91,35,3,11). Show that if all internal nodes in a tree have degree k, then number n of external nodes is such that n mod(k-1)=1. Draw optimal 3 way merge tree obtained using rule area when (q1..q11)=(3,7,8,9,15,16,18,20,23,25,28). **(7.5)**
(b) The jobs are scheduled on 3 processors. The task times are given by matrix J as follows J=[2 0 ; 3 3 ; 5 2]. Draw two possible schedules. **(5)**

OR

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Q5 (a) Show that knapsack optimization problem reduces to knapsack decision problem when all the P's, W's and m are integers and complexity is measured as a function of input length. If input length is q, then $\sum pi <= n^2$, where n is no. of objects. **(4)**

(b) Show job sequencing with deadlines problem is NP-hard? **(4)**

(c) How we count the number of parenthesis in MCM Problem. Use substitution method to show solution to recurrence is (2^n). Assume symbol as omega. **(4.5)**

Q6 (a) Give $O(n^2)$ time algorithm to find longest monotonically increasing subsequence for n numbers? **(4)**

(b) How task scheduling problem is solved using matroids. If S is set of unit time tasks with deadlines and I is set of all independent tasks then prove that corresponding system (S,I) is matroid. **(5)**

(c) Explain Floyd Warshall algorithm and explain its time complexity. **(3.5)**

OR

Q7 (a) Professor George proposes new divide and conquer algorithm for computing Minimum Spanning tree(MST). If graph is partitioned into 2 sets V1 and V2. Let E1 and E2 are set of edges that are incident only on vertices in V1 and V2. Recursively solve MST problem on each of two sub-graphs G1(V1,E1) and G2(V2,E2). Finally select minimum weight edge in E that crosses cut(V1,V2) and use this edge to unite the resulting two minimum spanning trees into a single spanning tree. Sets V1 and V2 differ by maximum 1. **(7)**

(b) How would you extend Robin karp Method to problem of searching a text string for an occurrence of anyone of given set of k patterns. Assume all k patterns have some length Generalize your solution for different pattern strings. **(5.5)**

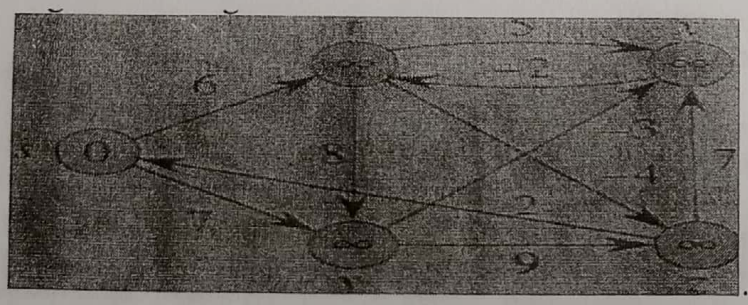
Q8 (a) Illustrate String matching with Finite automata? **(4.5)**

(b) Give pseudo code to reconstruct LCS from completed c table and original sequences $X=(x1,x2,x_n)$ and $Y=[y1,y2,\ldots,y_n)$ without using b table in $O(m+n)$ time. Give its memorized version. **(8)**

OR

Q9 (a) Let G be a connected undirected graph with n vertices. Show G must have at least n-1 Edges and that all connected and undirected graphs with n-1 edges are trees. What is minimum no. of edges in a strongly connected digraph with n vertices? What from do such digraphs have? **(6)**

(b) Give properties of shortest path and relaxation. Run bellman ford algorithm on directed Graph. In each pass, relax edges in the same order as in figure. Using vertex z as source, show d and pi values after each pass. now change the weight of edge(z,x) to 4 and run algorithm using s as source. **(6.5)**



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END TERM EXAMINATION

FIFTH SEMESTER [B.TECH] DECEMBER 2017

Paper Code: ETCS 301 **Subject: Algorithm Design & Analysis**

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

Note: Attempt all questions as directed. Internal choice is indicated.

Q1. a) Define asymptotic notations? **(2.5x10=25)**
b) What is substitution method?
c) Explain Hashing and elaborate its advantages over linear and binary search.
d) Differentiate between Dynamic programming and Divide and conquer approach.
e) Explain the concept of overlapping subproblems.
f) What are the advantages of optimal binary search tree over binary search tree?
g) Explain 0-1 Knapsack problem.
h) What are the elements of Greedy strategy?
i) Define matroid with an example.
j) Explain P and NP briefly.

