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Assignment of Data Structure and Algorithms

Assignment 2 : Stack And Queue

Part I stack

A . Basics

Q.1 How does this show the LIFO nature of stacking?

- ✓ In the MTN mom Alphen you fill payment details step by step , pressing back removes the last step you entered.
- ✓ This matches LIFO (Last in First Out)because the most recent(Last) action is undone first, just like popping from a stack.

Q.2 .Why is this action like popping from stack?

- ✓ In UR Canvas, pressing back undoes the last step.
- ✓ Similar, in a stack, the pop operation removes the top element (last added item)
- ✓ Both remove the recent action.

Application

Q.3: How could stack enable the undo faction when correcting mistakes?

- ✓ Every action (like typing text or doing a transaction) is pushed onto the stack.
- ✓ When you press undo, the system performs a Popp removing the latest action.
- ✓ This allows you to go back step by step in reverse order.

Q.4: How can stacks ensure forms are correctly balanced?

In forms of (egg Rambo registration), brackets or fields must be properly matched.

A stack can be used by

- ✓ 1. Puch each opening bracket/ field.
- ✓ 2. Pop when a matching is empty the form is correctly balanced.

If ,at the end, the stack is empty, the form is collecting Ly balanced.
If not there’s a mismatch error

Logical

Q.5: Which task is next (top of stack)?

Operations:

Push("CBE notes") → ["CBE notes"]
Push("Math revision") → ["CBE notes", "Math revision"]
Push("Debate") → ["CBE notes", "Math revision", "Debate"]
Pop() → removes "Debate" → ["CBE notes", "Math revision"]
Push("Group assignment") → ["CBE notes", "Math revision", "Group assignment.

Q6: Which answers remain in the stack after undoing?

Suppose the student performed actions and then undoes 3 actions = perform 3 pops.

Example: If stack = [A, B, C, D, E] (E on top)

Undo 1 → Pop(E) → [A, B, C, D]

Undo 2 → Pop(D) → [A, B, C]

Undo 3 → Pop(C) → [A, B]

After undoing 3 actions, the remaining stack elements are the earliest actions that were not undone.

<u>Advanced Thinking (Stack)</u>

Q7 – Pop to backtrack (Rhandir booking):
Each form step is pushed onto a stack as the user fills it. When the user goes back, the system does a pop to remove the most recent step and return to the previous state. Because stacks are LIFO, this naturally retraces the exact steps in reverse order and lets the user step back one level at a time.

Q8 – Push words, then Pop to reverse:
Algorithm:

1. Split the sentence into words.

2. Push each word onto a stack.

3. Pop words one by one and concatenate – popped order is reversed.
Example: push ["Awana", "no", "Umut ware"] → pop sequence: "Umut ware in Awana".

Q9 – DFS using a stack (library shelves):

DFS explores one branch deeply before backtracking. A stack (explicit or call stack) ensures you always continue from the most recently discovered node (LIFO), so you can go deep and then backtrack correctly. A queue would do BFS (level-order), not deep search, so a stack is better for DFS.

Q10 – Feature suggestion (BK Mobile transaction navigation):
Add a Back/Forward transaction navigator using two stacks:

Back stack: push current transaction view when user moves to another.

Forward stack: when user presses Back (pop from Back → current pushed to Forward).
This enables undo/redo-style navigation through transaction history (view previous transaction, then go forward again).

<u>Part II</u>
<u>A. Basics</u>

Q1: How does this show FIFO behavior?
- ✓ At a Kigali restaurant, customers are served in the order they arrive. This shows FIFO (First In, First Out) behavior because the first customer entering the queue is the first to be served.

Q2: Why is this like a dequeue operation?
- ✓ In a YouTube playlist, the next video plays automatically, removing it from the front of the list–just like a dequeue operation removes the front item in a queue.

<u>B. Application</u>

Q3: How is this a real-life queue?
- ✓ At RRA offices, people form a line to pay taxes. Each person waits their turn. This is a real-life queue because jobs (people) are enqueued as they arrive and processed in order.

Q4: How do queues improve customer service?
- ✓ In MTN/Airtel service centers, requests are handled in the order received. This ensures fairness, reduces confusion, and helps manage customer expectations, leading to better customer service.

C. Logical

Q5: Who is at the front now?
Operations:
- ✓ Enqueue(“Alice”), Enqueue(“Eric”), Enqueue(“Chantal”), Dequeue(), Enqueue(“Jean”)

Queue: [Eric, Chantal, Jean]
Answer: Eric

Q6: Explain how a queue ensures fairness.
- ✓ A queue ensures fairness by processing items in the order they arrive (FIFO). Everyone waits their turn without being skipped, which avoids bias.

D. Advanced Thinking

Q7: Explain how each map to real Rwandan life.
- ✓ Linear queue = people at a buffet served in order.
- ✓ Circular queue = buses at Nyarugenge go in loops (start again after the last stop).
- ✓ Deque = boarding a bus from both front/rear doors.

Q8: How can queues model this process?

- ✓ At a restaurant, customer orders are enqueued when placed and dequeued when ready–ensuring orders are processed in the order received.

Q9: Why is this a priority queue, not a normal queue?

- ✓ At CHUK hospital, emergencies are handled first. This is a priority queue because items (patients) are ordered by urgency, not by arrival time.

Q10: How would queues fairly match drivers and students?

- ✓ A matching queue system pairs the first waiting rider with the first available driver, ensuring both parties are matched fairly in the order they arrive.