Course Code : CST 314 **JSRK/MW – 17 / 2054**

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 questions.
(3) Mention comments properly before writing the algorithms.

1. (a) Solve the following recurrence usign recurrence tree method.

$T(n) = 2T(n/3) + n^2$ 5(CO1)

(b) Solve the following non – homogenous recurrence.

$t(n) = 4t_{n-1} + 3^n + 5$ 5(CO1)

(c) Solve the following logarithmic recurrence.

$T(n) = T(n/2) + \log_2 n$ Where $T(1) = 3$ 5(CO1)

2. (a) Derive the complexity equation of Selection Sort. Implement the sorting process on following set :

77 , 44 , 55 , 22 , 11 , 66 , 99 , 88 , 33 5(CO1)

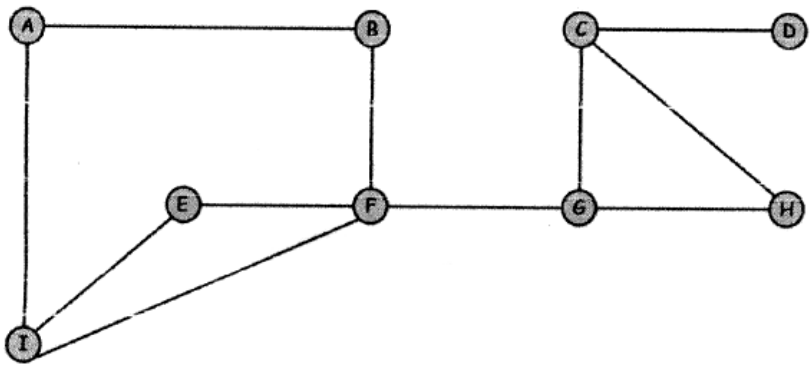
(b) Define and find upper bound, lower bound and tight bound ranges for following :—

(i) $4^n + 3$

(ii) $7^{2n} + 2n^2$

(iii) $20n^2 + 4n + 200$. 5(CO 3)

(c) Implement Beadth First Search on following graph. Find out maximum size of Queue required to implement the BFS.



5(CO 3)

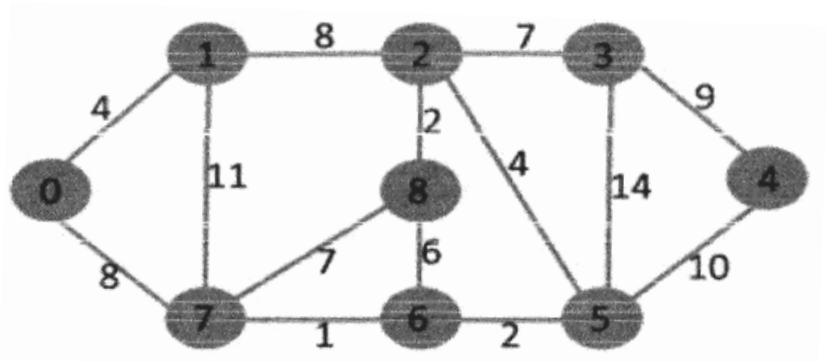
3. (a) Demonstrate the complexity analysis of Binary Search on array [1..14]. Derive various relationships. Draw the search tree for following set :—

[– 10 , 15 , 25 , 35 , 45 , 55 , 65 , 75 , 85 , 95 , 105 , 115 , 125 , 135]

5(CO2)

(b) Compute the minimum cost spanning tree using Kruskal lagorithm for the graph shown below :—

Write in brief about Find – Union function.



5(CO 2)

(c) The application involves manipulation on four different images sorted in the form of matrix. The manipulation is based on optimal multiplications of images. Suggest suitable mechanism to perform multiplication in minimum number of operations.

[10 x 14] [14 x 25] [25 x 65] [65 x 23] 5(CO2 , 5)

4. (a) A city tour is to be designed for the following distance matrix. The tour starts and ends with same location. Design suitable strategy to cover all locations in shortest distance. The distance matrix is given as below :—

0	12	7	9
15	0	8	11
7	9	0	12
4	12	10	0

5(CO2,3)

(b) Write algorithm for multistage graph. Implement algorithm on following graph and find the shortest path between source and destination.

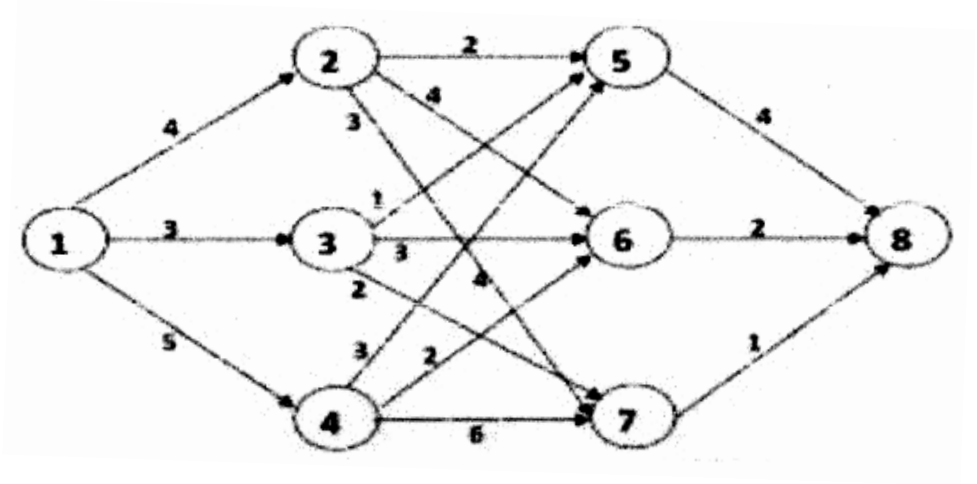


Figure 3.3 Graph example : Test Graph_1

5(CO 5)

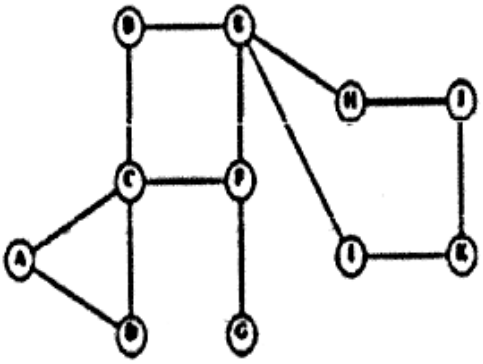
(c) Write formulation for "String Editing" problem. Implement formulation on following strings.

String A : A B B A C A A
String B : A A B B A A B

Comment on space complexity of process. 5(CO 2 , 5)

5. (a) Write any two applications of Hamiltonian cycle. Write algorithm for designing Hamiltonian cycle. Comment on main condition and demonstrate algorithm on partial solution using suitable example. 5(CO 2 , 3)

(b) Illustrate the process of designing articulation point on the following graph. Write the formulation used in designing articulation point.



5(CO 3)

(c) Explain sum of subset problem. Design fixed and variable size tuple tree for following data set : [11 , 13 , 24 , 7] and sum = 31.
Comment on space complexity and size of tree. 5(CO 2 , 3)

6. (a) Differentiate NP – Hard and NP – Complete, with suitable example. Write Non – Deterministic Searching algorithm. 5(CO 4)

(b) Illustrate 3SAT problem and its significance in NP domain. Demonstrate NP completencess on any two problem of string domain. 5(CO 4)

(c) Define triangular inequality property. Use the property to design approximate solution for Independent Set problem. 5(CO 4)