CBCS SCHEME

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15CS43

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 ← 0
for i ← 1 to n do
s ← 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).

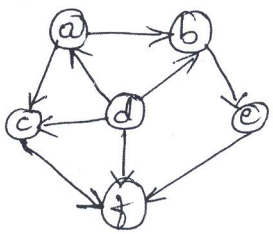

Fig.Q4(c) **(03 Marks)**

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).

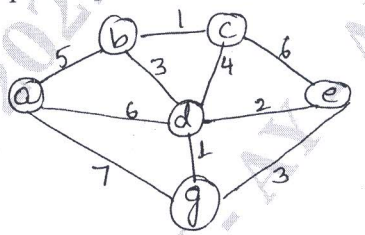

Fig.Q5(b) **(08 Marks)**

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.

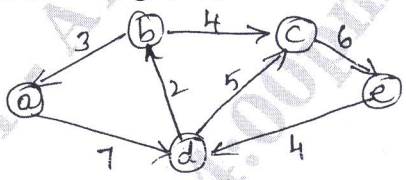

Fig.Q6(a) **(08 Marks)**

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).

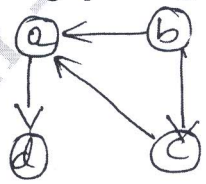

Fig.Q7(b) **(06 Marks)**

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

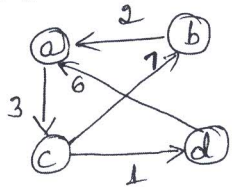

Fig.Q7(c) **(06 Marks)**

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).

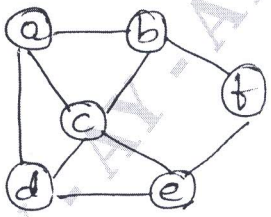

Fig.Q9(b) **(04 Marks)**

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).

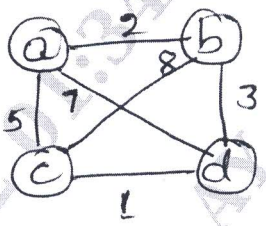

Fig.Q10(a) **(08 Marks)**

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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