LEX8: Lexical Analyzer

Lexical Analysis

CMPT 379: Compilers

Instructor: Anoop Sarkar

anoopsarkar.github.io/compilers-class

Lexical Analyzer using NFAs

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- For input $i_1, i_2, \ldots, i_n$ run NFA simulation which returns some final states (each final state indicates a token)
- If no final state is reached then raise an error
- Pick the final state (token) that has the longest match in the input,
  - e.g. prefer DFA #8 over all others because it read the input until i_{30} and none of the other DFAs reached i_{30}
  - If two DFAs reach the same input character then pick the one that is listed first in the ordered list

Lexical Analysis using NFAs

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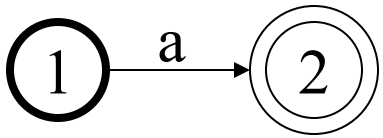
TOKEN_A = a

Lexical Analysis using NFAs



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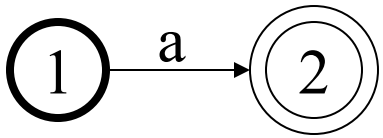

TOKEN_A = a

TOKEN_B = abb

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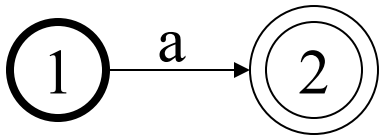

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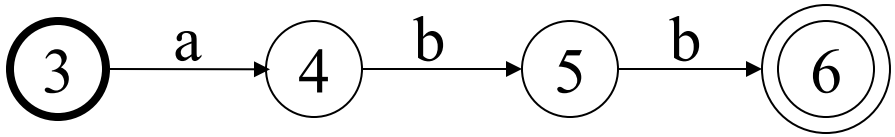

TOKEN_B = abb

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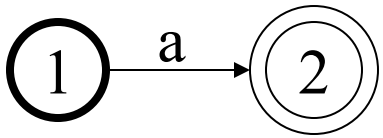

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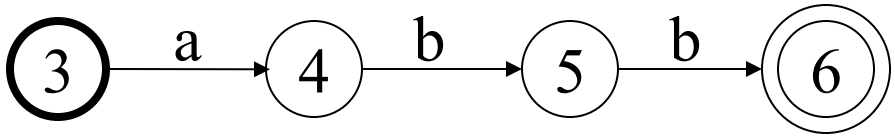

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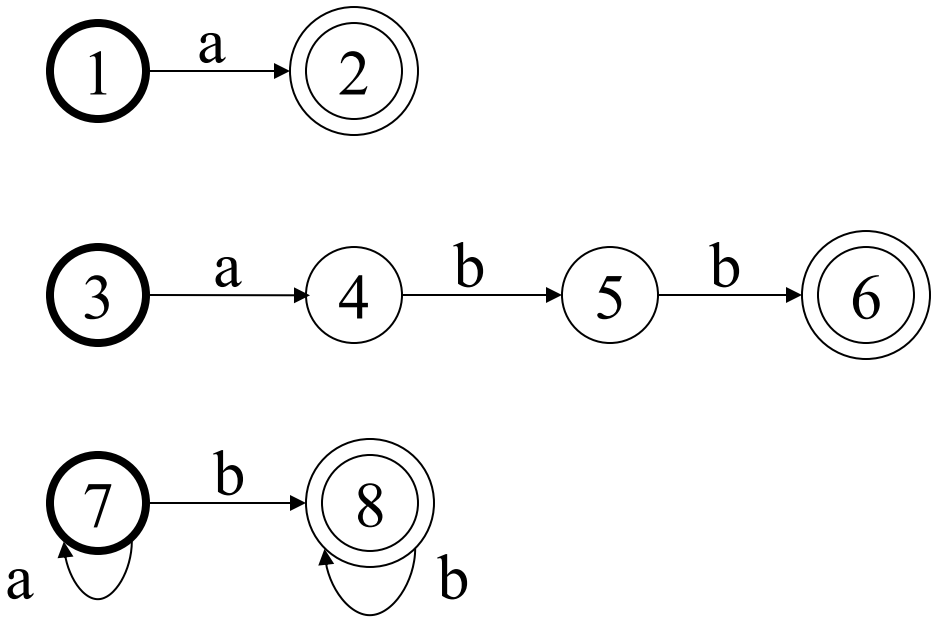

