UNIVERSITY OF RWANDA

COLLAGE OF BUSINESS AND ECONOMICS

DEPARTMENT OF BUSINESS INFORMATION AND TECHNOLOGY

MODULE: DATA STRUCTURE AND ALGORITHM

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ASSIGNMENt

STACK

Q1 *MTN MoMo back button as LIFO*

When you enter payment details step by step, each detail is **pushed** onto the stack. Pressing **back** removes the last entered step first. This shows LIFO because **the most recent step (last in) is the first removed (first out).**

Q2. *UR Canvas back navigation as Pop*

When you go back in Canvas, the most recent page visited is undone/removed first, just like **popping the top element** from a stack. The earlier steps remain underneath.

B. Application

Q3. *Undo function in BK Mobile Banking*

If each action (transaction, correction, typing, etc.) is **pushed** to a stack, then undoing means **popping** the last action. The stack ensures you can go backward step-by-step in the correct order.

Q4. *Balanced forms in Irembo*

Stacks ensure correctness by **pushing each opening bracket (or field)** and **popping when a matching closing bracket appears**. If at the end the stack is empty, the form fields are balanced and properly matched.

C. Logical

Q5. *Task sequence*
Steps:

- 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]

☞ **Top of stack = "Group assignment"**

Q6. *Undo 3 answers*
If the student pops (undoes) 3 actions, then the **last 3 answers** are removed, leaving only the **earlier answers still in the stack**. This ensures only the oldest unchanged work remains.

D. Advanced Thinking

Q7. *Backtracking in RwandAir booking*
Each step of filling the form is pushed. To backtrack, you pop steps one by one, retracing exactly in reverse order. That's why stacks fit perfectly for step-by-step back navigation.

Q8. *Reversing proverb*
Phrase = "Umwana ni umutware"
Steps:

- Push "Umwana", Push "ni", Push "umutware"
- Pop → "umutware"
- Pop → "ni"
- Pop → "Umwana"

☞ Reversed = **"umutware ni Umwana"**

Q9. *DFS in Kigali Library*
DFS uses a stack because it **goes deep into one shelf first**, pushing unexplored paths, and only

backtracks (popping) when no further depth is possible. A queue would explore **breadth-first**, which isn't efficient when searching deep.

Q10. *Feature for BK app navigation*
A **stack-based transaction navigation** could allow users to press **undo** to backtrack through recent transactions or corrections, ensuring they can retrace steps safely before final confirmation.

Part II – QUEUE

A. Basics

Q1. *Restaurant serving = FIFO*
First customer in line is served first. This is **First-In-First-Out** — earliest arrival gets priority.

Q2. *YouTube autoplay as dequeue*
When a video finishes, the **front of the playlist queue is dequeued**. The next video (now at the front) plays automatically. This is the same as **removing the first element** in a queue.

B. Application

Q3. *RRA tax line*
People arrive one after another and are served **in their arrival order**. This is a perfect example of enqueue and dequeue.

Q4. *Customer service improvement*
Queues ensure **fairness** — requests are processed in order, preventing confusion or jumping the line. This reduces frustration and keeps the system organized.

C. Logical

Q5. *Bank sequence*

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

☞ **Front = Eric**

Q6. *Fairness in pension applications*
Since a queue processes applications in arrival order, no one can skip ahead. Every applicant is handled fairly, ensuring orderliness.

D. Advanced Thinking

Q7. *Queue types in Rwanda*

- **Linear queue** = people waiting at a wedding buffet (first to line up eats first).
- **Circular queue** = buses looping at Nyabugogo (after finishing, they rejoin at the back).
- **Deque** = boarding a bus from either front or rear door (two-sided entry).

Q8. *Restaurant orders*
Orders are **enqueued** as customers place them. When food is ready, it is **dequeued** in the same order to call customers fairly.

Q9. *Priority queue at CHUK*
Emergency patients are **prioritized ahead of normal arrivals**. Unlike a normal queue (strict FIFO), priority queues reorder items by urgency.

Q10. *Moto/e-bike taxi app*
Drivers (supply) wait in a queue. Students (demand) are matched **in order of arrival** to the first available driver, ensuring fairness and avoiding bias.

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