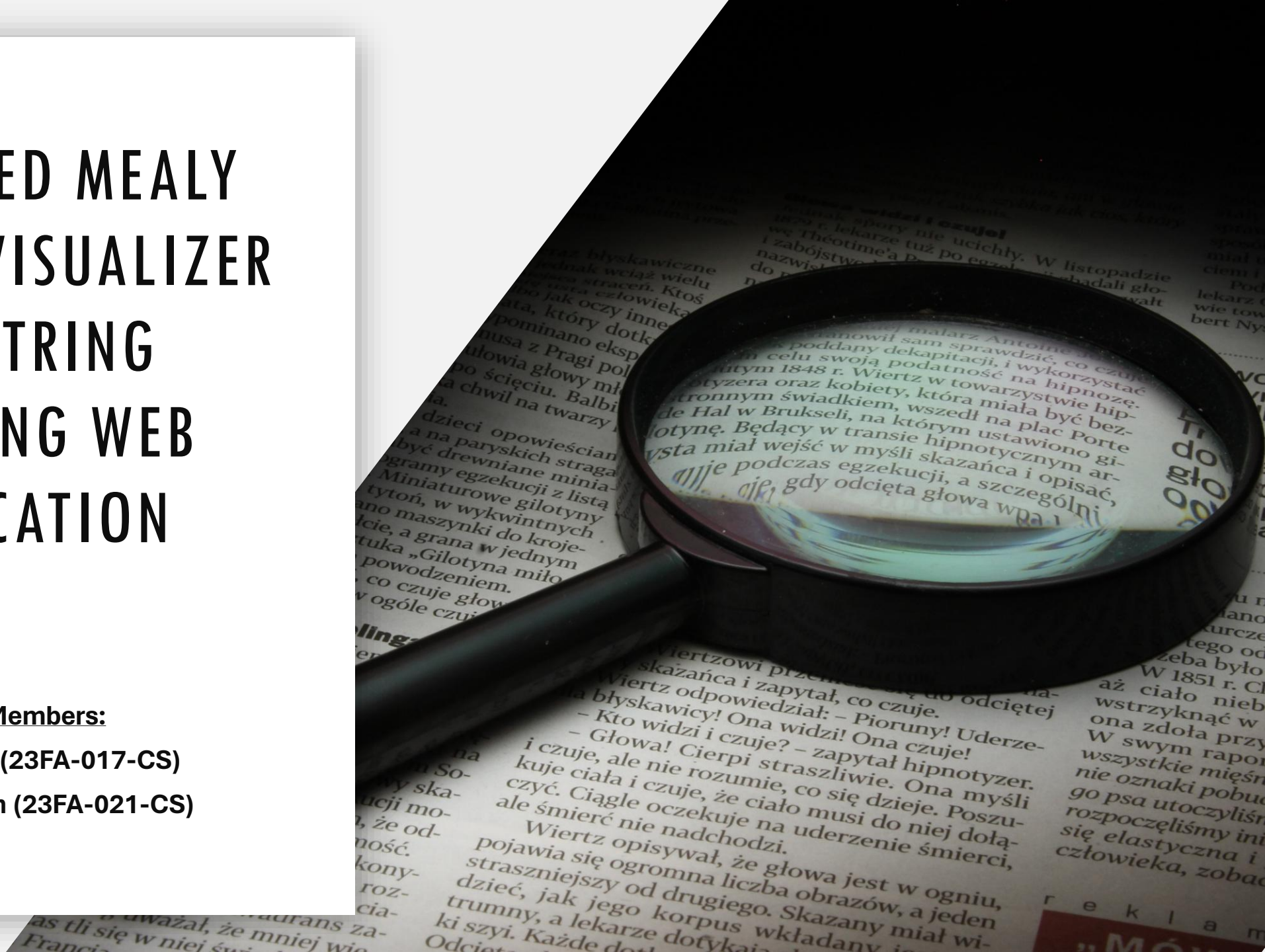
KMP-BASED MEALY MACHINE VISUALIZER AND STRING MATCHING WEB APPLICATION



Group Members:

Javaria Owais (23FA-017-CS)

Sahir Ul Hassan (23FA-021-CS)

THE PROBLEM

We want to **find a small word (pattern)** inside a **big word (text)**.

Example:
Text = ababcabac
Pattern = abac
We want to find where **abac** appears in the text.

