UNIVERSITY OF RWANDA

COLLEGE OF BUSINESS AND ECONOMICS

BIT DEPARTMENT

BIT: GROUP 1

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MODULE TITLE:DATA STRUCTURE AND ALGORITHM

ASSIGNMENT:2

QUESTIONS AND ANSWERS FOR BOTH PARTS (PART1: STACK AND PART2: QUEUE)

PART1. STACK

A: Basics

Operations: Push/Pop (LIFO)

Q1. How does this show the LIFO nature of stacks?

When you press back in MTN MoMo, it removes the last step you entered which shows LIFO (Last In First Out) because the last thing you did is the first thing removed. It means the most recent action is handled first ,Older steps stay in memory until removed.
So you retrace steps in reverse order.

Q2. Why is this action similar to popping from a stack?

In UR Canvas pressing back removes the last page or module you opened which is like pop because pop removes the last item from the stack. The navigation history is stored as a stack and popping retrieves the last module visited, following LIFO. This is exactly how pop works on a stack, Only the top-most (latest) page is removed.

B. Application

Operation: Push (Add to stack)

Q3: How could a stack enable the undo function when correcting mistake?

When you click undo, the stack removes (pops) the last action you did, so you go back step by step until the mistake is corrected as each action you do is stored on the stack. This removes the most recent mistake first. Older work stays unchanged and you can pop many times to undo step by step.

Q4: How can stacks ensure forms are correctly balanced?

When filling forms, each opening field is pushed into the stack and when you finish it is popped and at the end if the stack is empty everything is matched and balanced correctly. If something is left unmatched, stack will not be empty .This shows there is missing data.It ensures form fields are filled correctly.

C. Logical

Operation: Push and Pop sequence

Q5: Which task is next (top of stack)?

Push ("CBE notes"), push ("math revision")

Push ("debate"), pop() remove "debate",

Push ("group assignment")

So the stack is now :[CBE notes,math revision ,Group assignment]

Next to pop is "Group assignment"

Q6: Which answers remain in the stack after undoing?

If the stack contains actions [A1,A2,A3,A4,A5] (A5 being the most recent), undoing 3 actions means popping A5,A4, and A3. The stack now contains [A1,A2]. The exact answers depend on the initial stack but only the first two actions remain. Undo works step by step from latest to oldest. Remaining answers are the first ones done, So only initial answers stay in memory.

D. Advanced thinking

Operation:Undo with multiple Pops.

Q7: How does a stack enable this retracing process?

In RwandaAir's booking process, each step is pushed onto the stack .To retrace the app pops the top step returning to the previous one following LIFO to navigate backward through the sequence of actions. You return to the previous page after each pop. This allows step-by-step retracing,You stop popping when you reach the desired step.

Q8: Show how a stack algorithm reverses the proverb.

Push each word on stack:

Push ("Umwana")

Push ("ni")

Push ("Umutware")

Then pop to reverse order:

Pop() →"umutware"

Pop() →"ni"

Pop()→ "umwana"

Reversed: "Umutware ni Umwana"

Q9: Why does a stack suit this case better than a queue?

In a deep search (DFS) you need to go deep into one shelf and if nothing found go back step by step to try another path, a stack helps to backtrack easily (pop last step) and continue searching while aqueue searches level by level (not deep).

Q10: Suggest a feature using stacks for transaction navigation.

A recent transactions undo/redo feature could use two stacks; one for transaction history and another for undone actions. Popping from the history stack undoes a transaction pushing it to the redo stack. Popping from the redo stack re-applies the transaction seamless navigation and correction.

PART II: QUEUE

A.Basics

Operation:Enqueue (add at rear), Dequeue (remove from front)

Q1: How does this show FIFO behavior?

At a restaurant the first customer to join the line is served first, this shows FIFO (First in first out) because, people are served in order they arrive.

Q2: Why is this like a dequeue operation?

In a YouTube play list, the first video in the list plays first and then the next one comes after, this is like dequeue because it removes the first item from the queue and moves to the next, maintaining FIFO. This is just like dequeuing the front element,The playlist continues in order Nothing skips ahead.

B. Application

Operation: Enqueue (job submission).

Q3: How is this a real-life queue?

At RRA offices people wait in the line to pay taxes ,this is areal queue because everyone waits their turn and is served one by one. This FIFO Structure ensures orderly and fair processing of tax payments.

Q4: How do queues improve customer service?

In MTN/AIRTEL Queues ensure sim replacement requests are processed in the order received (FIFO) reducing wait time disputes and ensuring fairness. This organized approach improves efficiency and customer satisfaction by maintaining a predictable service flow.

C. Logical

Operation:Sequence of Enqueue/Dequeue.

Q5: Who is at the front now?

Operations:

Enqueue(Alice), Enqueue(Eric), Enqueue(Chantal),Dequeue(Alice),Enqueue(Jean)

Order now :[Eric,Chantal,Jean]

After Dequeue(),Alice is removed.so, Eric is at the front.

Q6: Explain how a queue ensures fairness.

A queue processes RSSB pensions applicants in the order they are received(FIFO), ensuring that earlier applicants are handled before later ones. This prevents favoritism or skipping, promoting fairness by respecting arrival time.

D. Advanced thinking

Operation: Different queue types.

Q7: Explain how each maps to real Rwandan life

Linear Queue:people lining at wedding buffet,the first person arrive is served first,and the last person waits for everyone ahead to finish.

Circular queue:Like buses at Nyabugogo,when bus finishes a trip.it goes back to the end of the line and wait for its turn to leave again.

Deque: Like passengers boarding a bus from both the front and back doors ,people can enter or leave from either ends.

Q8: How can queues model this process?

At Kigali restaurant When customer enqueue their orders, when the food is ready the kitchen dequeues the first order(FIFO)ensuring orders are prepared and served in the sequence they were received maintaining fairness and efficiency.

Q9: Why is this a priority queue, not a normal queue?

At CHUK hospital ,emergencies are treated first even they arrived last this is a priority queue because order depends on how urgent the case is not just the arrival time.

A normal queue would make emergencies wait which could be dangerous, This saves lives in hospitals while Other patients wait their turn.

Q10: How would queues fairly match drivers and students?

In a moto bike /e-bike app a queue can manage riders by enqueuing them as they become available. students requesting rides are matched with the driver at the front ensuring the longest waiting driver gets the next ride. This FIFO approach ensures fairness by prioritizing drivers based on waiting time.

END.