Lexical Analysis
Programming Languages

Sujit Kumar Chakrabarti

IIITB

Implementation of Lexical Analysis

Finite State Automata

Example

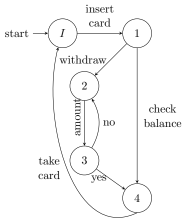
ATM:

Implementation of Lexical Analysis

Finite State Automata

Example

ATM:



- Alphabet Σ: {insert card, check balance, no, yes, withdraw, amount, take card }
- States, initial state
- Transitions

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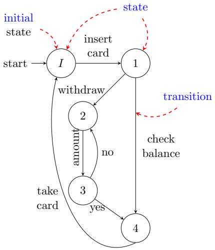

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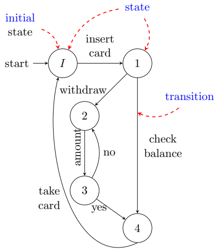

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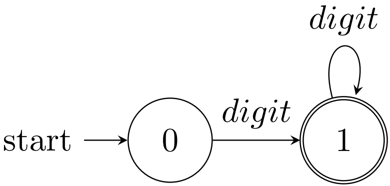

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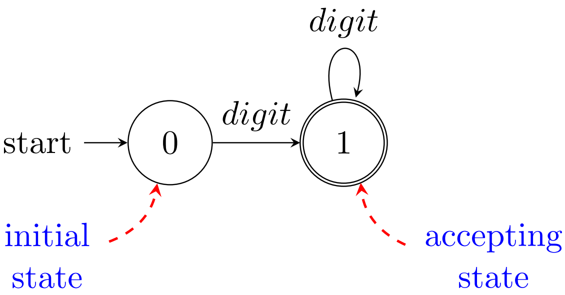

Implementation of Lexical Analysis

Finite State Automata as recogniser

A string can be considered accepted if:

- input pointer has reached the end of the string.
- machine is in an accepting state.

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A string can be considered accepted if:

- input pointer has reached the end of the string.
- machine is in an accepting state.

A string can be considered rejected if:

- input pointer has reached the end of the string and machine is not in an accepting state.
- a symbol occurs for which the machine can't make a transition.

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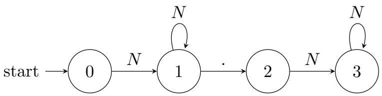

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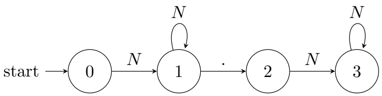

1. $NN.N$ $\quad 0 \xrightarrow{N} 1 \xrightarrow{N} 1 \xrightarrow{.} 2 \xrightarrow{N} 3$

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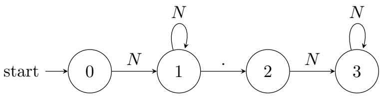

1. $NN.N$ $\qquad 0 \xrightarrow{N} 1 \xrightarrow{N} 1 \xrightarrow{.} 2 \xrightarrow{N} 3$ ✓

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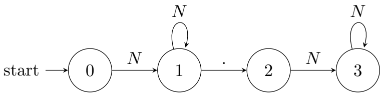

1. $NN.N$ $\quad 0 \xrightarrow{N} 1 \xrightarrow{N} 1 \xrightarrow{.} 2 \xrightarrow{N} 3$ ✓
2. $NN.NN$ $\quad 0 \xrightarrow{N} 1 \xrightarrow{N} 1 \xrightarrow{.} 2 \xrightarrow{N} 3 \xrightarrow{N} 3$

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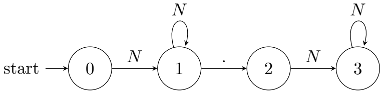

1. $NN.N$ $\quad 0 \xrightarrow{N} 1 \xrightarrow{N} 1 \xrightarrow{.} 2 \xrightarrow{N} 3$ ✓
2. $NN.NN$ $\quad 0 \xrightarrow{N} 1 \xrightarrow{N} 1 \xrightarrow{.} 2 \xrightarrow{N} 3 \xrightarrow{N} 3$ ✓

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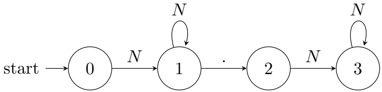

1. $NN.N$ $\quad 0 \xrightarrow{N} 1 \xrightarrow{N} 1 \xrightarrow{.} 2 \xrightarrow{N} 3$ ✓
2. $NN.NN$ $\quad 0 \xrightarrow{N} 1 \xrightarrow{N} 1 \xrightarrow{.} 2 \xrightarrow{N} 3 \xrightarrow{N} 3$ ✓
3. $NN.$ $\quad 0 \xrightarrow{N} 1 \xrightarrow{N} 1 \xrightarrow{.} 2$

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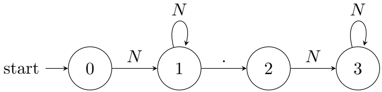

1. $NN.N$ $\quad 0 \xrightarrow{N} 1 \xrightarrow{N} 1 \xrightarrow{.} 2 \xrightarrow{N} 3$ ✓
2. $NN.NN$ $\quad 0 \xrightarrow{N} 1 \xrightarrow{N} 1 \xrightarrow{.} 2 \xrightarrow{N} 3 \xrightarrow{N} 3$ ✓
3. $NN.$ $\quad 0 \xrightarrow{N} 1 \xrightarrow{N} 1 \xrightarrow{.} 2$ ×

