DATA STRUCTURE ASSIGNMENT

PROJECT 11

STACK QUESTION

Challenge: Reverse “STACKFIFO” using stack

The reverse the string "STACKFIFO" by simulating a stack.

High-level idea: push every character onto the stack, then pop them off; popping yields characters in reverse order (because the last pushed is the first popped

Algorithm (Step-by-step)

1. **Initialize an empty stack**.
2. **Push each character** of `"STACKFIFO"` onto the stack one by one.
    - After pushing: Top of stack = last character `'O'`.
3. **Pop characters one by one** from the stack and append them to a new string.
    - Since stack follows **LIFO**, the last pushed character comes out first.
4. The new string formed will be the **reverse** of the original string.

Example Execution

Original string:

```
S T A C K F I F O
```

- Push order: `S → T → A → C → K → F → I → F → O`
- Pop order: `O → F → I → F → K → C → A → T → S`

So, reversed string = **"OFIFKCATS"**

Python-like Pseudocode

```
stack = []
for ch in "STACKFIFO":
    stack. append(ch) # push

reversed_str = ""
while stack:
    reversed_str += stack.pop ()  # pop

print(reversed_str) # Output: OFIFKCATS
```

Reflection: Why stack ensures LIFO behavior?

- A stack is a data structure where insertion (`push`) and deletion (`pop`) happen only at one end (the top).
- Because of this rule:
    - The last element pushed is the first one popped.
- Example: If you pile up plates, the last plate placed on top is the first one removed.
- This Last-In, First-Out (LIFO**)** principle ensures order is reversed automatically when elements are popped.

QUEUE: QUESTION

Challenge: Queue vs Stack for Distributing ID Cards

- If we use a Stack (LIFO):
    - The last student who arrives will get their ID card first.
    - This is unfair because people who came earlier will keep waiting while latecomers get served first.
    - It causes confusion and conflict.
- If we use a Queue (FIFO):
    - The first student who arrives is the **f**irst to receive their ID card.
    - Everyone is served in the order they came.
    - This is fair and organized, so no one feels cheated.

Therefore, a Queue works better for distributing ID cards.

Reflection: Why FIFO avoids conflicts in government services?

- In government offices (e.g., national ID, passport, tax services), people **arrive at** different times.
- FIFO **(**First-In**,** First-Out**)** ensures that:
    - The earliest person in line is served first.
    - Nobody is skipped or ignored.
    - It prevents arguments, pushing, or bribery because order is transparent.
- Just like at RRA offices or hospital waiting lines, FIFO maintains fairness and peace.