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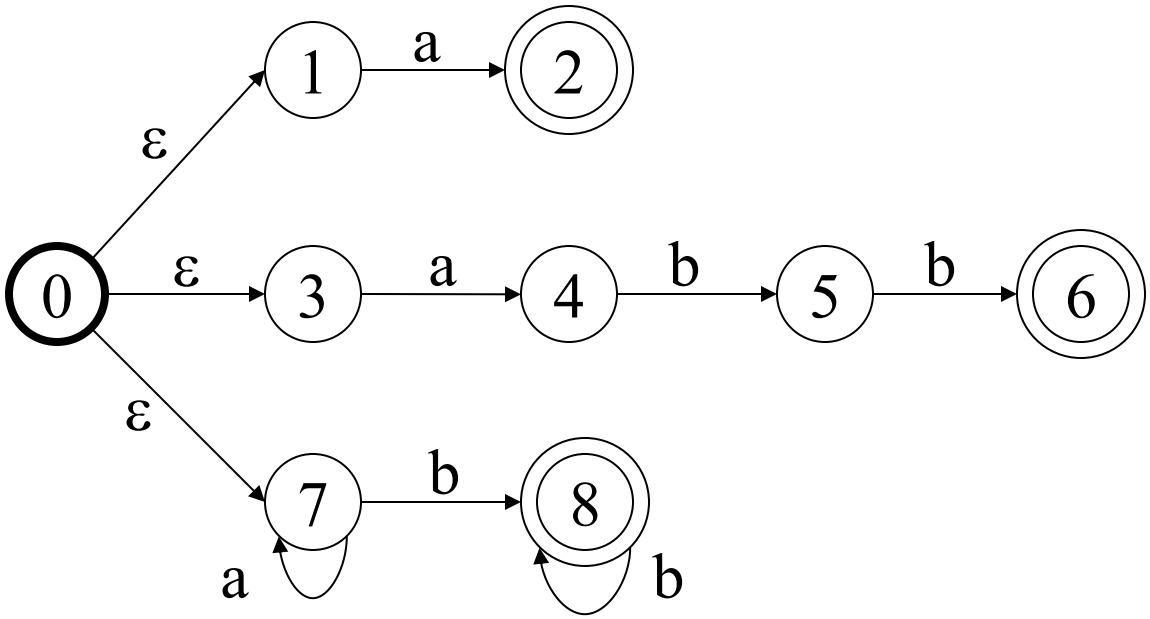

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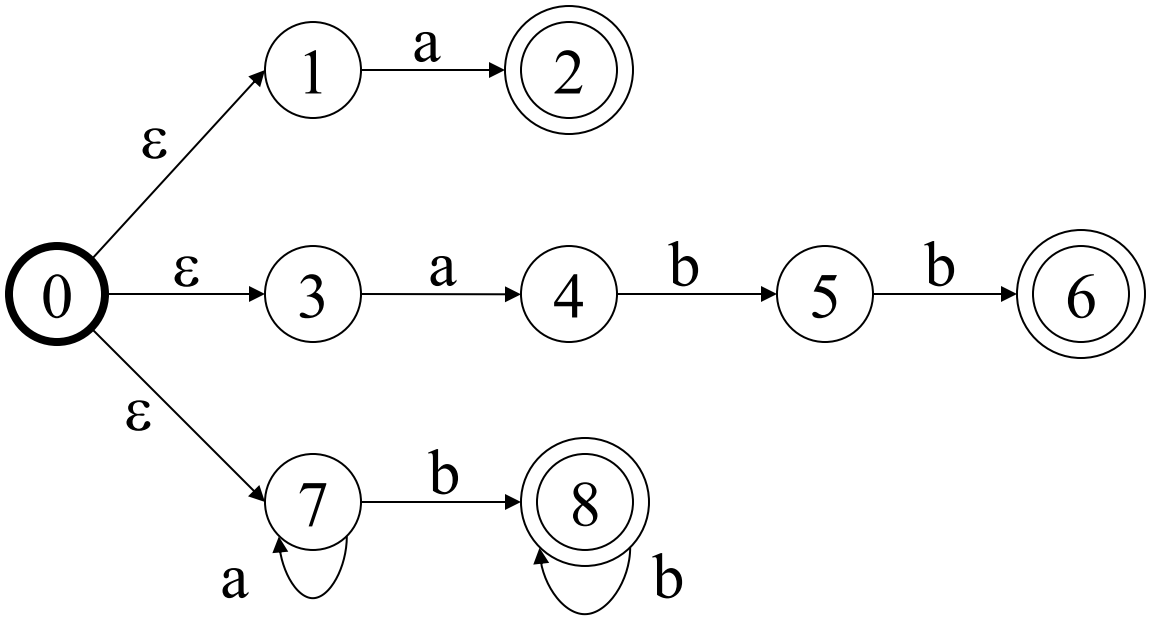