Q2. a) Explain Quick sort and compute the analysis of quick sort perform quick sort on following data.
14,15,25,28,30,32,35,40.
What is the problem with quick sort, if the data is already sorted? Discuss. **(6)**

b) Sort the following numbers using Merge sort. **(6.5)**
13, 19, 9, 5, 12, 8, 21, 11, 56, 19

OR

Q3. a) Explain data structures for Disjoint set, its operations and its applications. **(4)**

b) Solve the following recurrence relation **(8.5)**
i) $T(n)= 4T(n/2)+n^2$ (Using recursion-tree)
ii) $T(n)= 5T(n/4) + \theta(n^3)$ (Using master theorem)

Q4. a) What are the basic steps of Dynamic programming? **(4)**

b) Find an optimal parenthesization of a matrix chain product whose sequence of dimension is <2,4,6,8,12,10> **(8.5)**

OR

Q5. a) Compute binomial coefficient using Dynamic programming. **(6)**

b) Explain the Floyd warshal algorithm and discuss its complexity. **(6.5)**

Q6. a) Explain the difference between Dijkstra's and Bellman Ford algorithm with the help of example. **(6)**

b) Find the optimal schedule for the following jobs with profit (p_1, p_2, p_3, p_4, p_5, p_6)= (3, 5, 17, 20, 6, 10) and deadlines (d_1, d_2, d_3, d_4, d_5, d_6)= (1, 3, 3, 4, 1, 2) **(6.5)**

OR

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Q7. a) Explain Prim's algorithm for finding the minimum spanning tree and analyze its complexity. **(6.5)**

b) Consider six items along their respective weights and values: **(6)**
w= (5, 10, 20, 30, 40, 15) v= (30, 20, 120, 90, 180, 120).

The capacity of Knapsack is 60. Find the solution to fractional Knapsack problem.

Q8. a) Differentiate between P and NP problems. Explain Polynomial time verification with an example. How it is different from polynomial time solutions. **(5)**

b) Illustrate string matching with Finite Automation. **(7.5)**

OR

Q9. a) Explain NP hard and NP complete problems with the help of suitable example. **(5)**

b) Explain KNUTH-MORRIS-PRATT string matching algorithm. **(7.5)**

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END TERM EXAMINATION

FIFTH SEMESTER [B.TECH.] DECEMBER 2016

Paper Code: ETCS-301 **Subject: Algorithm Design and Analysis**

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

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

Q1 (a) Define little Omega and little Oh notation. **(2.5)**
(b) What is recursion tree method? **(2.5)**
(c) Write a short note on Memorization. **(2.5)**
(d) What is optimal substructure and overlapping substructure? **(2.5)**
(e) What are the applications of minimum spanning tree? **(2.5)**
(f) Explain fractional knapsack problem. **(2.5)**
(g) Differentiate between Dynamic Programming and Greedy Approach. **(2.5)**
(h) What is Matroid? **(2.5)**
(i) Write Naïve String Matching Algorithm. **(2.5)**
(j) Explain NP Hard Problem briefly. **(2.5)**

UNIT-I

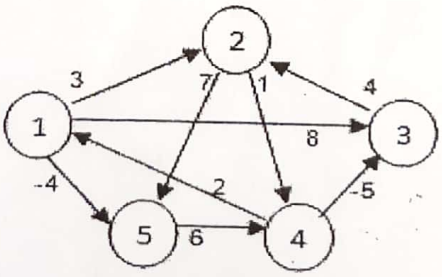
Q2 (a) Explain Merge Sort and compute the analysis of merge sort. **(6)**
(b) Perform the Quick Sort to sort the following numbers. **(6.5)**
20, 40, 50, 15, 10, 05, 80, 90

Q3 (a) Explain Strassen's algorithm for matrix multiplication. **(6)**
(b) Apply Strassen's matrix multiplication algorithm to multiply the following matrices. **(6.5)**

$$\begin{bmatrix} 1 & 3 \\ 5 & 7 \end{bmatrix} \quad \begin{bmatrix} 8 & 4 \\ 6 & 2 \end{bmatrix}$$

