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Data structure and algolithm assignment 3

Project 80

Stack Questions

1. Practical (Rwanda): UR pushes ["Course1", "Course2", "Course3"]. Undo all. Which remains?

Step 1: Push Course1 → Stack = [Course1]

Step 2: Push Course2 → Stack = [Course1, Course2]

Step 3: Push Course3 → Stack = [Course1, Course2, Course3]

Undo (pop Course3) → [Course1, Course2]

Undo (pop Course2) → [Course1]

Undo (pop Course1) → []

Answer: Nothing remains (stack is empty).

2. Practical (Rwanda): In Irembo, push ["Step1", "Step2", "Step3"]. Undo 1. Which is left?

Push Step1 → [Step1]

Push Step2 → [Step1, Step2]

Push Step3 → [Step1, Step2, Step3]

Undo (pop Step3) → [Step1, Step2]

Answer: Step2 is on top.

3. Challenge: Push ["X", "Y", "Z"], pop one, push "W". Which is top?

Push X → [X]

Push Y → [X, Y]

Push Z → [X, Y, Z]

Pop (removes Z) → [X, Y]

Push W → [X, Y, W]

Answer: W is on top.

4. Reflection: Why stack models reverse sequences?

A stack uses Last-In-First-Out (LIFO).

The most recent item goes on top and is removed first.

This naturally reverses the order of items: pushing them in sequence and popping them retrieves them in the opposite order.

Example: pushing [A, B, C], popping gives [C, B, A].

Answer: Stacks reverse sequences because LIFO ensures the last element added comes out first.

Queue Questions

1. Practical (Rwanda): At Nyabugogo, 10 buses queue. After 5 depart, who is front?

Queue = [Bus1, Bus2, Bus3, Bus4, Bus5, Bus6, Bus7, Bus8, Bus9, Bus10]

5 depart (Bus1 → Bus5) → [Bus6, Bus7, Bus8, Bus9, Bus10]

Answer: Bus6 is now at the front.

2. Practical (Rwanda): At CHUK, 8 patients queue. Who is served last?

Queue = [P1, P2, P3, P4, P5, P6, P7, P8]

FIFO means last in line (P8) is served last.

Answer: Patient 8.

3. Challenge: Queue vs stack for lunch line. Which is fair?

A queue (FIFO) ensures first-come, first-served → fair for lunch lines.

A stack (LIFO) would serve the last arrival first, unfair to those who came earlier.

Answer: Queue is fair because FIFO gives service in arrival order.

4. Reflection: Why FIFO ensures fairness in dining halls?

FIFO respects the order of arrival.

Prevents conflicts since earlier arrivals are served first.

Maintains discipline and fairness in shared services like dining halls.

Answer: FIFO ensures fairness because everyone is served in the order they arrived.