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Module: DSA (Data Structures and Algorithms)

Assignment

Year: Two BIT

1. Push/Pop, when we say Push, it means adding (inserting) an item into the stack.

-Pop means removing (taking out) the top item from the stack. A stack has only one open end (the top) you cannot remove from the bottom because everything else is blocking it. That is why it is called Last In, First Out (LIFO).

Q1. The MoMo app shows the LIFO nature of stacks because the last step you entered is always the one removed when you go back. For instance, when using MoMo app, you enter payment details step by step.

Step 1 = *182*1*1*recipient's number*amount (frw)*PIN#

So, if you press back, the app removes the most recent step, the last one you added. Pop operates that by removing the top of the stack.

Q2. This action is like popping a stack, this is because when you are learning in UR Canvas, you move through these steps.

1. Open the course.

2. Go to Module
3. Open Lesson
4. Open Quiz

The app removes the top item , it means the last thing you opened, If you are in the quiz and press back the quiz is removed and you go back to the lesson, press back again lesson will removed and you go to back to the module. That is the same as in Pop in stack, remove the top (The last item added) and in Canvas Back removes the last page opened and shows the previous one. Means that pressing back in Canvas is just like doing Pop operation in a stack.

A. Application

Q3. A stack enables the undo function because it stores every action you make in order, with the most recent action always on the top. When you perform an action, it pushed onto the stack(added), when you want to undo the system simply pops were made from the stack.

Example: If you want to perform actions step by step at BK Mobile Banking:

- 1.Transfer money
- 2.Pay electricity bill
- 3.Pay Application fees

Thes actions are pushed onto the stack in order: Transfer-Pay Electricity-Pay Application fees. If you make a mistake let say you pay much money than what you supposed to pay on Application fees, the undo function will Pop the last action

from the stack. The system looks at the top of the stack (pay application fees), remove it, and cancels/reverses it.

Now the stack becomes (Transfer -pay electricity) If you press undo again, it removes “pay electricity” then stack becomes (Transfer)

Undo is naturally a reverse of your last step and stacks are last perfect for this because they always deal with the most recent action first.

Q4. Matching brackets is like opening and closing doors. You open one, then another, and you must close them in reverse order. A stack helps track that sequence.

C. Logical

Q5: After pushing "CBE notes", "Math revision", and "Debate", then popping "Debate", and pushing "Group assignment", the top of the stack is Group assignment, the last thing added.

Q6: If you undo three actions from a stack of five, you are left with the first two. It is like peeling off sticky notes, you remove the top ones first.

D. Advanced Thinking

Q7: When booking a bus ticket, each step—selecting route, time, seat is pushed onto a stack. If you go back, you pop each step one by one.

Q8: Reversing “Umwana ni umutware” using a stack gives you “umutware ni Umwana.” You push each word, then pop them in reverse.

Q9: DFS (Depth-First Search) is like exploring a maze by going deep into one path before backtracking. A stack helps you remember where you have been.

Q10: In a money app, you could use a stack to track recent transactions. Pressing “undo” would pop the last transaction and show the previous one.

QUEUE

➤ Think of it like a line at the bank.

A. Basics

Q1: At the bank, the first person to arrive is the first to be served. That is a queue—First In, First Out.

Q2: In a playlist, the first song plays, then the next. Each song waits its turn, just like people in line.

B. Application

Q3: At RRA, people line up. Each new person joins the end of the queue, and the first person gets served first. Simple and fair.

Q4: Queues help keep order. Everyone knows their turn is coming, and no one gets skipped.

C. Logical

Q5: After enqueueing "Emille", "Elia", "Chantal", then dequeuing "Emille", and enqueueing "John", the front of the queue is **Elia**.

Q6: FIFO ensures fairness. If you apply for something, you are processed in the order you arrive no jumping ahead.

D. Advanced Thinking

Q7:

- **Linear queue:** Like a buffet line—one way, no turning back.
- **Circular queue:** Like buses at Nyabugogo—they loop and reuse space.
- **Deque:** Like boarding a bus from either front or back flexible.

Q8: In a restaurant, orders are taken and placed in a queue.

When ready, they are served in order first ordered, first served.

Q9: At CHUK, emergencies jump ahead. That is a priority queue—urgent cases get treated first, even if they arrived later.

Q10: Students request rides. Drivers are matched in order. The first student gets the first available driver just like a queue.