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BIT LEVEL 2 – DATA STRUCTURES EXERCISE

PROJECT 78 – STACKS AND QUEUES

Stack Questions

1. Practical (Rwanda): UR example

At the University of Rwanda, let's picture a student saving lecture notes one by one. First, the student saves *Note1*, then *Note2*, and finally *Note3*. All these notes are stored in a stack where the last one added, *Note3*, is on top.

If the student decides to undo two actions, the last two notes are removed first, which means *Note3* and *Note2* disappear. The only note that remains in the stack is **Note1**, because it was the first one added and not yet undone.

This example shows how stacks work when it comes to removing actions: the last items added are always the first to be removed.

2. Practical (Rwanda): Irembo example

On the Irembo platform, a person follows three steps when applying for a service:

1. *Upload File*

2. *Fill Details*

3. *Confirm*

If something goes wrong and the person undoes one step, the stack removes the most recent action, which is *Confirm*. That leaves behind **Upload File** and **Fill Details** in the stack.

This shows that Irembo and other online platforms can use stack operations to handle actions like undo, ensuring that only the latest step is affected first.

3. Challenge

Suppose we push the numbers **1, 2, 3, and 4** into a stack. The stack now looks like this: [1, 2, 3, 4], with *4* at the top.

If three elements are popped out, then 4, 3, and 2 are removed in that exact order. The only element left in the stack is *1*. After this, if we push another number, which is *5*, the stack becomes [1, 5]. The new top element is **5** because it was the last one added.

This demonstrates how the push and pop operations keep changing the contents and the order of the stack.

4. Reflection

A stack represents memory history because it follows the principle of **Last In, First Out (LIFO)**. In many computer systems, the most recent task is the first one removed from memory.

Think about browsing history: when you open several pages, the newest page is always the one you go back from first when you press the "back" button. The older pages remain further down in the stack.

This is why stacks are useful for representing memory — they naturally match the way computers and even human memory handle the latest information first.

Queue Questions

1. Practical (Rwanda): Nyabugogo example

At Nyabugogo bus park, buses line up before departing. Let's say there are 12 buses waiting. Once 8 buses leave, the line moves forward. The bus that was originally in the 9th position now becomes the first one in front.

So, after 8 buses depart, the **9th bus is at the front** of the queue.

This clearly shows how queues operate on the **First In, First Out (FIFO)** principle, meaning the buses leave exactly in the order they were arranged.

2. Practical (Rwanda): CHUK example

At CHUK hospital, imagine there are 5 patients waiting to see a doctor. The patients are served in the order they arrived. That means the first patient is served first, and the second patient is the next one to go in.

So, the patient who is served second is simply the **second person in line**.

This is a real-life reflection of how queues manage order fairly in health facilities.

3. Challenge: Graduation ceremony seating

During a graduation ceremony, it makes more sense to organize people with a queue system instead of a stack. In a queue, students are seated in the order they arrived or registered, which makes everything fair and organized.

If a stack was used, the last student to arrive would be seated first, which would create confusion and unfairness. That is why **queues are the correct structure** for handling seating arrangements during ceremonies.

4. Reflection

The FIFO principle ensures fairness in ceremonies because everyone is treated equally. Those who arrived earlier get seated earlier, and those who came later wait for their turn.

This prevents fights, complaints, or disorganization. In big events like graduation, such order is very important because it keeps everything running smoothly and shows respect for the efforts of those who came on time.