**Main Topics**

**Array..**

**Stack..**

**Linkes List..**

**Queue..**

**Tree**

**BST**

**AVL Must prepare it with 5 to 6 examples**

**Heap Tree..Must prepare it with 5 to 6 examples**

**Graphs Must prepare it with 5 to 6 examples**

**BFS and DFS Must prepare it with 5 to 6 examples**

**Sorting**

**Hashing**

**Recurssion**

**Note: Please prepare Graphs BFS, DFS and Heap Tree thoroughly .**

**These questions will help you in preparing the questions.**

**Question 1** Sort the following collection of books based on their publication years using Insertion Sort: Book A (2005), Book B (1998), Book C (2012), Book D (2003), Book E (2017), Book F (1995). Provide the state of the books after each partition step.

**Question 2. You have a dataset of employee salaries given below ,that you need to sort in ascending order. Which sorting algorithm would be the best choice based on timing considerations?**

**Employee A - Salary: $50,000**

**Employee B - Salary: $70,000**

**Employee C - Salary: $40,000**

**Employee D - Salary: $60,000**

**Employee E - Salary: $55,000**

**Question 3 :**

**As a travel agent, you need to plan a vacation itinerary for a client to visit multiple cities while minimizing travel costs. Given the costs of visiting each city: City A ($100), City B ($150), City C ($80), City D ($120), and City E ($90), determine the optimal order in which the cities should be visited using the Greedy Algorithm.**

**Question 4: (A) How do you avoid infinite recursion in a recursive function?**

**Question 4: (B) 3 marks**

**Using recursion, provide pseudo code which caclulates the factorial of a given positive integer. Implement a recursive function to compute the factorial and provide the factorial value for the number 15**

