5056

B.Tech. Examination, 2017

(Fifth Semester)

(C.S. & I.T. Branch)

DESIGN AND ANALYSIS OF ALGORITHMS

Paper - IV

Time Allowed : Three Hours

Maximum Marks : 100

Note : Attempt any five questions. All questions carry equal marks.

Q. 1. (a) State Master theorem for solving recurrence equations. Use the matrix method to give tight asymptotic bonds for the following recurrences :

(i) $T(n) = 4\ T\ (n/2) + n$

(ii) $T(n) = 4\ T\ (n/2) + n^2$

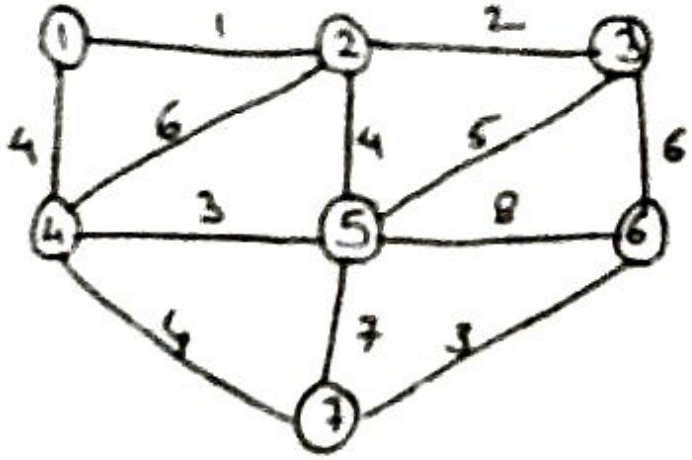
(iii) $T(n) = 4\ T\ (n/2) + n^3$

(b) Explain substitution method with example.

Q. 2. (a) Explain the MAX-HEAPIFY and the HEAPSORT algorithm with suitable example.

(b) Define NP hard problem with example.

Q. 3. (a) Consider the graph G = (V, E) given below :



Find the minimum spanning tree by Kruskal's algorithm.

(b) Write the Bellman's-ford algorithm for finding the shortest path algorithm.

Q. 4. (a) What do you mean by optimal solution ?

Compute the optimal solution for the following instances of Knapsack problem

Number of objects = 3

Knapsack capacity = 20

Profits of weights are

(p_1, p_2, p_3) = (25, 24, 15) and (w_1, w_2, w_3) = (18, 15, 10)

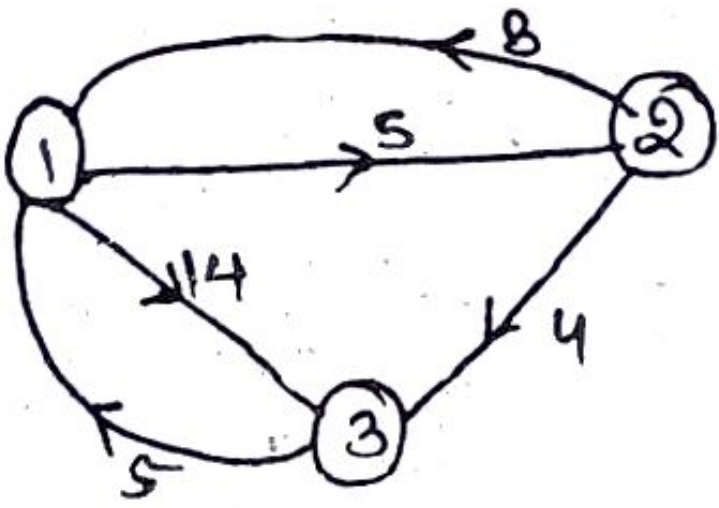
(b) Briefly discuss the algorithm analysis framework. How it is different from design framework ?

Q. 5. (a) Sort the elements 19, 41, 11, 6, 14, 34, 7 using the Quick sort technique. Show each step clearly. Write its complexity in worst case.

(b) A person wants to determine the cost of travelling from his native place to all the districts of his state. Describe and write the algorithm to fulfill his aim with the help of suitable example. The cost should be minimum for each city.

