Course Code : CST 314 **CXDW/RW – 18 / 5055**

Fifth Semester B. E. (Computer Science and Engineering) Examination

DESIGN AND ANALYSIS OF ALGORITHMS

Time : 3 Hours] [Max. Marks : 60

Instructions to Candidates :—

(1) All questions carry equal marks.
(2) Solve any **Two** sub-questions from each question.
(3) Mention comments properly before writing the algorithms.

1. (a) Solve the following recurrence equation :

$T(n) = 2T(n/4) + n^{0.5} + 4$, given $T(1) = 2$ for $n>=4$ 5(CO 1)

(b) Use recurrence tree method to solve the following recurrence equation:

$T(n) = 3T(n/3) + n^2$ 5(CO 1)

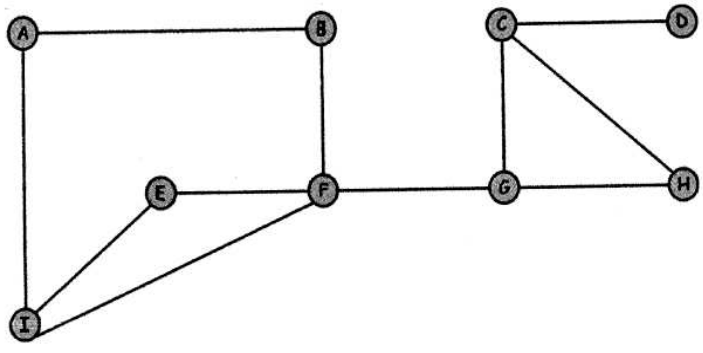
(c) Solve the following recurrence using substitution method.

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

Comment on why some of the recurrences equations cannot be solved using standard approaches. 5(CO 1)

2. (a) What is amotorized complexity ? Demonstrate various methods for computing complexity, with suitable examples. 5(CO 1)

(b) Implement Breadth First Search on following graph. Find out maximum size of Queue required to implement the BFS. Write any two applications of BFS.



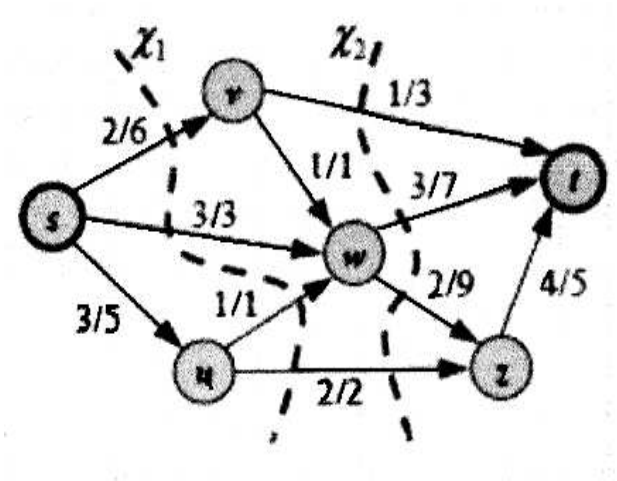
5(CO 1)

(c) Write algorithm for Insert, Delmax and Adjust methods for Heap Sort. Comment on time complexity of heap sort. How heap process can be used in Graph Algorithms, given suitable example ? 5(CO 1)

3. (a) For the following graph: Define : Flow, Capacity and residual capacity.

With respect to cut, find out forward edges, backward edges in the graph. Compute Flow and Capacity across the cut. Write any two applications of Maximum Flow Network.

Graph



5(CO 2,CO 3,CO 5)

(b) Write step wise process to find median of two sorted arrays. Implement the process on the following set of sorted arrays.

A = [10, 30, 50, 60, 90, 95]

B = [20, 40, 70, 100, 120, 140]

Comment on complexity of the process and stack size required for implementing the process. 5(CO 2,CO 3,CO 5)

(c) Write the complexity equation of quick sort. Modify Quick sort by using two elements as pivot elements. Comment on time complexity of quick sort. Demonstrate with example, indicating worst case complexity of quick sort. 5(CO 2)

4. (a) In search engine optimization, suggest suitable data structure to predict the search query automatically based on the following probability distributions.

	K0	K1	K2	K3	K4	K5
Pi		0.10	0.10	0.15	0.05	0.05
Qi	0.05	0.15	0.10	0.15	0.05	0.05

Assume K1 = Bank, K2 = Interest, K3 = Rate, K4 = High, K5 = Low Find out the "root" key to predict the best search sequence. Also write any two sequences representing queries. 5(CO 2,CO 5)

(b) Construct Longest Common Subsequence [LCS] for following two strings:

A = Exponential

B = Polynomial

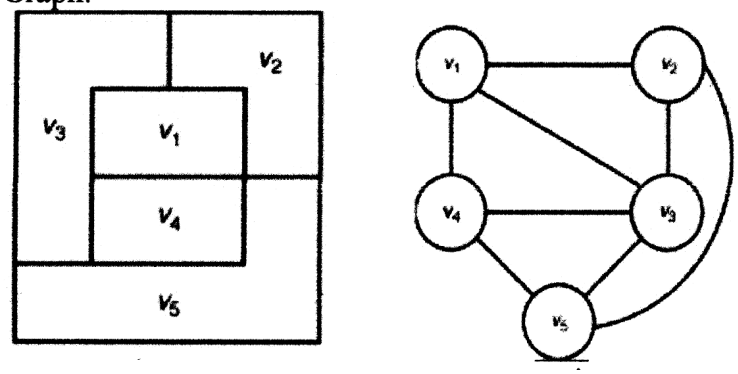
Write an algorithm and comment on the space complexity of algorithm. 5(CO 2,CO 5)

(c) The data set available related to four stocks for period of July–Oct for four different years. There are three possible values between the range –20 to +90 [Positive, Negative, Zero]. Construct suitable 4x4 matrix with distinct values and find out the range in which the sum of change is maximum. 5(CO 2,CO 5)

5. (a) Illustrate the role of Graph Coloring in computing chromatic number. Implement Graph Coloring on following graph. Write the formulation to compute maximum number of colors required for implementing graph coloring algorithm.

Comment on time complexity of algorithm

Graph:



5(CO 2,CO 3,CO 5)

(b) Assume Big Data environment. It is required to implement the search process for finding out trace of data. Which type of algorithms are suitable for the given requirement. Write about auxiliary data structures required for implementing the search space. 5(CO 2,CO 3,CO 5)

(c) Explain two types of constraints in backtracking solutions. For the process of N–Queen problem, explain the formulation of constrain equation and its usage in finding the suitable position of Queens. Write algorithm for N–Queen Solution. 5(CO 2,CO 5)

6. (a) Demonstrate polynomial reduction principle by using Clique as base algorithm and GPT and ISP as derived algorithms. Classify the algorithms into suitable NP class, with justification. 5(CO 4)

(b) What is NP Complete ? How to prove any given problem as NP Complete? Write procedure for Vertex Cover Problem and illustrate, how it can be proved as NP Complete. 5(CO 4)

(c) Define triangular inequality property. How is it useful in approximation algorithms? Use the property to design approximate solution for Travelling Salesman problem. 5(CO 4)