Naive Algorithm (slow)	KMP Algorithm (smart)
Start matching from the beginning and if a mismatch happens, it starts again from the next character	It remembers what it has already matched; never goes backward. It uses LPS array for transitions
This wastes time because we recheck characters we already know	This saves time and avoid rechecking characters (more efficient)
Time complexity: O(n * m)	**Time complexity:** O(n + m)

LPS (Longest Prefix that is also Suffix)

prefix: starting part of the string

suffix: ending part of the string

Note: It cannot be the whole string

lps = [0, 0, 1, 0]

Meaning: at index 2, ‘a’ matches the beginning ‘a’

Example pattern: abac

We calculate LPS for each position:

Index	Pattern	Prefix-Suffix Length
0	**a**	**0**
1	**b**	**0**
2	**a**	**1**
3	**c**	**0**

WORKING (1/2)

KMP as a Finite Automaton (FA)

- **Automaton Modeling**

States: Represent number of matched characters of the pattern

States = {0, 1, 2, ..., m}

Valid Characters: {a, b} or {0, 1}

Start State: State 0 (no characters matched)

Accepting State: State m (full pattern matched)

WORKING (2/2)

KMP as a Finite Automaton (FA)

How We Build Transitions?

We do not use any Python's built-in String Searching function or any external Automata library.

Transition function δ(state, input) is computed using:

LPS Array

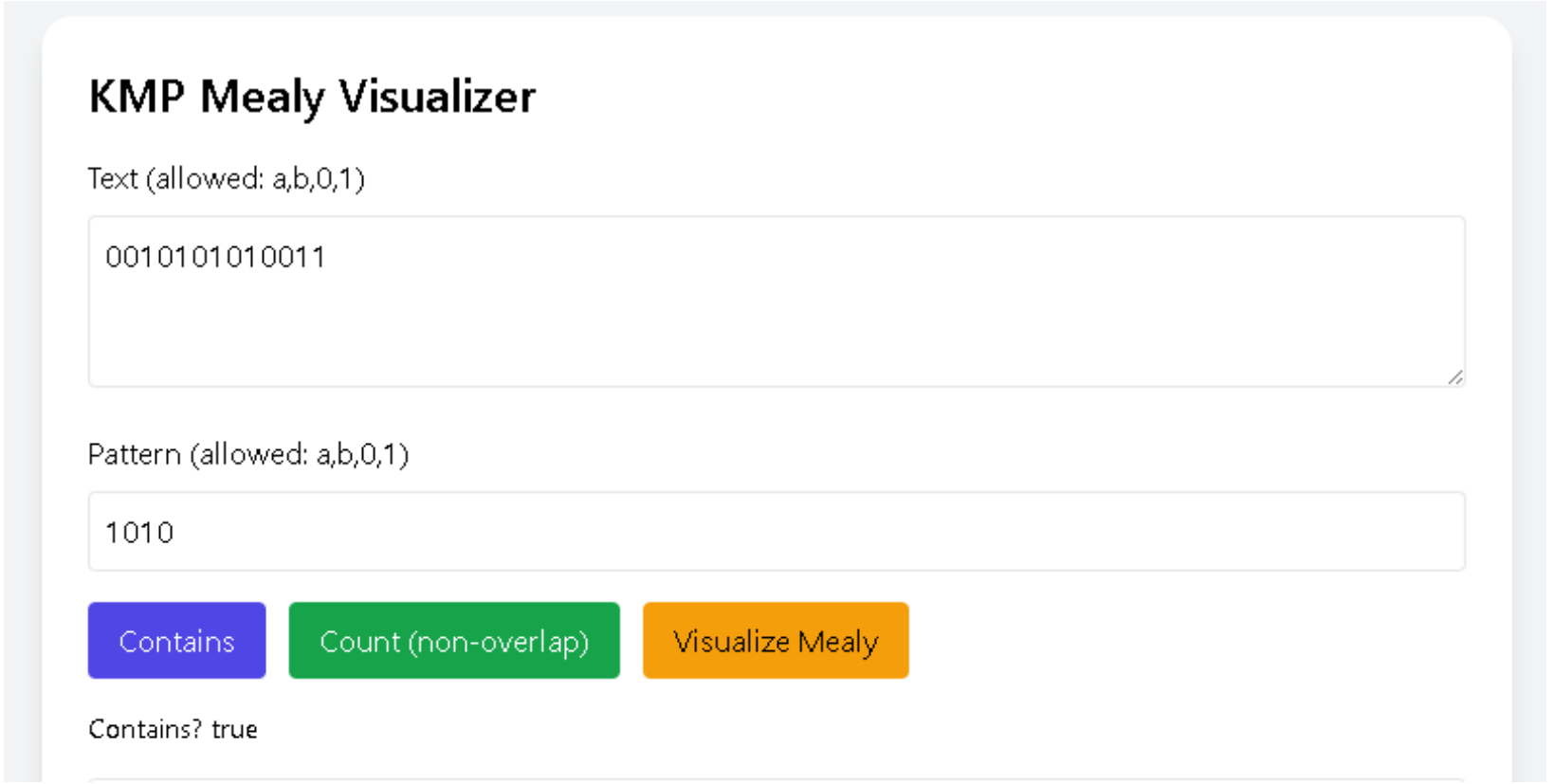
On match → move to next state

On mismatch → fall back using **lps[state - 1]**

This simulates FA transitions efficiently

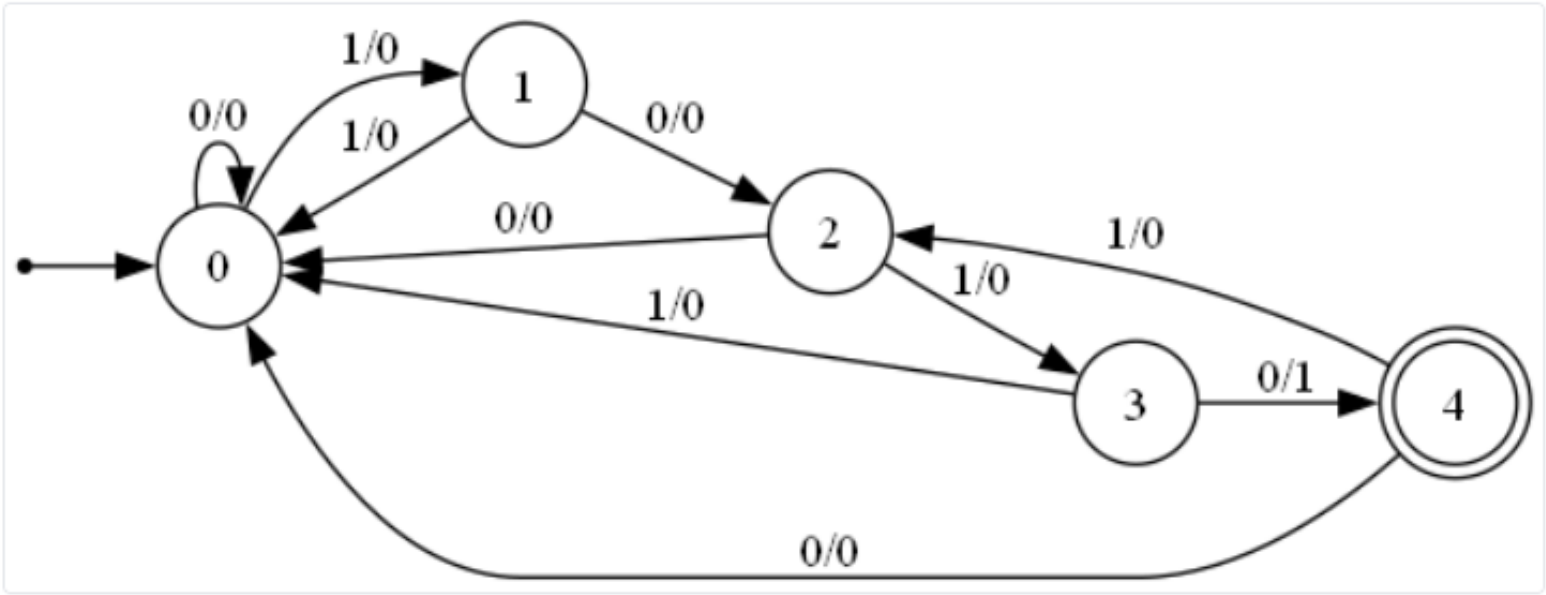
IMPLEMENTATION (1/2)

KMP as a Finite Automaton (FA)



IMPLEMENTATION (2/2)

KMP as a Finite Automaton (FA)



Note: pattern and text must use only the characters a,b or 0,1. Open this page from the Flask server at `http://127.0.0.1:5000`.

THANKYOU!