Lexical Analysis
Programming Languages

Sujit Kumar Chakrabarti

IIITB

FSA and Lexical Analysis

1. Each token class has an FSA.
2. FSA acts as the recogniser of a token.
3. FSA simulated to accept or reject a string.

FSA and Lexical Analysis

1. Each token class has an FSA.
2. FSA acts as the recogniser of a token.
3. FSA simulated to accept or reject a string.

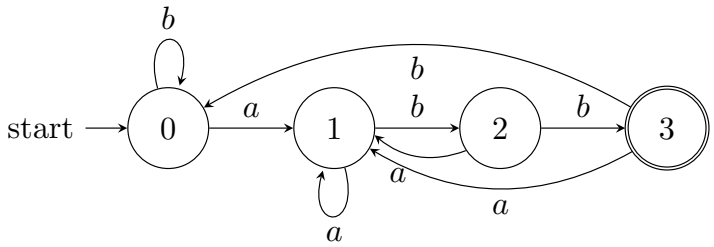
FSA simulation is central to lexical analysis.

Deterministic FSA (DFA)

- Finite set of states – (S)
- Alphabet - $(\sum)$
- Transition function $(T : S \times \sum \rightarrow S)$
- Initial state (S_0)
- Final/accepting states $(F \subseteq S)$
- **Acceptance of a string:** When there exists a path corresponding to the input leading to an accepting state.

Simulating FSAs

Representating transition function using transition tables

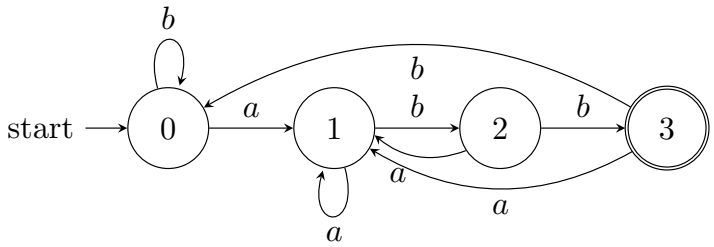


Transition Table:

State	a	b
0		
1		
2		
3		

Simulating FSAs

Representating transition function using transition tables



Transition Table:

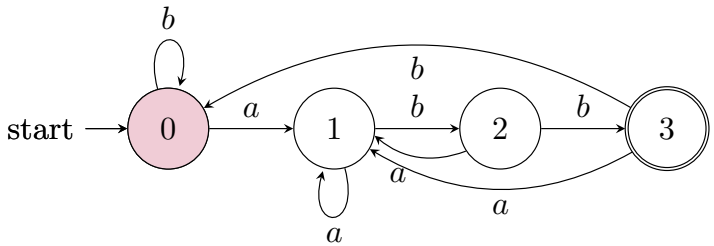
State	a	b
0	1	0
1	1	2
2	1	3
3	1	0

Simulation of DFA

```
procedure simDFA(D, inp)
    s ← D.s0                                   ▷ D.s0: initial state
    while there is input left do
        c ← nextChar
        s ← D.move(s, c)          ▷ Extract next state from transition table
        if s = nil then
            break
        end if
    end while
    if s ∈ D.F then                            ▷ D.F: Final states
        return true
    else
        return false
    end if
end procedure
```

