STACK and QUEUE

STACK

Basics of Stack

Q1: How does the MTN MoMo app show the LIFO nature of stacks?

Answer is the following: as we know in stacking what pushed last is popped first so,
In the MTN MoMo app, each step you complete like entering payment details is added to a virtual stack. When you press 'back,' the last step you entered is removed first. This mirrors the Last-In-First-Out (LIFO) principle: the most recent action is undone before earlier ones. It is like stacking books, if you want to remove one, you start from the top. And also it is like stacking plates you add one on the top and also you remove it at the top that is why stacking is “last in first out”.

Q2: Why is pressing back in UR Canvas like popping from a stack?
Navigating course modules in UR Canvas involves moving forward through content. Each new module is pushed onto the stack. When you press 'back,' the last module viewed is popped off, revealing the previous one. This is a direct application of the pop operation in stacks, where the top item is removed to return to the previous state.

Applications of Stack

Q3: How could a stack enable undo in BK Mobile Banking?
Each transaction or action (e.g., entering amount, confirming payment) is pushed onto a stack. If a mistake occurs, the app can pop the last few actions to undo them. This allows users to backtrack step-by-step, ensuring corrections are made without affecting earlier valid actions.

Q4: How can stacks ensure forms are correctly balanced in Irembo?
When filling forms with brackets or nested fields, stacks help track opening and closing elements. For each opening bracket, push it onto the stack. When a closing bracket appears, pop the top item. If the stack is empty at the end, the form is balanced. This prevents mismatched or incomplete entries.

Logical Stack Operations

Q5: Which task is next (top of stack)?
Sequence:

Push('CASS notes')
Push('English revision')
Push('Debate')
Pop() → removes 'Debate'
Push('Group assignment')
Top of stack: 'Group assignment'. The last item pushed after popping 'Debate' is now at the top.

Q6: Which answers remain after undoing 3 actions?
Assuming the stack had 5 actions:
Push('Login')
Push('Open exam')
Push('Answer Q1')
Push('Answer Q2')
Push('Answer Q3')
Undoing 3 actions (Pop x3): removes 'Answer Q3', 'Answer Q2', 'Answer Q1'.
Remaining: 'Login', 'Open exam'.

Advanced Stack Thinking

Q7: How does a stack enable retracing in RwandAir booking?
Each form step (e.g., passenger info, flight selection) is pushed onto the stack. Pressing 'back' pops the last step, allowing the user to revisit and edit previous entries. This ensures a smooth, reversible navigation experience.

Q8: Show how a stack reverses 'Igihugu ni URWANDA'
Steps:
Push('Igihugu')
Push('ni')
Push('URWANDA')
Then pop each word:
Pop() → 'Igihugu'
Pop() → 'ni'
Pop() → 'URWANDA'
Result: 'URWANDA ni Igihugu'. Stacks reverse order naturally through LIFO.

Q9: Why does a stack suit DFS in Kigali Public Library?
Depth-First Search (DFS) explores one path deeply before backtracking. A stack stores visited shelves. When a dead end is reached, pop to backtrack and explore other paths.

This is efficient for deep exploration, unlike queues which suit breadth-first search.

Q10: Suggest a stack-based feature for BK Mobile app navigation
Implement a 'History Stack' where each transaction is pushed. Users can pop to view previous transactions or undo recent ones. This allows intuitive navigation and error correction, enhancing user control.

QUEUE

Basics of Queue

Q1: How does a restaurant queue show FIFO behavior?
Customers arrive and are added to the end of the line (enqueue). The first customer is served first (dequeue). This First-In-First-Out (FIFO) behavior ensures fairness and order, just like a queue data structure.

Q2: Why is a YouTube playlist like a dequeue operation?
Videos are added to the playlist in order. When played, the first video is removed (dequeue), and the next one plays. This mirrors how queues process items: oldest first.

Applications of Queue

Q3: How is RRA tax payment a real-life queue? Answer is the following:
People arrive and wait in line. Each person is added to the rear (enqueue). When their turn comes, they are served (dequeue). This ensures orderly service and prevents skipping.

Q4: How do queues improve customer service at MTN/Airtel?
SIM replacement requests are handled in arrival order. This avoids confusion and ensures fairness. Queues also help staff manage workload efficiently, reducing wait times and improving satisfaction.

Logical Queue Operations

Q5: Who is at the front now in Equity Bank?
Sequence:
Enqueue('Alice')
Enqueue('Eric')
Enqueue('Chantal')
Dequeue() → removes 'Alice'

Enqueue('Jean')
Queue now: ['Eric', 'Chantal', 'Jean']
Front: 'Eric'.

Q6: How does a queue ensure fairness in RSSB applications?
Applications are processed in the order they arrive. No one can jump ahead. This FIFO system ensures equal treatment and transparency, critical for public services.

Advanced Queue Thinking

Q7: Explain queue types in Rwandan life answer is the following:
Linear queue: Wedding buffet line people move forward as food is served.
Circular queue: Nyabugogo buses loop routes and return to start.
Deque: Boarding buses from front or rear double-ended access.

Q8: How can queues model restaurant orders?
Customers place orders (enqueue). When food is ready, they are called (dequeue). This system ensures timely service and avoids confusion.

Q9: Why is CHUK hospital a priority queue? Answer is the following: because at the hospitals emergencies are treated first regardless the people arrived first that is why Queue is also called first in first out.
Emergencies are treated first, regardless of arrival time. Priority queues assign urgency levels, ensuring critical cases are handled immediately.

Q10: How would queues match drivers and students fairly? Answer is the following:
Each rider request is enqueued. Drivers are matched in order of availability. This prevents bias and ensures efficient, fair pairing in the app.