BIT YEAR 2 DATABASE STRUCTURE AND ALGORITHM

Part I – STACKS

A. Basics

Q1: How does this show the LIFO nature of stacks?
In the MTN Momo app, each payment step I complete is like pushing onto a stack. When I press "back", it removes the last step I entered, just like a stack pops the last item added. That's why it behaves like LIFO—Last In, First Out.

Q2: Why is this action similar to popping from a stack?
When I'm in UR Canvas and press back, it undoes the last step or page I was on. This is like popping the top of a stack—removing the most recent action.

B. Application

Q3: How could a stack enable the undo function when correcting mistakes?
In BK Mobile Banking, each transaction can be pushed onto a stack. If I make a mistake, the app could pop the last transaction off the stack to undo it, helping me go back step by step.

Q4: How can stacks ensure forms are correctly balanced?
Stacks help by pushing opening parts of the form (like open brackets or steps), and popping them when the correct closing part is added. If something doesn't match or one is missing, the stack helps detect the error.

C. Logical

Q5: Which task is next (top of stack)?
Here's what happens:

- Push("CBE notes")
- Push("Math revision")
- Push("Debate")
- Pop() → removes "Debate"
- Push("Group assignment")

So, the top of the stack is **"Group assignment"**.

Q6: Which answers remain in the stack after undoing?
If a student undoes 3 actions (3 pops), then the last 3 pushed actions are removed. Only the earlier ones remain. For example, if they had pushed A, B, C, D, E, then popped three times (E, D, C), only **A and B** are left.

D. Advanced Thinking

Q7: How does a stack enable this retracing process?
In RwandAir booking, each step I complete is pushed onto a stack. When I want to go back, the app pops each step off in reverse order, letting me backtrack step by step—just like using a stack.

Q8: Show how a stack algorithm reverses the proverb.
To reverse “Umwana ni umutware”:

1. Push each word: Push("Umwana"), Push("ni"), Push("umutware")
2. Then pop: "umutware", "ni", "Umwana"
   So the reversed proverb is: **"umutware ni Umwana"**

Q9: Why does a stack suit this case better than a queue?
In DFS (Depth First Search) like searching shelves, a stack goes deep into one path first. It remembers where it left off using the stack. A queue would go level by level (BFS), which is not efficient for deep searching.

Q10: Suggest a feature using stacks for transaction navigation.
In the BK Mobile app, each time I view a transaction, it’s pushed to a history stack. A cool feature could be an "Undo View" or "Back to previous transaction" button that pops to the last viewed transaction.

Part II – QUEUE

A. Basics

Q1: How does this show FIFO behavior?
In a Kigali restaurant, the first customer to arrive is the first to be served. This is First In, First Out—just like a queue.

Q2: Why is this like a dequeue operation?
In a YouTube playlist, the next video automatically plays. That’s like dequeueing—the video at the front is removed (played), and the next one comes forward.

B. Application

Q3: How is this a real-life queue?
At RRA, people line up to pay taxes. Each person waits their turn. They are added at the back (enqueue), and served from the front (dequeue)—that's a perfect example of a queue.

Q4: How do queues improve customer service?
Queues make sure everyone is served fairly and in order. This avoids confusion or fighting about who goes first, especially in busy places like MTN or Airtel service centers.

C. Logical

Q5: Who is at the front now?
Here's the sequence:

- Enqueue("Alice")
- Enqueue("Eric")
- Enqueue("Chantal")
- Dequeue() → removes "Alice"
- Enqueue("Jean")

Now the queue is: Eric, Chantal, Jean → **Eric** is at the front.

Q6: Explain how a queue ensures fairness.
Since a queue serves people in the order they arrive (FIFO), it means no one can jump ahead. That way, everyone is treated fairly—like in RSSB applications.

D. Advanced Thinking

Q7: Explain how each maps to real Rwandan life.

- **Linear queue** – At weddings, people line up for food one after the other.
- **Circular queue** – Buses at Nyabugogo loop back and start again like a cycle.
- **Deque** – When boarding buses, some people enter from the front, some from the back—like a double-ended queue.

Q8: How can queues model this process?
At restaurants, when people order, each order is enqueued. When the food is ready, it's dequeued (called out). This keeps orders organized and fair.

Q9: Why is this a priority queue, not a normal queue?
At CHUK hospital, emergencies are more urgent. They are served first even if they arrived later. That's what makes it a **priority queue**—patients are ranked by urgency, not by arrival.

Q10: How would queues fairly match drivers and students?
In a moto/e-bike app, students request rides. The first rider available is matched with the first student waiting. Using a queue ensures both drivers and passengers are matched in order and fairly.