Simulation of DFAs

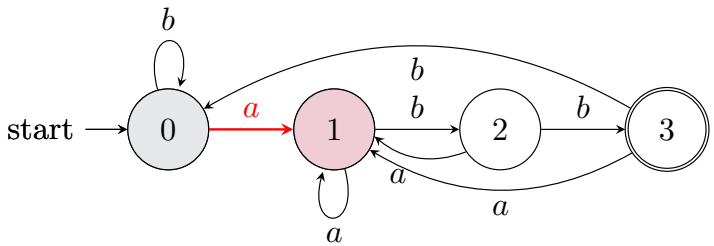
Example 1



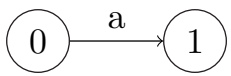
Input: *aabbabb*

Simulation of DFAs

Example 1

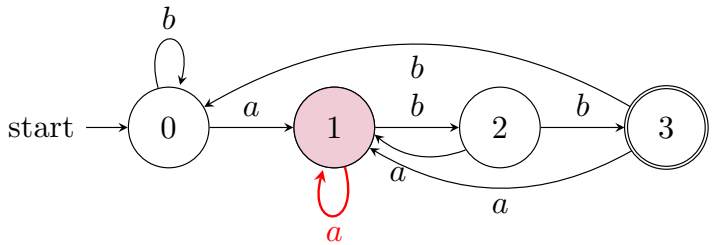


Input: **a***abbabb*

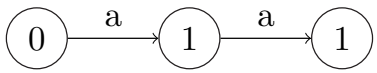


Simulation of DFAs

Example 1

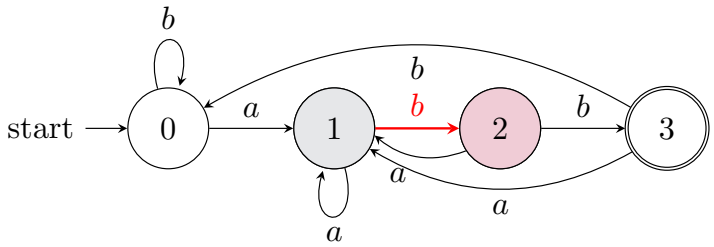


Input: *aabbabb*

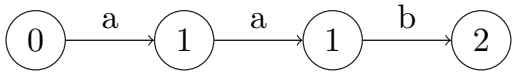


Simulation of DFAs

Example 1

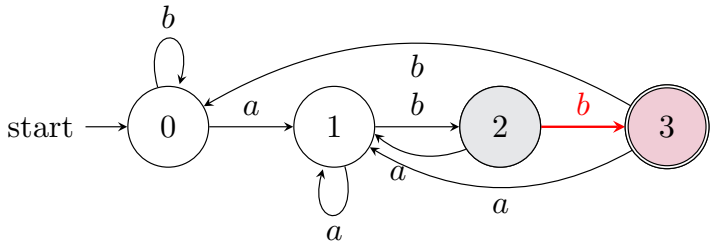


Input: $aabbabb$

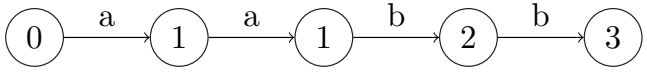


Simulation of DFAs

Example 1

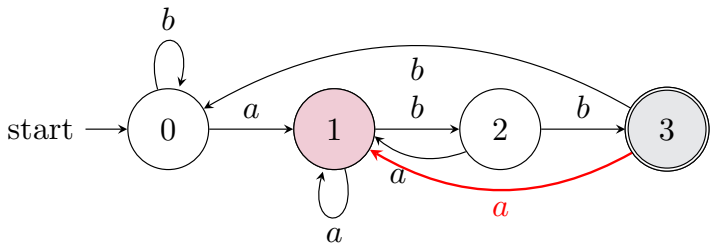


Input: $aabbabb$

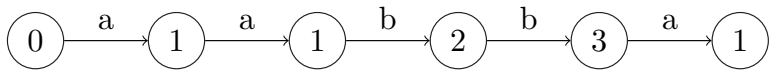


Simulation of DFAs

Example 1

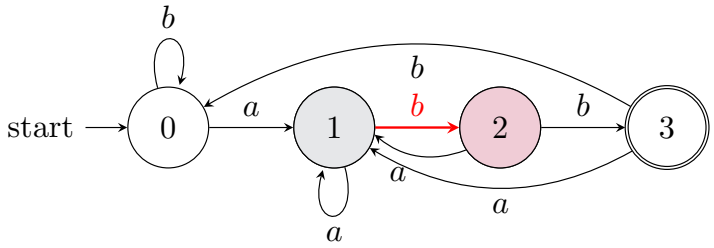


Input: $aabbabb$

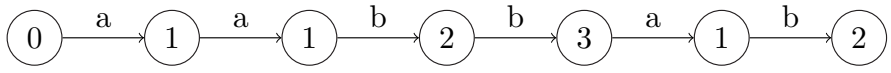