Q. 6. (a) Discuss the relationship between the class P, NP, NP-complete and NP-hard problems.

(b) Find ali pair shortest path using Warshall's algorithm for the following graph :



Q. 7. (a) Analyse the insertion sort algorithm. Argue on its best case, average case and worst case time complexity.

(b) What are the asymptotic notations used for analysis and design algorithm ? Explain with examples.

Q. 8. Write short notes on any two of the following :

(a) Hamiltonian path problem

(b) Vertex cover

(c) Non-deterministic algorithm

(d) Clique problem

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DESIGN AND ANALYSIS OF ALGORITHMS

Paper - IV

Time Allowed : Three Hours

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Note : Attempt any five questions. All questions carry equal marks.

Q. 1. (a) Discuss the sequence of steps typically required in designing and analyzing an algorithm.

(b) Prove that for any two functions f(n) and g(n), we have

$f(n) = \theta(g(n))$ if and only if

$f(n) = O(g(n))$ and $f(n) = \Omega(g(n))$

Q. 2. (a) Show the various steps involved in the quick sorting of (1, 3, 4, –5, 9, 2, 6, 5, 3).

(b) Show the red-black tree that results after each of the integer keys 21, 32, 64, 75 and 15 are inserted. Show the tree after each insertion and rotation if performed.

Q. 3. (a) Write an algorithm for divide and conquer algorithm for merging two sorted array.

(b) Solve the following instance of the knapsack problem by branch and bound algorithm, with

$w = 16$

Item	Weight	Value
1	10	100
2	7	63
3	8	56
4	4	12

Q. 4. (a) For the following graph having four nodes given by the matrix below, determine the all pairs source shortest path

0	∞	3	∞
2	0	∞	∞
∞	7	0	1
6	∞	∞	4

(b) Explain how to solve travelling salesman problem by the method of dynamic programming and analyse complexity.

Q. 5. (a) Write the container loading greedy algorithm and explain. Prove that this algorithm in optimal.

(b) Explain the backtracking method to solve the following :

(i) Hamiltonian circuit problem

(ii) Subset-sum problem

Q. 6. (a) Discuss the approximation algorithms for NP-hard problem.

(b) Discuss the cliques decision problem.

Q. 7. Write short notes on :

(a) Fast Fourier transform

(b) Shell sort

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B.Tech. Examination, 2015

(Fifth Semester)

(C.S. & I.T. Branch)

DESIGN AND ANALYSIS OF ALGORITHMS

Paper – IV

Time Allowed : Three Hours

Maximum Marks : 100

Note : Attempt any FIVE questions. All questions carry equal marks.

Q. 1. (a) Is the function [lg n] ! polynomially bounded ?

Is the function [lg lg n]! polynomially bounded ? **10**

(b) (i) Can the master method be applied to solve recurrence

$T(n) = 4T(n/2) + n^2 \log n$?

Why or why not ? 5

(ii) Solve the recurrence

$T(n) = 4T(n/2) + n^2$

using master method. 5

Q. 2. (a) Illustrate the operation of COUNTING SORT on the array : 10

$A = <6,12,3,20,1,8,16,2,3,6>$

(b) What is the largest possible number of internal nodes in a red black tree with black

