Course Code : CST 314 **KOLP/RW – 19 /9107**

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 usign recurrence tree method
$T(n) = 3T(n / 2) + n$ 5(CO1)

(b) Solve the following recurrence using master method.
$T(n) = 4T(n / 4) + 2n$ 5(CO1)

(c) Solve the following recurrence using master method :
$T(n) = 2T(n / 4) + n^{0.5} + c$

Assume $T(4) = 2$. 5(CO1)

2. (a) In January, you buy a new car from a dealer who offers you the following maintenance contract : $ 50 each month other than March, June, September and December (this covers an oil change and general inspection), $100 every March, June and September (this covers an oil change, a minor tune – up, and a general inspection), and $200 every December (this covers an oil change, a major tune – up, and a general inspection). We are to obtain an upper bound on the cost of this maintenance contract as a function of the number of months. Use three approaches of amortized complexity and determine the cost of maintenance. 5(CO1)

(b) Write Insert, Delmax and Adjust algorithm to implement Heap sort. Comment on time complexity of Heap Sort. 5(CO1)

(c) Solve the following asymptotic notations :

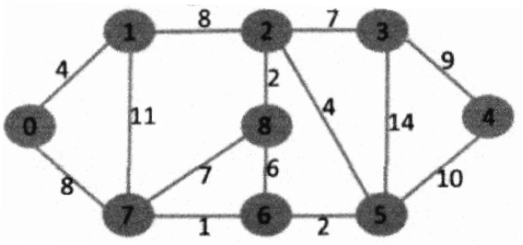
$T(n) = 4n^2 + 5n + 3$

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

Justify the role of constants in above equations. 5(CO1)

3. (a) The sensors are deployed at different locations in forest. The strategy is to be designed for data transmission, so that sensor can transmit data. Design suitable strategy for data transmission, to minimize the transmission energy. The transmission energy depends on distance between two sensors. The algorithm should be executed in logarithmic complexity. Use suitable [x , y] coordinates for distance. [Minimum 15 points]. 5(CO2)

(b) Implement Kruskal Algorithm on following graph. Determine number of computation cycles are required for execution. Comment on complexity of Algorithm.



5(CO2)

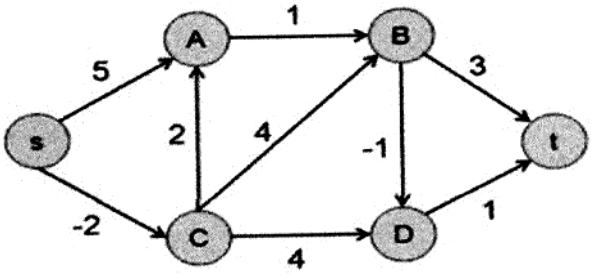
(c) Write an algorithm to generate median of two sorted arrays. The algorithm considers all possible scenarios. Implement algorithm on following arrays.

A = [1 , 12 , 15 , 18 , 21 , 26]

B = [10 , 14 , 19 , 22 , 35] 5(CO2)

4. (a) The distance graph for various cities across is represented in the form of vertices and edges. Design a strategy to find out path of minimum distance from one source to all destination.

Illustrate a real life scenario using negative edge value. Write distance formula and generate distance array.



5(CO3)

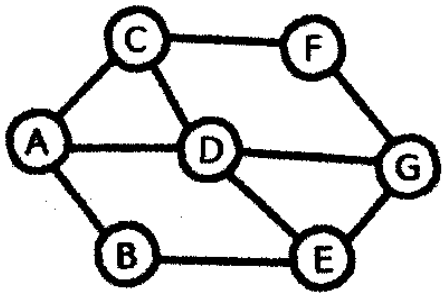
(b) The data set containing rainfall in mm for various cities of states is provided by weather forecasting department. It is required to present data such that it represents the cities in increasing order of rainfall. Suggest suitable strategy and implement.
Dataset = [0 , 4 , 12 , 2 , 10 , 6 , 9 , 13]
How many loops are required for implementing the algorithm ? How many times each loop will iterate ? 5(CO3)

(c) Given a matrix containing run scored by 5 batsman against 5 different countries. Design a strategy and algorithm to determine batsman – country combination with maximum run scored.

23	45	11	67	56
34	123	190	12	11
57	45	56	116	12
90	77	44	77	15
91	123	22	125	224

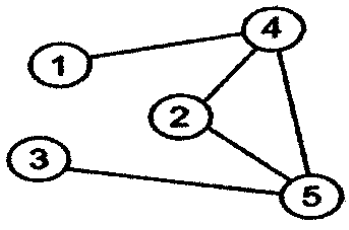
5(CO3)

5. (a) Implement the DFS algorithm on following grapah using suitable intermediate data structure. Write the content of intermediate data structure at each step. Design formula based on degree of vertex to determine maximum size of intermediate data structure.



5(CO3)

(b) The graph shows interdependency of variables. Design suitable strategy to determine register allocation, which will also reduce number of registers required for execution.
Write algorithm and comment on time complexity.



5(CO3)

(c) The matrix represents the location of enemy and shooter. The shooter can shoot the enemy if in sight of angles [0 , 45 , 90]. Design a strategy to protect enemy from shooter. Find out two possible set of locations of shooter and enemy, such that shooter cannot shoot the enemy. Assume dimension : 6×6. 5(CO3)

6. (a) Write non – deterministic algorithm for Hamiltonian cycle and reduce it to solve travelling salesman problem. 5(CO4)

(b) Write approximation algorithm for Vertex cover using 2 – Approximation. Prove approximation using suitable graph. 5(CO4)

(c) Write a non – deterministic sorting algorithm. Comment on time complexity of algorithm. 5(CO4)