Mahindra University

MAHINDRA UNIVERSITY HYDERABAD

École Centrale School of Engineering

Minor Examination - I

Program: B.Tech
Branch: CSE/AI/ECM/CM/CB
Subject: Design and Analysis of Algorithms (CS/AI 2102)
Start Time: 02:00 PM

Year: Second/Third
Semester: First
Date: 24-10-2024

Please read the following instructions before answering questions.

1. Answer all eight questions. The exam is worth a total of 20 marks. The first four questions are worth 2 marks each, and the last four are worth 3 marks each.
2. Provide concise and focused responses – include only essential details.
3. Answer all parts of a question in one place, one after the other. If not, you may risk losing marks.
4. If a question seems unclear, clearly state your assumptions before answering.

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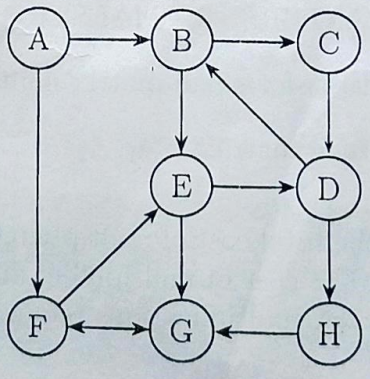
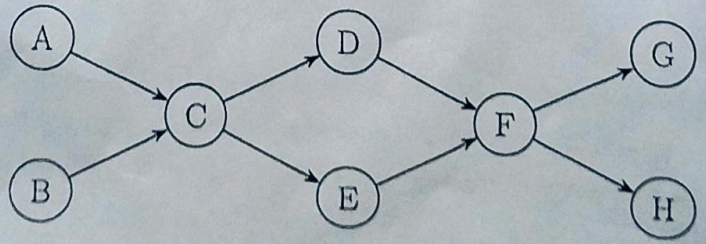
1. Draw an undirected graph G whose adjacency matrix is

$$\begin{array}{c} \\ A \\ B \\ C \\ D \end{array}\begin{array}{c} \begin{array}{cccc} A & B & C & D \end{array} \\ \begin{bmatrix} 0 & 1 & 1 & 0 \\ 1 & 0 & 1 & 1 \\ 1 & 1 & 0 & 1 \\ 0 & 1 & 1 & 0 \end{bmatrix} \end{array}.$$

2. Perform depth-first search(DFS) on the following graph; whenever there is a choice of vertices, pick the one that is alphabetically first, and provide the list of vertices in the order they are visited during the DFS.



3. Run the DFS-based topological ordering algorithm on the following directed graph. Whenever you have a choice of vertices to explore, always pick the one that is alphabetically first. What topological ordering is found by the algorithm?

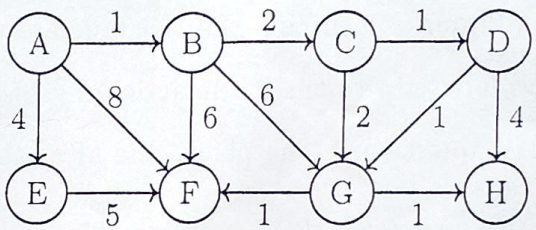


4. You are required to calculate the n-th Fibonacci number given $F(0) = 0$, $F(1) = 1$, where n is reasonably large. Which of the following two methods would you prefer, and why? Your response should not exceed four sentences.

   (a) Compute Fibonacci numbers iteratively, from $F(2)$ to $F(n)$.

   (b) Recursively calculate Fibonacci numbers using $F(n) = F(n-1) + F(n-2)$.

5. Suppose Dijkstra's algorithm is run on the following graph, starting at node A. Draw a table showing the intermediate distance values of all the nodes at each iteration of the algorithm.



6. Suppose a CS curriculum consists of n courses, all of them mandatory. The prerequisite graph G has a node for each course, and an edge from course v to course w if and only if v is a prerequisite for w. Find an algorithm that works directly with this graph representation, and computes the minimum number of semesters necessary to complete the curriculum (assume that a student can take any number of courses in one semester). The running time of your algorithm should be linear.

7. In the computation of edit distance, where the substitution/replacement cost is 2 and the costs for both insertion and deletion are 1, determine the value of $E(7, 7)$ for the transformation from "MASTERS" to "MAESTRO".

8. Design an efficient algorithm for chain matrix multiplication:

   - *Input:* A sequence of n matrices, $A_1, A_2, \ldots, A_n$, where matrix A_i has dimension $m_{i-1} \times m_i$.
   - *Output:* Minimize the total cost of multiplying the matrices to obtain the product $A_1 \times A_2 \times \ldots \times A_n$. The cost of multiplying any two matrices A and B is defined as the number of scalar multiplications required to compute $A \times B$.

** All The Best **