Simulation of DFAs

Example 1

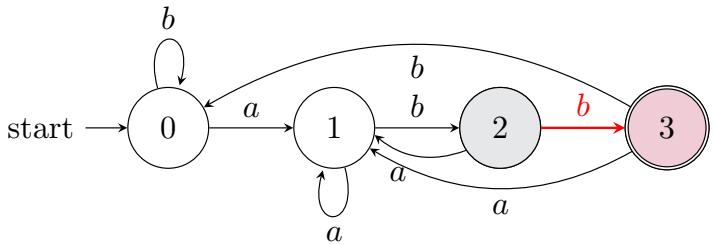


Input: $aabbabb$

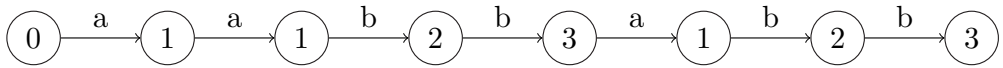


Simulation of DFAs

Example 1

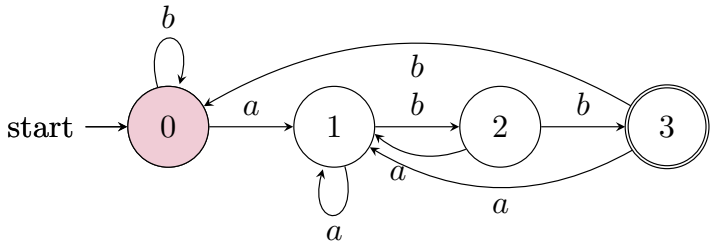


Input: *aabbabb*

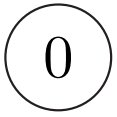


Simulation of DFAs

Example 2

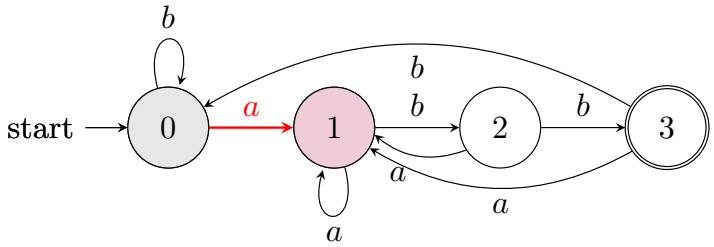


Input: $abab$

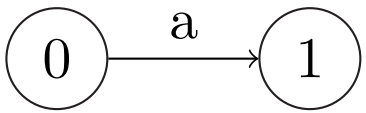


Simulation of DFAs

Example 2

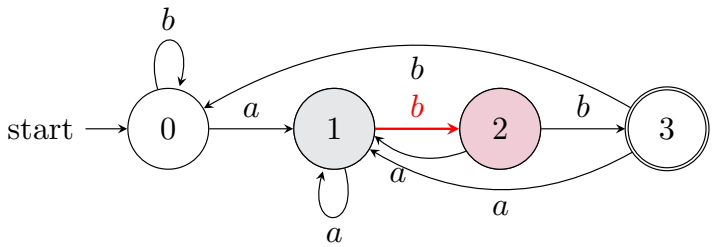


Input: a*bab*

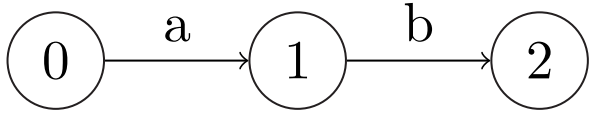


Simulation of DFAs

Example 2

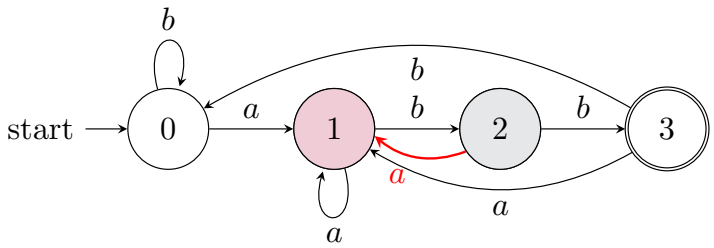


Input: $abab$

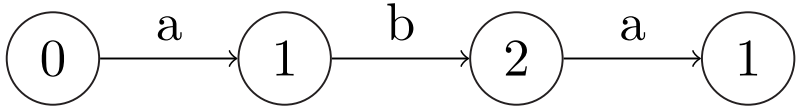


Simulation of DFAs

Example 2

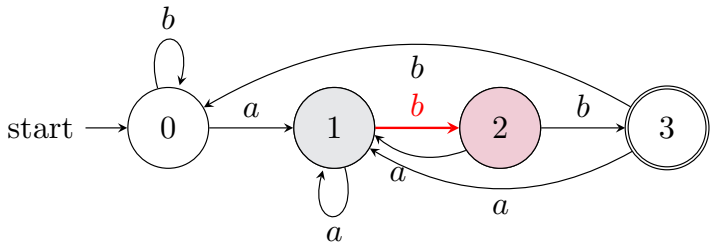


Input: $abab$



Simulation of DFAs

Example 2



Input: $aba\mathbf{b}$