Data Structures and Algorithms

Department of Computer Science

University of Engineering and Technology, Lahore

Mid Term | Fall 2025 | Time: 60 Mintus

Name:_____ | Roll no:_____ | Section:_____

Questions	CLOs	Marks
1. The "Call Center" VIP Router A customer support center has a standard waiting line implemented as a **Linear Queue**. However, they have introduced a "Platinum Membership". Platinum members do not stand in the queue; they are inserted directly into a special "Priority List" based on the urgency of their issue. Design a hybrid system: 1. **GeneralQueue**: A standard Queue for normal users (FIFO). 2. **PlatinumList**: A Singly Linked List for VIPs. 3. **join(id, type, urgency)**: 1. If type == "Normal", enqueue to GeneralQueue. 2. If type == "Platinum", insert into PlatinumList such that the list remains **sorted by urgency** (Highest urgency at Head). 4. **assignAgent()**: This function assigns an agent to a customer. It must check the PlatinumList first. Only if the PlatinumList is empty should it dequeue from the GeneralQueue. 5.	CLO1, CLO3	10
2. The "Mars Rover" Navigation Log You are designing the navigation system for a Mars Rover. The Rover moves from one checkpoint to another. These checkpoints are stored as a **Singly Linked List** because the path is continuous. However, the Rover often encounters sandstorms and must "backtrack" exactly the way it came to find a safe spot. To support this, you must use a **Stack** to record the history of visited nodes.	CLO1, CLO3	10

1. **The Path (Linked List):** Create a Linked List where each node represents a Checkpoint (contains CoordinateID and TerrainType). Initialize it with 5 checkpoints: A -> B -> C -> D -> E. 2. **The Tracker (Stack):** Create a Stack (manual array-based implementation). 3. **moveForward():** Traverse the Linked List from Head to Tail. As the Rover visits each node, **push** that node's CoordinateID onto the Stack. 4. **encounterStorm(steps):** This simulates a hazard. When called, the Rover must reverse. You must **pop** steps number of items from the Stack and print "Retreating to [ID]..." for each pop. **The Twist:** After retreating, the Rover decides to abandon the rest of the original path. You must **delete** the remaining nodes in the Linked List that correspond to the popped values so they are not visited again.		