UNIT-II

Q4 (a) Explain Floyd-Warshall algorithm. **(6)**
(b) Apply Floyd-Warshall algorithm for constructing shortest path. **(6.5)**



Q5 (a) What does Dynamic programming have common with Divide and Conquer and what are differences? **(6)**
(b) Determine the LCS of <A,B,C,B,D,A,B> and <B,D,C,A,B,A>. **(6.5)**

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UNIT-III

Q6 (a) Explain the difference between Kruskal's and Prim's Algorithm with the help of suitable example. **(6)**

(b) What is an Optimal Huffman Code for the following set of frequencies? a:1 b:1 c:2 d:3 e:5 f:8 g:13 h:21 **(6.5)**

Q7 Illustrate Dijkstra's and Bellman Ford Algorithm for finding the shortest path. **(12.5)**

UNIT-IV

Q8 (a) Give Knuth Morris Pratt algorithm for pattern matching? **(6.5)**
(b) Explain NP-completeness reduction with an example. **(6)**

Q9 (a) Explain Rabin- Karp string matching algorithm. **(6)**
(b) What is Finite Automata and its significance to match a string with algorithm and complexity. **(6.5)**

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END TERM EXAMINATION

FIFTH SEMESTER [B.TECH] DECEMBER 2015-JANUARY 2016

Paper Code: ETCS-301 **Subject: Algorithm Design & Analysis**

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

Note: Attempt any five questions including Q.no.1 which is compulsory.

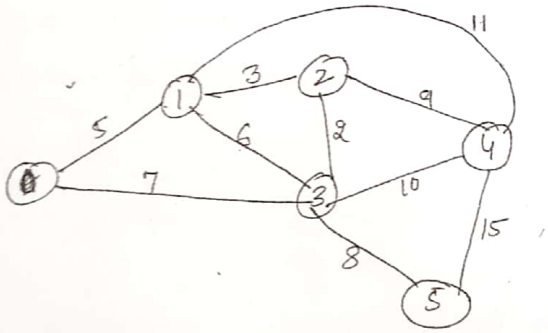
Q1 (5x5=25)
(a) Define θ, π, 0 notations and explain.
(b) Prove $3n^2 + 2n^2 = 0\ (n^2); 3^n \neq 0\ (2^n)$.
(c) Write an algorithm for merge sort. Find its worst case, best case and average case complexity.
(d) Explain 0-1 Knapsack problem and discuss its solution.
(e) Differentiate between the functioning of Dijkristra and Bellman ford algorithm.

Q2 (a) What are recurrence relations? Solve following using recurrence relation. (6.25)
$x(n) = x(n-1)$ for $n > 0$ and $x(0) = 0$.
(b) State and prove master theorem. Solve any example using master method. (6.25)

Q3 (a) Explain Strassen's algorithm and explain. (6.25)
(b) Compute following using strassen's algorithm. (6.25)

$$\begin{bmatrix} 1 & 2 & 1 \\ 0 & 3 & 2 \\ 0 & 5 & 4 \end{bmatrix} \times \begin{bmatrix} 2 & 4 & 3 \\ 4 & 8 & 9 \\ 3 & 8 & 9 \end{bmatrix}$$

Q4 (a) Explain any one algorithm for generating spanning tree with minimum cost. Write code/algorithm neatly. (6.25)
(b) Using same algorithm, find minimum spanning tree for the following: (6.25)



Q5 (a) What is Dynamic Programming Paradigm? Explain its characteristics. (6.25)
(b) Solve any problem using dynamic programming paradigm. In the example clearly show how it meet the dynamic paradigm criterion. (6.25)

Q6 (a) Write the Huffman's Algorithm. Explain. Discuss its applications. (6.25)
(b) Generate Huffman's tree for the following data and obtain Huffman code for each character. (6.25)

Character	A	B	C	D	E	-
Probability	0.5	0.35	0.5	0.1	0.4	0.2

Q7 (a) Define P, NP and NPC problems. (6.25)
(b) Give atleast 3 examples of NP complete problems. (6.25)

Q8 Write short note on following: (6.25 x 2=12.5)
(a) Khuth-Moris Pratt algorithm.
(b) OBST problem.

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