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ME24B1079
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ASSIGNMENT TITLE:
Robotic Assembly Line Simulation Using Data Structure.

PROBLEM STATEMENT:

This assignment simulates a robotic car manufacturing process using various data structures. The goal is to model different stages of the assembly line.

1. Delivering and assembling car parts in the correct sequence,

2. Managing the car prototypes in the garage,

3. Handling defective and repaired cars,

4. Tracking VIP cars that undergo premium upgrades.

OBJECTIVE OF THE PROBLEM:

1. Simulate part delivery and assembly using queues and stacks.

2. Store completed cars efficiently using arrays with FIFO logic.

3. Manage defective cars using a singly linked list.

4. Track repaired vehicles using a doubly linked list for forward and backward navigation.

5. Rotate through VIP cars for upgrades using a circular linked list.

6. Demonstrate understanding of key data structures and their applications.

7. Implement real-world problem-solving using C programming.

SELECTION STRATEGY FOR DATA STRUCTURE:

a) Queue (for Part Delivery):
A queue models real-world part delivery where items are processed in the order they arrive (FIFO - First In, First Out).

b) Stack (for Robot Arm):
The robot arm assembles parts in reverse order of delivery (LIFO - Last In, First Out). A stack is ideal for this, ensuring the last part delivered

(like the Hood) is placed last.

c) Array (for Garage Storage):
A fixed-size array efficiently stores cars. If the garage is full, the oldest car (index 0) is removed and new ones are added, mimicking prototype dispatch.

d) Singly Linked List (for Defective Cars):
This structure allows dynamic tracking of defective cars with easy insertions at the head, as inspection might randomly flag any vehicle.

e) Doubly Linked List (for Repaired Cars):
Once repaired, cars are stored with bidirectional access, allowing forward and backward tracking of all fixed vehicles.

f) Circular Linked List (for VIP Cars):
VIP cars receive periodic upgrades. A circular linked list supports infinite rotation through this exclusive group, perfect for repeated passes.

EFFECTIVENESS OF CHOSEN DATA STRUCTURE IN PROBLEM SOLVING:

1. Queues and Stacks: queue and stack work hand-in-hand for modeling delivery and robotic arm mechanics in a time-efficient, structured way.

2. Arrays: array provide quick access and overwrite capabilities, good for modeling limited storage with priority removal.

3. Linked Lists (both singly and doubly): allow flexible memory usage and efficient car tracking without fixed limits.

4. Circular Lists:circular lists are excellent for scenarios requiring continuous looping, like multiple upgrade rounds for VIP cars.