

Assignment for Data Structure and Algorithms

Name: ESHIMA FRANCOISE

Reg number: 224011782

BIT GROUP 1

UNIVERSITY OF RWANDA , HUYE CAMPUS



Part 1: STACK

A stack works on the Last-In, First-Out (LIFO) principle. In real-life systems in Rwanda, we can think of stack operations like steps you take in apps or transactions. You add steps (push) and remove the most recent step (pop).

A. BASICS

1. MOMO payment: Every step of completing a MOMO payment is stored in a stack. If you make a mistake and hit 'back', the system removes your most recent step (pop), taking you to the previous one.
2. UR Canvas navigation: Every page you open in UR Canvas is pushed onto the stack. When you press back, the most recent page is popped off, showing you the previous page.

B. APPLICATION

3. BK Banking undo: Every banking action is stored on the stack. Undo simply pops the most recent transaction, restoring the previous state.
4. IREMBO forms: Stacks help verify if forms with brackets are valid. Each opening bracket is pushed, and each closing bracket pops one. If brackets don't match, there's an error.

C. LOGICAL

5. Student tasks: Imagine a student's tasks as a stack. Steps: Add 'CBE', Add 'Math', Add 'Debate', Remove top task, Add 'Group Assignment'. The top task now is 'Group Assignment', since it was the last one added.
6. ICT exam undo: If you undo 3 actions, the last 3 most recent answers are popped off. The earlier answers remain on the stack.

D. ADVANCED THINKING

7. RwandAir booking: Every step in booking a ticket is pushed onto the stack. Pressing 'back' pops the last step and takes you one step earlier.
8. Reversing words: To reverse 'Umwana ni umutware', push each word: Umwana, ni, umutware. Popping them gives: 'umutware ni Umwana'.
9. Library search: When searching deeply in library shelves, you keep going down one path (pushing). When you reach a dead end, you pop back to the previous decision point.
10. BK transaction: Sending money is a good example of push and pop in banking.

Part 2: QUEUE

A queue works on the First-In, First-Out (FIFO) principle. It is like a line of people at a bank. The first person in is the first person out.

A. BASICS

1. Restaurant: First customer in line is the first to be served. This shows FIFO clearly.
2. YouTube Playlist: Videos are arranged in a queue. The first video added plays first, followed by the next in line.

B. APPLICATION

3. RRA tax line: People take a number and wait in a queue. The first to arrive is the first to be served.
4. MTN/Airtel service center: Queues make service fair, ensuring people are served in order of arrival.

C. LOGICAL

5. Equity bank line: People in line: Alice, Eric, Chantal. Alice is served (leaves). Jean joins. The person at the front now is Eric.
6. RSSB pensions: Applications are processed in the order they arrive. This fairness means no one is skipped ahead.

D. ADVANCED THINKING

7. Queue types in Rwanda:
 - > Linear queue: A straight buffet line at a wedding.
 - > Circular queue: Buses at Nyabugogo car park; when one leaves, the space is reused.
 - > Deque (double-ended queue): Like boarding a bus from both front and back doors.
8. Restaurant orders: Orders go to the kitchen in arrival order. First order placed is cooked first.

9. CHUK hospital: This is a Priority Queue. A patient with a heart attack is treated before someone with a sore thumb, even if they arrived later.

10. Moto taxi app: The app matches the student who waited longest with the driver who has been free the longest. This ensures fairness.