height K ? What is the smallest possible number ? 10

Q. 3. (a) Find an optimal parenthesization of a matrix-chain product whose sequence of dimensions is : 10

<5, 10, 3, 12, 5, 50, 6, >

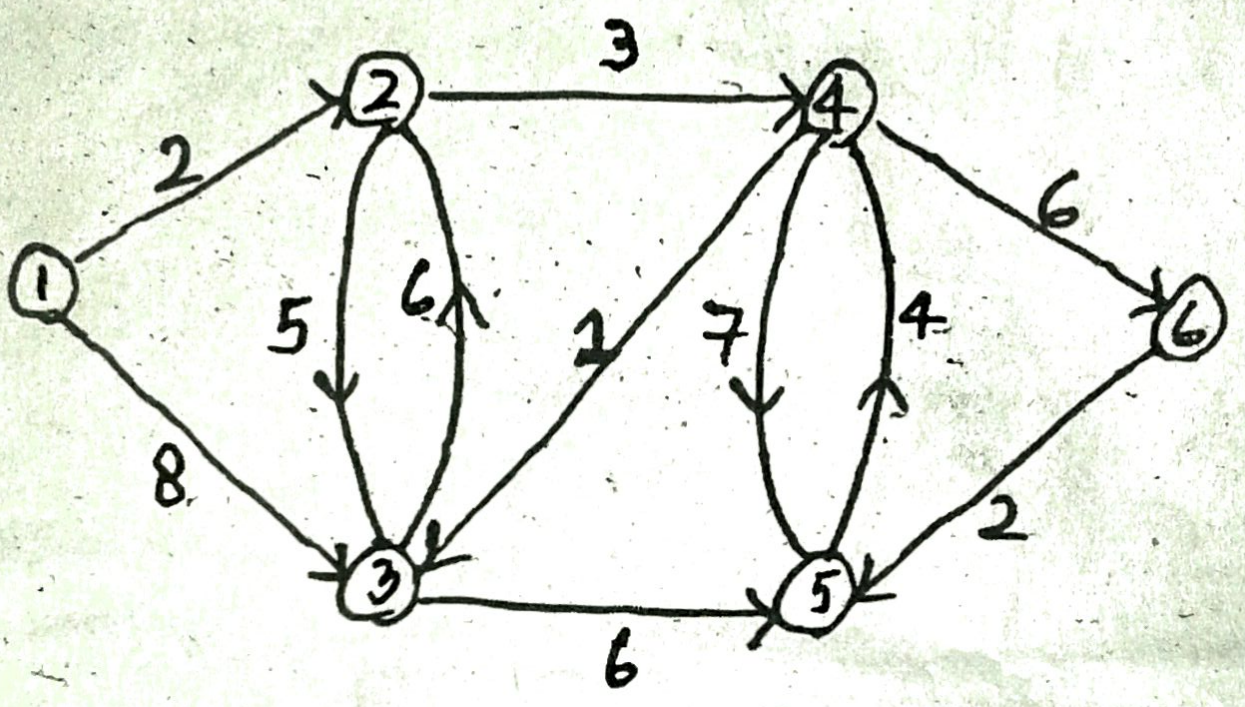
(b) Find an optimal solution for the knapsack instances : 10

n = 7, M = 15,

$(P_1, P_2, P_3, P_4, P_5, P_6, P_7) = (10, 5, 15, 7, 6, 18, 3)$ and $(W_1, W_2, W_3, W_4, W_5, W_6, W_7) =$

(2, 3, 5, 7, 1, 4, 1)

Q. 4. (a) Solve the shortest path problems using Dijkstra's algorithm. 10



(b) Explain Bellman-Ford algorithm in detail. 10

Q. 5. (a) Design a back tracking algorithm for the Hamiltonian cycle problem. 10

(b) Solve travelling sales person problem by using Branch and Bound technique. 10

Q. 6. (a) Show the conparisons the naive string matcher makes for the pattern : 10

P = 10001 in the text

T = 0000100010010

(b) Prove that : If any NP-complete problem is polynomial time solvable, then P = NP. If any problem in NP is not polynomial time solvable, then all NP complete problems are not polynomial time solvable. 10

Q. 7. Write short notes on the following : 5×4=20

(a) Kruskal's algorithm

(b) Graph coloring

(c) B-trees

(d) Merge sort

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B.Tech. Examination, 2014

(Fifth Semester)

(C.S. & I.T. Branch)

DESIGN AND ANALYSIS OF ALGORITHMS

Paper - IV

Time Allowed : Three Hours

Maximum Marks : 100

Note : Attempt any **five** questions. All questions carry equal marks.

Q. 1. (a) (i) Solve the recurrence relation using Master Theorem. 4 9

$$T(n) = 3\,T(n^{1/3}) + \log 3^n$$

(ii) Solve the recurrence relation using iteration :

$$T(n) = T(n-1) + n^4$$

(b) (i) Solve the recurrence relation :

$$T(n) = T(n/3) + T(2n/3) + O(n)$$

(ii) Apply Quick sort to sort the list :

E, X, A, M, P, L, E

Q. 2. (a) Explain RB-tree with RB-insert algorithm and its properties.

(b) (i) Show the result of inserting the keys in B-Tree, where degree t = 4 : F, S, Q, K, C, L, H, T, V, W, M, R, N, P, A, B, X, Y, D, Z, E in order, in an empty B-tree.

(ii) Explain Bionomial Heap and its cases for UNION of two bionomial.

