Part I — STACK (LIFO)

A. Basics

Q1 — MTN MoMo "Back" button (LIFO in action)

- The app saves each step of the payment flow as you move forward.
- The last step completed is stored at the top of an internal stack.
- Pressing "Back" removes (pops) that last step first and shows the previous step.
- **Key point:** Push = store step, Pop = remove the most recent step.

Summary: This exactly demonstrates Last-In-First-Out (LIFO).

Q2 — UR Canvas back navigation = Pop from a stack

- Each visited page/module is added to a history stack.
- The most recent page sits at the top.
- Pressing "Back" pops the latest page and returns to the one before.

Summary: Navigation history behaves like a stack: back = pop.

B. Application

Q3 — BK Mobile "Undo" for correcting mistakes

- Every edit is saved as an action on top of an undo stack.
- "Undo" pops the top action, restoring the previous state.

Summary: The most recent changes are undone first — LIFO.

Q4 — Balanced fields in Irembo forms

- Opening of a form section = push onto stack.
- Closing of a form section = pop from stack and match.
- If any unmatched items remain, the form is invalid.

Summary: Stacks ensure nested sections open and close correctly.

C. Logical Thinking

Q5 — Sequence: Push & Pop
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]

Answer: Top = **Group assignment**.

Q6 — Undo 3 recent actions

- Popping three times removes the last three actions.
- Earlier actions remain intact.
  Example: [A, B, C, D, E] → Pop 3 = remove E, D, C → remain [A, B].

D. Advanced Thinking

Q7 — RwandAir booking backtracking

- Each booking step is pushed onto a stack.
- Press "Back" = pop current step and restore the previous one.
- Multiple backs = repeated pops.

Q8 — Reverse the proverb using push-then-pop
Original: "Umwana ni umutware"
Push words → Pop words → reversed: "umutware ni Umwana".

Key idea: Push preserves order; Pop reverses it.

Q9 — Why DFS uses a stack

- DFS = go deep before exploring siblings.
- A stack always processes the most recent node first.
- A queue would produce breadth-first, not depth-first.

Q10 — Feature suggestion for BK Mobile

- Navigation stack for transactions (Back/Forward).
- Undo stack for edits.

- Optional redo stack to reapply popped edits.

Benefit: Fast, predictable navigation + undo/redo.

Part II — QUEUE (FIFO)

A. Basics

Q1 — Restaurant in Kigali (FIFO)

- Customers join at the end of the line.
- First to arrive = first served.

Key point: Arrival order = service order.

Q2 — YouTube playlist (dequeue)

- Next video = at the front.
- Auto-play removes the played video and moves to the next.

Key point: Front processed first — FIFO.

B. Application

Q3 — RRA offices (job submission)

- People take tokens or stand at the end.
- Counter calls the next token from the front.

Summary: Real-life FIFO queue.

Q4 — Queues in MTN/Airtel centers

- Bring fairness and transparency.
- Allow better prediction of wait times.
- Digital ticketing further improves experience.

C. Logical

Q5 — Equity Bank sequence
Enqueue("Alice") → [Alice]
Enqueue("Eric") → [Alice, Eric]
Enqueue("Chantal") → [Alice, Eric, Chantal]
Dequeue() → removes "Alice" → [Eric, Chantal]
Enqueue("Jean") → [Eric, Chantal, Jean]

Answer: Eric is now at the front of the queue.

Key Takeaways (Stacks vs Queues)

Feature	**Stack (LIFO)**	**Queue (FIFO)**
Access order	Last in, first out	First in, first out
Basic ops	Push / Pop	Enqueue / Dequeue
Real-world use	Undo, Back buttons, DFS, reversing text	Waiting lines, playlists, scheduling
Behavior analogy	Stack of plates — take from top	Line at a ticket counter

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How to remember:

- **Stack = "Backtrack"** → you leave the last place you entered.
- **Queue = "Wait your turn"** → you leave in the order you arrived.