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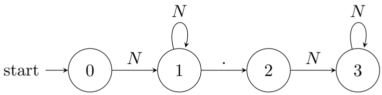

1. $NN.N$ $\quad 0 \xrightarrow{N} 1 \xrightarrow{N} 1 \xrightarrow{.} 2 \xrightarrow{N} 3$ ✓
2. $NN.NN$ $\quad 0 \xrightarrow{N} 1 \xrightarrow{N} 1 \xrightarrow{.} 2 \xrightarrow{N} 3 \xrightarrow{N} 3$ ✓
3. $NN.$ $\quad 0 \xrightarrow{N} 1 \xrightarrow{N} 1 \xrightarrow{.} 2$ ×
4. $.N$ $\quad 0 \xrightarrow{.}$

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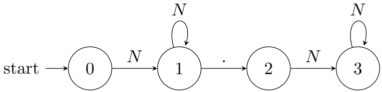

1. $NN.N$ $\quad 0 \xrightarrow{N} 1 \xrightarrow{N} 1 \xrightarrow{.} 2 \xrightarrow{N} 3$ ✓
2. $NN.NN$ $\quad 0 \xrightarrow{N} 1 \xrightarrow{N} 1 \xrightarrow{.} 2 \xrightarrow{N} 3 \xrightarrow{N} 3$ ✓
3. $NN.$ $\quad 0 \xrightarrow{N} 1 \xrightarrow{N} 1 \xrightarrow{.} 2$ ×
4. $.N$ $\quad 0 \xrightarrow{.}$ ×

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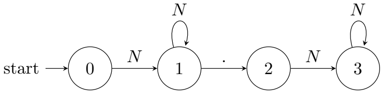

1. $NN.N$ $\quad 0 \xrightarrow{N} 1 \xrightarrow{N} 1 \xrightarrow{.} 2 \xrightarrow{N} 3 \; \checkmark$
2. $NN.NN$ $\quad 0 \xrightarrow{N} 1 \xrightarrow{N} 1 \xrightarrow{.} 2 \xrightarrow{N} 3 \xrightarrow{N} 3 \; \checkmark$
3. $NN.$ $\quad 0 \xrightarrow{N} 1 \xrightarrow{N} 1 \xrightarrow{.} 2 \; \times$
4. $.N$ $\quad 0 \xrightarrow{.} \; \times$
5. $N\alpha$ $\quad 0 \xrightarrow{N} 1 \xrightarrow{\alpha}$

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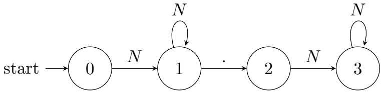

1. $NN.N$ $\quad 0 \xrightarrow{N} 1 \xrightarrow{N} 1 \xrightarrow{.} 2 \xrightarrow{N} 3$ ✓
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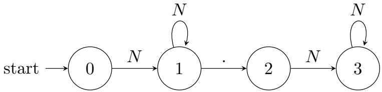

1. $N N.N$ $\quad 0 \xrightarrow{N} 1 \xrightarrow{N} 1 \xrightarrow{.} 2 \xrightarrow{N} 3$ ✓
2. $N N.N N$ $\quad 0 \xrightarrow{N} 1 \xrightarrow{N} 1 \xrightarrow{.} 2 \xrightarrow{N} 3 \xrightarrow{N} 3$ ✓
3. $N N.$ $\quad 0 \xrightarrow{N} 1 \xrightarrow{N} 1 \xrightarrow{.} 2$ ×
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5. $N\alpha$ $\quad 0 \xrightarrow{N} 1 \xrightarrow{\alpha}$ ×
6. $N.N\alpha$ $\quad 0 \xrightarrow{N} 1 \xrightarrow{N} 1 \xrightarrow{.} 2 \xrightarrow{N} 3 \xrightarrow{\alpha}$

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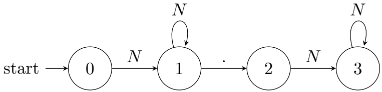

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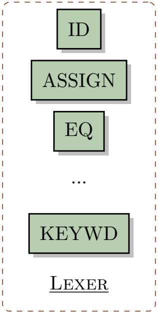
- Each token class T is represented using an FSA F.
- Acceptance of an input string i by F indicates that $i \in T$.
- Lexical analyser consumes i and returns T.



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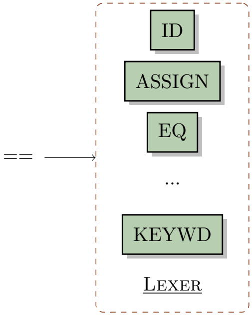

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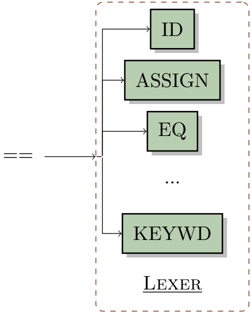

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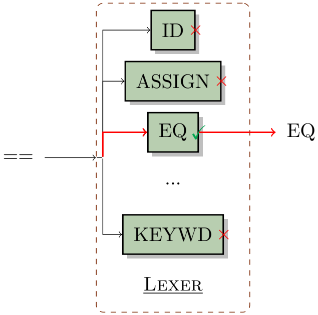

Next

1. DFA and NFA
2. Implementation of FSAs