Q. 3. (a) Consider 5 items along their respective weights and values :

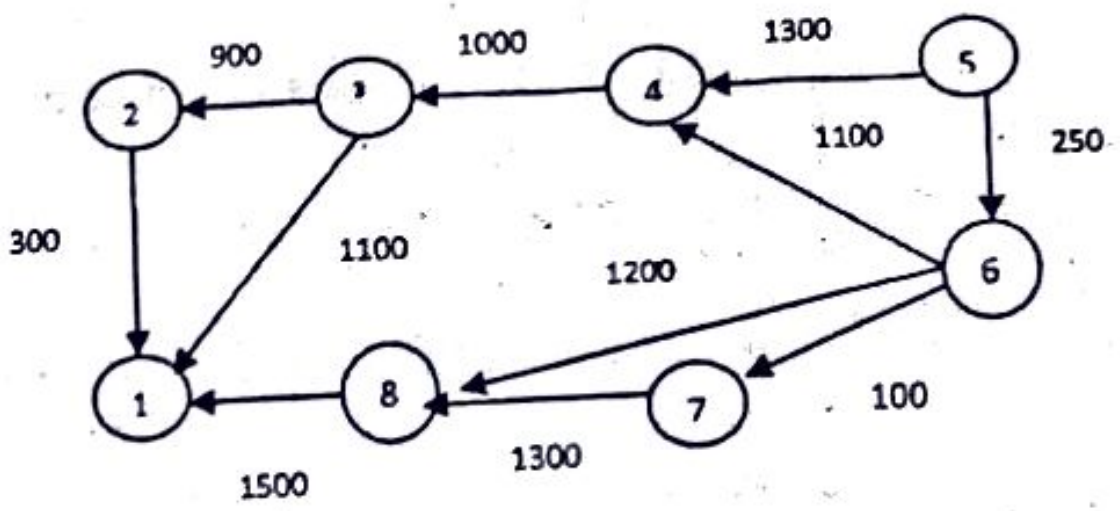
$I = (I_1, I_2, I_3, I_4, I_5)$

$W = (5, 10, 20, 30, 40)$

$V = (30, 20, 100, 90, 160)$

The capacity of Knapsack W = 60. Find the solution to the fractional knapsack problem.

(b) Write dijkstra's algorithm for single source shortest path. Apply it on following graph with source node as 5. Also comment on whether shortest path algorithm work correctly if weights are negative.



Q. 4. (a) Given two sequences X = {1, 0, 0, 1, 0, 1, 0, 1} and Y = (0, 1, 0, 1, 1, 0, 1, 1, 0}. Find the longest common subsequence (LCS) of X and Y using Dynamic programming. Also write the longest common subsequence.

(b) Given 10 activities along with their start and finish time as :

S = (A1, A2, A3, A4, A5, A6, A7, A8, A9, A10)

S_i = (1, 2, 3, 4, 5, 6, 7, 8, 9, 10)

f_i = (4, 2, 3, 5, 6, 7, 10, 11, 12)

Compute a schedule where the largest number of activities takes place.

Q. 5. (a) Find all solutions of a QUEEN, problems in which you have 'n' Queen as a n x n chess board. Consider that they are non attacking each other. Take an example of 4-QUEENs. You have to set non-attacking position on 4 × 4 Chess Board using Back tracking method.

(b) Prove that if the weights of the edge of the connected undirected graph are distinct then there is an unique minimum spanning tree. Give an example in this regard. Also discuss Kruskal's minimum spanning tree in details.

Q. 6. (a) Write a Rabin-Karp algorithm. For string matching working modulo q = 11, how many spurious bits does the Rabin-Karp matcher encounter in the Text T = 3141592653598793 when looking for pattern P = 26 ?

(b) Find the shortest tour of TSP for the following instance using branch and bound

	A	B	C	D
A	∞	12	5	7
B	11	∞	13	6
C	4	9	∞	18
D	10	3	2	∞

Q. 7. – Write shorts notes on any two of the following :

(i) Fast Fourier Transform (FFT)

(il) Approximation algorithm for travelling salesman problem.

(iii) Class P, NP, NP-complete, NP-Hard and also give a relationship.

Randomized algorithm

(iv) Convex Hull