USN

Fourth Semester B.E. Degree Examination, Feb./Mar. 2022
Design and Analysis of Algorithms

Time: 3 hrs.

Max. Marks: 80

Note: *Answer any FIVE full questions, choosing ONE full question from each module.*

Module-1

1 a. What is an algorithm? List and explain the criteria that an algorithm must satisfy. **(05 Marks)**

   b. Algorithm Mystery(n)
      //Input : A non-negative integer n
      $s \leftarrow 0$
      for $i \leftarrow 1$ to n do
          $s \leftarrow s + i * i$
      return s
      i)   What does this algorithm compute?
      ii) What is its basic operation?
      iii) How many times is the basic operation is executed?
      iv) What is the efficiency class of this algorithm? **(04 Marks)**

   c. Give an algorithm for selection sort. If c(n) denotes the number of times the algorithm executed, obtain expression for c(n). **(07 Marks)**

OR

2 a. Define recursive algorithm. Write recursive algorithm for solving tower of Hanoi problem. Show that time complexity of tower of Hanoi is exponential in nature. **(06 Marks)**

   b. Write the algorithm to add two matrices and obtain the step count of the algorithm using step table. **(05 Marks)**

   c. List important problem types and explain any four of problem types. **(05 Marks)**

Module-2

3 a. Give recursive binary search algorithm. Write binary decision tree for the following n = 14 elements $-20, -8, 1, 7, 9, 24, 68, 80, 99, 115, 134, 145, 150, 186$. And also write average number of comparisons required in successful and unsuccessful search based on the decision tree. **(08 Marks)**

   b. Explain the concept of divide and conquer. Write quick sort algorithm. **(08 Marks)**

OR

4 a. Write merge sort algorithm and solve the recurrence relation for the merge sort to get worst case efficiency. **(08 Marks)**

   b. Explain Strassen's matrix multiplication. **(05 Marks)**

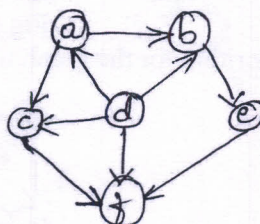   c. Illustrate the topological sorting using source – removal method for the graph in Fig.Q4(C).

Fig.Q4(c)

(03 Marks)

Module-3

5 a. Give the control abstraction for subset paradigm using greedy method. Solve the following instance of knapsack using greedy algorithm (Table Q5(a)). Knapsack capacity M = 10.

Item	1	2	3
Weight	18	15	10
Profit	25	24	15

Table Q5(a)   (08 Marks)

   b. Write Krurkal's algorithm to construct a minimum cost spanning tree. Apply Kruskol's algorithm to find the minimum spanning tree of the graph in Fig.Q5(b).
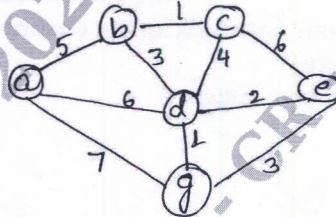

Fig.Q5(b)   (08 Marks)

OR

6 a. Write an algorithm to find single source shortest path. Solve the following instance of single-source shortest path problem in Fig.Q6(a) with "a" as the source.
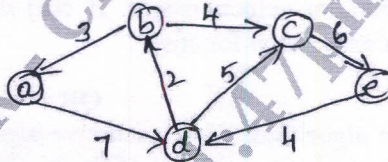

Fig.Q6(a)   (08 Marks)

   b. Construct Huffman code for the following data in Table Q6(b).

Character	A	B	C	D	–
Probability	0.4	0.1	0.2	0.15	0.15

Table Q6(b)   (04 Marks)

   c. Define Heap. Construct heap for the list 2, 9, 7, 6, 5, 8 (Max Heap).   (04 Marks)

Module-4

7 a. Explain the multi-stage graph with example.   (04 Marks)

   b. Define transitive closure. Write Warshall's algorithm to find the transitive closure of a graph. Write the transitive closure for the graph in Fig.Q7(b).
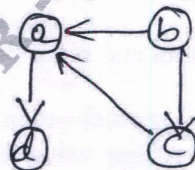

Fig.Q7(b)   (06 Marks)

   c. Trace the Floyd's algorithm for the graph in Fig.Q7(c).

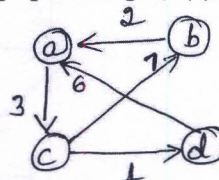Fig.Q7(c)   (06 Marks)

OR

8 a. Write Bellman – Ford algorithm to find single source shortest path. **(06 Marks)**
   b. Illustrate the optimal binary search tree algorithm for the four key set in Table Q8(b).

Key	A	B	C	D
Probability	0.1	0.2	0.4	0.3

Table Q8(b)   **(06 Marks)**
   c. Write a note on reliability design.   **(04 Marks)**

Module-5

9 a. Solve the subset sum problem for the following example. S = {1, 3, 4, 5} and d = 5 construct a state space tree. **(08 Marks)**
   b. Apply backtracking to the problem of finding Hamiltonian circuit in the following graph of Fig.Q9(b).
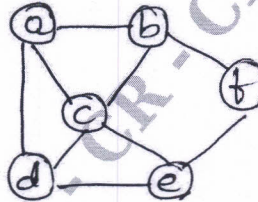

Fig.Q9(b)   **(04 Marks)**

   c. Construct a state space tree for the 4 – Queen's problem.   **(04 Marks)**

OR

10 a. Apply the branch and bound algorithm to solve the traveling sales person problem for the graph in Fig.Q10(a).

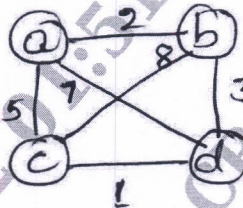Fig.Q10(a)   **(08 Marks)**
   b. What do you mean by lower bound arguments? List out 4 methods of obtaining lower bound. Explain them in brief. **(08 Marks)**

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