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BIT - Data structure Exercise - number 2

Part I – STACK

A. Basics

Question 1:
In MoMo app, when we enter payment steps like: *choose number - enter amount - confirm*, if we press back, the last step (*confirm*) goes first. This is LIFO (Last In First Out). The step we entered last is the first one to go away.
Example: If I enter amount of money then my MoMo PIN, pressing back delete MoMo PIN first.

Question 2:
In UR Canvas, moving through course modules step by step, pressing back removes the last visited one. This is like Pop, because Pop removes the top item in a stack.
Example: If you visit UR Canvas then check *Module: Data Structure and Algorithm – Chapter 1 – Sub chapter 1*, pressing back removes Sub chapter *1* first.

B. Application

Question 3:
In BK Mobile Banking, every transaction (like sending money or paying bills) is stored one after another in a list. If we want to undo, we can Pop the last transaction.
Example: If I *Send Rwf1000 - Pay Electricity - Pay Water Bill*, undo will remove Water Bill first.

Question 4:
In Irembo forms, opening bracket is like starting a field, closing bracket is like ending it. If every open has a correct close, the form is correct.
Stack makes sure for each Push (open) there is a Pop (close).
Example: Like typing *(Name [Ange])*. Balanced. But *(Name [Ange)* is not balanced.

C. Logical

Question 5:
Steps:

i. Push CBE notes

ii. Push Math revision

iii. Push Debate

iv. Pop Debate

v. Push Group assignment

Now top = Group assignment.
Example: If those were books piled on table, last book on top would've been Group assignment.

Question 6:
If a student undoes 3 actions (delete 3 answers), the last 3 disappear. Only earlier answers remain.
Example: If answers were [A1, A2, A3, A4, A5], undo 3 removes A5, A4, Q3. Left [A1, A2].

D. Advanced Thinking

Question 7:
In RwandAir booking, every step is pushed (choose city - choose date - confirm seat). If passenger goes back, pop removes confirm seat, then date, then city.
Example: Getting back to the first step in a game, pop removes recent steps one by one.

Question 8:
Sentence "Umwana ni umutware". Push each word:
Umwana - ni - umutware.
Now pop = umutware, ni, Umwana.
Reversed sentence = "umutware ni Umwana".
Example: Like writing on paper then erasing in reverse order.

Question 9:
DFS = go deep into shelves in library. Stack helps because it remembers last shelf visited.
Queue would go wide (line by line) which is not deep.
Example: If looking for a book, stack lets you check one shelf all the way before going back.

Question 10:
BK app could add a feature: *Undo last transaction view*. Each navigation is pushed. Going back (pop) helps user check last step without starting again.
Example: If you checked *Deposit → Transfer → Bills*, pop takes you back from Bills to Transfer.

Part II – QUEUE

A. Basics

Question 1:
At a restaurant in Kigali, first customer who enters is served first. That is FIFO (First In First Out).
Example: If Alice comes first in restaurant, Eric comes second, then Chantal comes last, Alice will be served first.

Question 2:
In YouTube playlist, the first video in the list plays first, next one after it. This is like dequeue from the front.
Example: Playlist has list of Song A, Song B, and Song C. Song A plays first.

B. Application

Question 3:
At RRA offices, people wait in a line to pay taxes. The first who came pays first. This is real queue.
Example: Person A comes 9am, person B comes 9:30am. Person A is served first.

Question 4:
At MTN/Airtel centers, SIM replacement is done one by one in order. This avoids confusion and improves service.
Example: Without queue, last person could be served before first, which is unfair.

C. Logical

Question 5:
Queue steps:

- Enqueue Alice
- Enqueue Eric
- Enqueue Chantal
- Dequeue Alice
- Enqueue Jean

Eric is one who is on the front.

Question 6:
In RSSB, pension forms are served by order of arrival. Queue ensures no one skips line.
Example: If five people arrive, the first one get served then second one, third one next, then fourth, and finally fifth get served lastly.

D. Advanced Thinking

Question 7:

- Linear queue: during wedding buffet, when people are doing self-service (getting food), line starts and then ends, no looping
- Circular queue: buses at Nyabugogo, after last stop they return and start again, they loop.
- Deque: a bus with both front and back doors, people can get inside or outside using both doors.

Question 8:
In Kigali restaurant: customers order - food goes in queue - when ready, customer will be served.
Example: Order list: Pizza, Chips, Rice. First ready: Pizza, served first.

Question 9:
At CHUK hospital, emergencies go first even if they came last. This is priority queue, not normal queue.
Example: If patient who have stomachache comes first but a patient with bruises from car accident comes later, the patient with bruises is served first.

Question 10:
In moto/e-bike app: Riders wait in line, passengers also wait. System matches in order.
Example: First rider gets first passenger, second rider gets second passenger. This is fair matching.