SEMESTER EXAMINATION-2021

CLASS - MCA III Sem SUBJECT- Computer Applications

PAPER CODE: MCA-C304 PAPER TITLE: Design and Analysis of Algorithms

Time: 3 hour **Max. Marks: 70**

Min. Pass: 40%

Note: Question Paper is divided into two sections: **A and B.** Attempt both the sections as per given instructions.

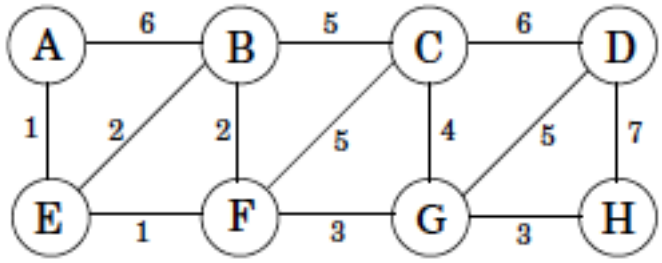
SECTION-A (SHORT ANSWER TYPE QUESTIONS)

Instructions: Attempt any five questions. Each question carries six marks. (5 X 6 = 30 Marks)

Question-1: With a suitable example, explain the method of solving recurrence equations.

Question-2: Given a sorted array of distinct integers A[1 …, n], you want to find out whether there is an index i for which A[i] = i. Give an algorithm that runs in time O(log n)

Question-3: Consider the following graph



(a) What is the cost of its minimum spanning tree?

(b) How many minimum spanning trees does it have? Draw all of them.

Question-4: Explain how greedy method can be applied to solve the knapsack problem.

Question-5: Given 2 sorted lists of numbers. Write the algorithm to merge them and analyze its time complexity.

Question-6: How is dynamic programming applied to solve the travelling sales person problem? Explain in detail with an example.

Question-7: Define a Problem class P & NP? What are the basic steps to prove a problem to be NP Complete?.

Question-8: With an example, show how Dynamic programming is used to find all-pairs shortest path in a graph.

Question-9: Write the recursive and non-recursive version of the factorial function. Examine how much time each function requires as 'n' becomes large.

Question-10: Write the algorithm to compute the 0/1 Knapsack problem using dynamic programming and explain it.

SECTION-B

(Long Answer Type Questions)

Instructions: *Answer any four questions in detail. Each question carries ten marks.*

(4 X 10 = 40 Marks)

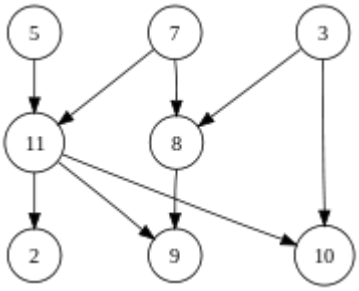
Question-11: From following problems discuss any two and also prove that they are NP–hard.

(i) Clique Decision Problem.
(ii) Node Cover Decision Problem.
(iii) Chromatic Number Decision Problem.

Question-12: Compare and contrast FIFO and LC branch-and-bound search techniques.

Question-13: How dose backtracking work on the 8 queens problem with suitable example?

Question-14: What is topological sorting? Use topological sorting algorithm to find the topological order of the vertices from the following graph? Comment on complexity of the topological sorting algorithm?

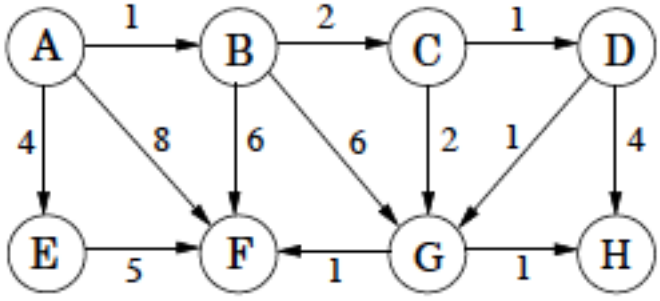


Question-15: How is dynamic programming applied to solve the travelling salesperson problem? Explain in detail with an example.

Question-16: (a). Find an optimal solution to the knapsack instance n=7, m=15 (p1, p2, p3, ..., p7) = (10, 5, 15, 7, 6, 18, 3) and (w1, w2, w3, ..., w7) = (2, 3, 5, 7, 1, 4, 1)

(b). Explain elaborately recursive backtracking algorithm.

Question-17: Write the Kruskal's algorithm, apply it to find a minimum spanning tree for the following graph.



Question-18: Write a non deterministic algorithm to find whether a given graph contains a Hamiltonian cycle.