**Question 5**

**You are a treasure hunter exploring an ancient cave filled with valuable artifacts. Inside**

**the cave, you stumble upon a collection of unsorted gemstones, each with a unique**

**weight. To organize the gemstones based on their weights, you decide to use the Merge**

**Sort algorithm.**

**Consider the following scenario:**

**In the cave, you discover a pile of gemstones with the following weights (in grams):**

**Gemstone 1 - Weight: 10 grams**

**Gemstone 2 - Weight: 7 grams**

**Gemstone 3 - Weight: 15 grams**

**Gemstone 4 - Weight: 5 grams**

**Gemstone 5 - Weight: 12 grams**

**Gemstone 6 - Weight: 8 grams**

**Perform the following steps using the Merge Sort algorithm:**

**1 Divide the pile of gemstones into smaller subpiles recursively until each subpile**

**contains only one gemstone. Write down the resulting subpiles.**

**2 Merge the subpiles back together, sorting the gemstones by weight in ascending**

**order. Write down the updated order of gemstones after each merge operation.**

**3 After all the merges, provide the final sorted order of the gemstones based on their**

**weights.**

**Question 6**

**You are a coach of a basketball team and want to arrange your players in order of**

**their shooting percentages using the Insertion Sort algorithm. Each player has a**

**shooting percentage that represents the proportion of successful shots out of the**

**total shots taken.**

**Consider the following scenario:**

**You have a team of seven players, and their shooting percentages are as follows:**

**Player 1 - Shooting Percentage: 0.55**

**Player 2 - Shooting Percentage: 0.62**

**Player 3 - Shooting Percentage: 0.70**

**Player 4 - Shooting Percentage: 0.48**

**Player 5 - Shooting Percentage: 0.58**

**Player 6 - Shooting Percentage: 0.66**

**Player 7 - Shooting Percentage: 0.51**

**Perform the following steps using the Insertion Sort algorithm:**

**Take the second player, Player 2, and insert them into the correct position in the**

**sorted subarray to the left. Write down the updated order of players.**

**Take the third player, Player 3, and insert them into the correct position in the**

**sorted subarray to the left. Write down the updated order of players.**

**Take the fourth player, Player 4, and insert them into the correct position in the**

**sorted subarray to the left. Write down the updated order of players.**

**Take the fifth player, Player 5, and insert them into the correct position in the**

**sorted subarray to the left. Write down the updated order of players.**

**Take the sixth player, Player 6, and insert them into the correct position in the**

**sorted subarray to the left. Write down the updated order of players.**

**Take the seventh player, Player 7, and insert them into the correct position in the**

**sorted subarray to the left. Write down the final order of players after all the**

**iterations.**

**Question 7**

**You are a delivery manager responsible for scheduling deliveries for a courier**

**company. Each delivery has a specific weight and a delivery time window. Your goal**

**is to schedule the deliveries in a way that minimizes the total waiting time for**

**customers.**

**Consider the following scenario:**

**You have a list of five deliveries with their weights and delivery time windows:**

**Delivery 1 - Weight: 10 kg, Delivery Time Window: 9:00 AM - 10:00 AM**

**Delivery 2 - Weight: 8 kg, Delivery Time Window: 10:30 AM - 11:30 AM**

**Delivery 3 - Weight: 6 kg, Delivery Time Window: 10:00 AM - 11:00 AM**

**Delivery 4 - Weight: 12 kg, Delivery Time Window: 11:00 AM - 12:00 PM**

**Delivery 5 - Weight: 9 kg, Delivery Time Window: 9:30 AM - 10:30 AM**

**Which solving method would you choose to efficiently schedule the deliveries and**

**minimize the total waiting time for customers? Explain your choice and provide the**

**final delivery schedule.**

**Question 8**

**You are a sales manager for a retail company and need to organize a list of products**

**based on their sales performance to determine the top-selling items. Each product**

**has a unique identifier and the total number of units sold.**

**Consider the following scenario:**

**You have a list of seven products with their respective sales performance:**

**Product 1 - Sales: 100 units**

**Product 2 - Sales: 80 units**

**Product 3 - Sales: 120 units**

**Product 4 - Sales: 90 units**

**Product 5 - Sales: 150 units**

**Product 6 - Sales: 110 units**

**Product 7 - Sales: 70 units**

**Which sorting algorithm would you choose to efficiently arrange the products in**

**descending order based on their sales performance? Explain your choice and**

**provide the final sorted list of products.**

**Question 9 :**

**Consider an AVL tree with the following initial values: 10, 20, 30, 40, 50. If we want to insert the value 35 into this AVL tree, what steps should be taken to maintain its balanced property? What is the maximum height of tree**

**Question 10**

**Consider an initially empty AVL tree. Insert the following values, one by one, into the AVL tree while maintaining its balanced property. Show the resulting AVL tree after each insertion.**

**Values to insert: 15, 10, 20, 5, 25, 17, 12, 30**

**Question 11**

**Given the following heap tree, perform the necessary steps to remove the root node while maintaining the heap property. Show the resulting heap tree after the removal.**

**50**

**/ \**

**40 30**

**/ \ /**

**20 10 15**

**Question 12:**

**Build a min heap tree by repeatedly inserting the following set of data. Show the step-by-step procedure by drawing the min heap tree after each insertion.**

**Data to insert: 25, 12, 30, 8, 20, 15, 17, 10, 6, 9**

**Question 13:**

**Convert the following infix expression into postfix form using a stack. Show the step-by-step process (stack contents + output string after reading each character of the input string).**

**Expression: (A+B)\*(C-D)/E^F**

**Please note that '^' represents exponentiation in this expression.**

**Question 14**

**Convert the following infix expression into postfix form using a stack. Show the step-by-step process (stack contents + output string after reading each character of the input string).**

**Expression: 4 + 5 \* (7 - 2)**

**Question 15:**

**Consider the following undirected graph:**

**Graph:**

**A -- B**

**/ \ | \**

**C -- D -- E**

**Identify the vertices and edges in the given graph.**

**Determine the degree of each vertex in the graph.**

**Is the graph connected? If not, identify the connected components.**

**Is there any cycle in the graph? If yes, identify and list one of the cycles.**

**Find the shortest path from vertex A to vertex E using Dijkstra's algorithm.**

**Please answer the above questions and provide the necessary explanations and calculations.**

**Question 16:**

**Consider the following directed weighted graph:**

**Graph:**

**5**

**(A)◄--- (B)**

**▲ ▲**

**│ │**

**3 │ │ 2**

**│ │**

**(C)◄--- (D)**

**4**

**1. Identify the vertices and edges in the given graph.**

**2. Provide the weight of each edge in the graph.**

**3. Determine the outdegree and indegree of each vertex in the graph.**

**4. Is there a path from vertex A to vertex D? If yes, what is the shortest path and its weight?**

**Question 17:**

**Perform a Breadth First Search (BFS) traversal on the following directed graph, starting from vertex A. Show the order in which the vertices are visited.**

**A --> B**

**/ ↖ ↓ \**

**↓ C D**

**↖ ↓ ↗**

**E -->**

**Question 18:**

**Provide the pseudo code for BFS and DFS and give example**

**Question 19:**

**What are the types of Hashing? Explain in detail**

**Question 20**

**What is Difference between AVL and BST.**