

UNIVERSITY OF RWANDA

BUSINESS INFORMATION TECHNOLOGY(BIT)L2

DATA STRUCTURES AND LOGARTHIMS

Names	UMUGANWA Ingabire Illumine
REG	224007080

PART I: STACKS

A. BASICS

Q1: MTN MoMo App (Back Button) The MTN MoMo app demonstrates the LIFO nature of stacks when filling payment details step-by-step. Each step completed by the user, such as entering the phone number or amount, is pushed onto a virtual stack. When the back button is pressed, the app removes the most recent step first, which mirrors the Last In, First Out behavior of stacks. This ensures that users retrace their steps in reverse order without affecting earlier inputs.

Q2: UR Canvas Navigation In UR Canvas, when navigating course modules, each page visited is added to a stack. Pressing the back button pops the top page from this stack, effectively undoing the last action. This behavior is similar to the pop operation in stacks, as it removes the most recent item while keeping earlier pages intact, allowing for step-by-step retracing of navigation.

B. Applications

Q3: BK Mobile Banking Undo In BK Mobile Banking, each transaction performed is pushed onto a stack. If a mistake occurs, the undo function pops the last transaction, removing it without disturbing earlier actions. This allows users to correct mistakes in reverse order of execution, demonstrating the usefulness of LIFO stacks for undo operations.

Q4: Irembo Form Validation Stacks can be used to ensure correct data entry in Irembo registration forms. Every opening field or data entry is pushed onto a stack. When a corresponding closing or confirmation is encountered, the stack pops the entry. If the stack is empty at the end, all fields are correctly balanced, preventing mismatched or incomplete entries.

C. Logical

Q5: We have this sequence:

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

The **next task (top of stack)** is **"Group assignment."**

Q6: ICT Exam Undo During ICT exams, a student may undo three recent actions. Each action is stored on a stack. Performing three pop operations removes the three most recent answers, leaving the earlier responses intact. This demonstrates how stacks allow multiple undo operations while preserving the sequence of older actions.

D. Advanced Thinking

Q7: RwandAir Booking In RwandAir booking forms, each completed step, such as selecting a flight, seat, or payment option, is pushed onto a stack. Pressing the back button pops the most recent step, allowing the passenger to retrace their steps in reverse order. The stack ensures accurate and orderly backtracking through the booking process.

Q8: • proverbs: ["Umwana", "ni", "umutware"]

- Push("Umwana") → Stack: ["Umwana"]
- Push("ni") → Stack: ["Umwana", "ni"]
- Push("umutware") → Stack: ["Umwana", "ni", "umutware"]
- Pop → "umutware", Pop → "ni", Pop → "Umwana"

• Reversed sentence: **"umutware ni Umwana"**

Q9: DFS at Kigali Library When performing a depth-first search in Kigali Public Library shelves, a stack is used to track visited locations. The student explores one path fully, pushing shelves visited onto the stack. If a dead-end is reached, the stack is popped to backtrack. Stacks suit DFS because they prioritize the most recent path first, unlike queues which explore level by level.

Q10: BK Mobile Transaction Navigation In the BK Mobile app, each viewed transaction is pushed onto a stack. Pressing back pops the last transaction viewed. A feature that could enhance

navigation is a redo option: temporarily store popped transactions in a secondary stack, then push them back when needed. This allows efficient forward and backward movement through transaction history.

PART B-QUEUE

A. Basis

Q1: Restaurant Serving At a restaurant in Kigali, customers are served in the order they arrive. Each new customer joins the end of the line, representing the enqueue operation, while service occurs from the front of the line, representing the dequeue operation. This demonstrates the FIFO principle, where the first person to arrive is the first served.

Q2: YouTube Playlist A YouTube playlist queues videos in the order they are added. The next video to play is dequeued from the front of the playlist. This mirrors the dequeue operation of a queue, as the first video added is the first to play, maintaining FIFO order.

B. Application

Q3: RRA Offices At RRA offices, people waiting to pay taxes form a line. Each person joins the end of the queue as they arrive, and the first person in line is served first. This real-life scenario demonstrates a FIFO queue, ensuring that customers are processed in the order they arrive.

Q4: MTN/Airtel Service Centers In MTN and Airtel service centers, SIM replacement requests are queued in order of arrival. Processing requests sequentially ensures fairness, avoids confusion, and improves efficiency. Queues provide a structured system for handling multiple requests, enhancing customer service.

C. Logical

Q5: Front of the queue in Equity Bank

Sequence of operations:

- Enqueue("Alice") → Queue: [Alice]
- Enqueue("Eric") → Queue: [Alice, Eric]
- Enqueue("Chantal") → Queue: [Alice, Eric, Chantal]
- Dequeue() → removes "Alice" → Queue: [Eric, Chantal]
- Enqueue("Jean") → Queue: [Eric, Chantal, Jean]

Front of the queue now: Eric

Q6: RSSB Pension Applications RSSB pension applications are handled in the order they arrive. Applications are enqueued upon submission and dequeued for processing. The FIFO principle ensures fairness, as earlier applicants are served first, and no one can skip the line.

D. Advanced thinking

Q7: Queue Types in Rwanda - Linear queue: people at a wedding buffet, served in the order they arrive. - Circular queue: buses looping at Nyabugogo continuously pick up passengers; after the last stop, the next bus starts again from the first stop. - Deque: boarding a bus from the front or rear allows insertion/removal at both ends, accommodating priority access while maintaining order.

Q8: Kigali Restaurant Orders Customers place orders that are enqueued into the kitchen system. As orders are prepared, they are dequeued and served to customers. This ensures orders are fulfilled in the order they were placed, maintaining a fair first-come, first-served process.

Q9: CHUK Priority Queue At CHUK hospital, emergencies are treated before others, even if they arrived later. This is a priority queue because service is based on urgency, not arrival time. Patients with higher priority are dequeued first, ensuring critical care is provided promptly.

Q10: Moto/E-Bike Taxi App Drivers are enqueued as they become available, and passengers are matched with the driver at the front of the queue. After completing a ride, drivers rejoin the rear of the queue. This system ensures all drivers have equal opportunities, maintaining FIFO fairness for passenger assignments.