Riphah International University Islamabad

Faculty of Computing

Semester Project Proposal

Submitted To:

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Course: Theory of Automata

Section: BSCS 5-1

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1. Introduction

This project demonstrates the practical implementation of automata theory concepts by converting a regular expression into various automata forms and performing string recognition. The project implements the complete pipeline from Regular Expression (RE) to Non-deterministic Finite Automaton (NFA), then to Deterministic Finite Automaton (DFA), and finally to a minimized DFA.

2. Regular Expression

Regular Expression: **aba + bb + c (aaa + aa + a) ***

This expression represents three alternative patterns:

- aba: Exact string "aba"
- bb: Exact string "bb"
- c (aaa + aa + a) *: String starting with 'c' followed by zero or more occurrences of a’s

3. Automata Concepts Used

Thompson's Construction

- **Purpose**: Convert regular expressions to NFA

Subset Construction

- **Purpose**: Convert NFA to DFA

DFA Minimization (Table-Filling Algorithm)

- **Purpose**: Reduce number of states in DFA for better resource utilization

4. Implementation Details

- **Programming Language:** Python 3
- **Modules:** nfa.py, dfa.py, regex_to_automata.py, display.py and main.py

5. Class Structure

- `NFAState`: Represents a state in NFA with transitions
- `NFA`: Complete NFA with start and final states
- `DFAState`: Represents a state in DFA
- `DFA`: Complete DFA structure
- `RegexToAutomata`: Main converter class

6. Core Functionality

- ☑ Regular expression validation
- ☑ RE to NFA conversion (Thompson's Construction)
- ☑ NFA to DFA conversion (Subset Construction)
- ☑ DFA minimization (Table-Filling Algorithm)
- ☑ String simulation and acceptance testing

7. Results and Examples

Test String	Expected Result	Actual Result	Status
aba	Accepted	Accepted	☑
bb	Accepted	Accepted	☑
c	Accepted	Accepted	☑
ca	Accepted	Accepted	☑
caa	Accepted	Accepted	☑
caaa	Accepted	Accepted	☑
a	Rejected	Rejected	☑
ab	Rejected	Rejected	☑
cab	Rejected	Rejected	☑

8. Sample Output

==========

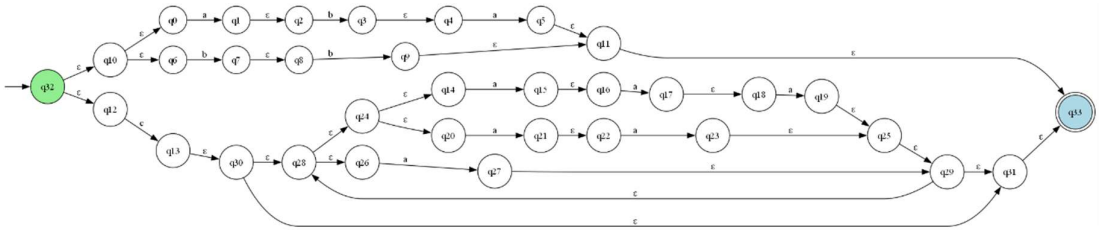
```
q1 --b--> q2
q2 --a--> q3
Ended at state q3 (FINAL)

✓ String ACCEPTED
```

==========

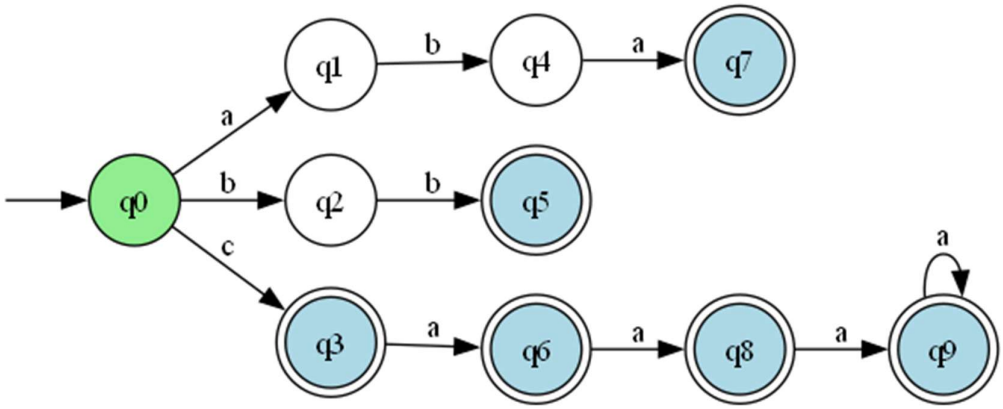
```
q1 --b--> q2
q2 --a--> q3
Ended at state q3 (FINAL)

✓ String ACCEPTED
```

==========

9. Complete NFA using Thompson Construction



10. Complete DFA using Subset Construction



11. Minimized DFA