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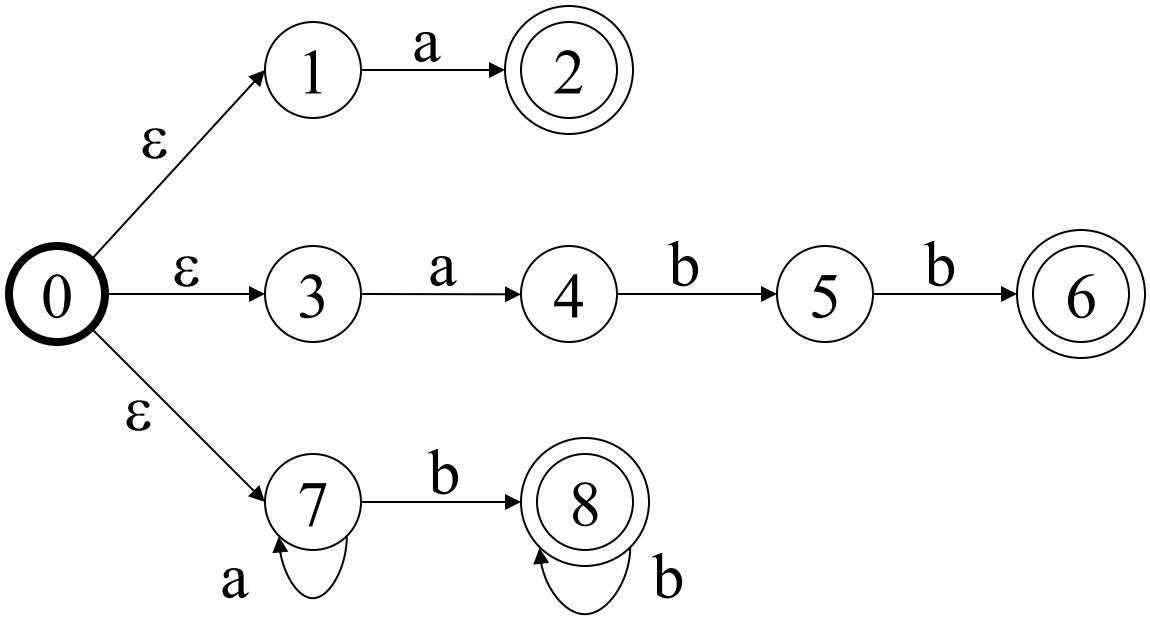

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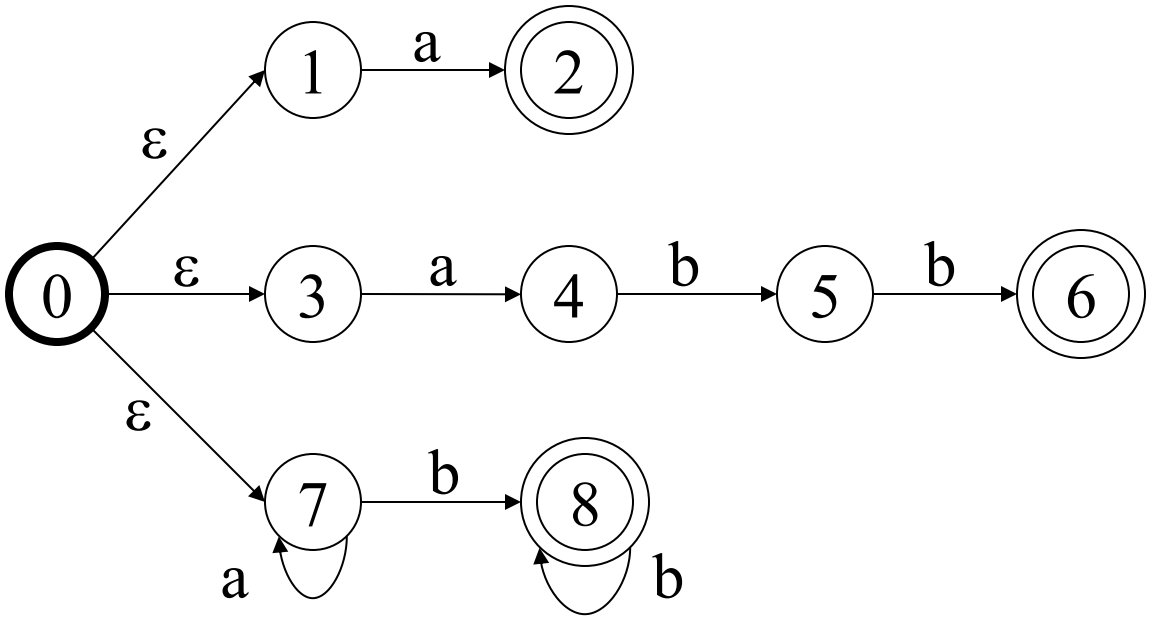

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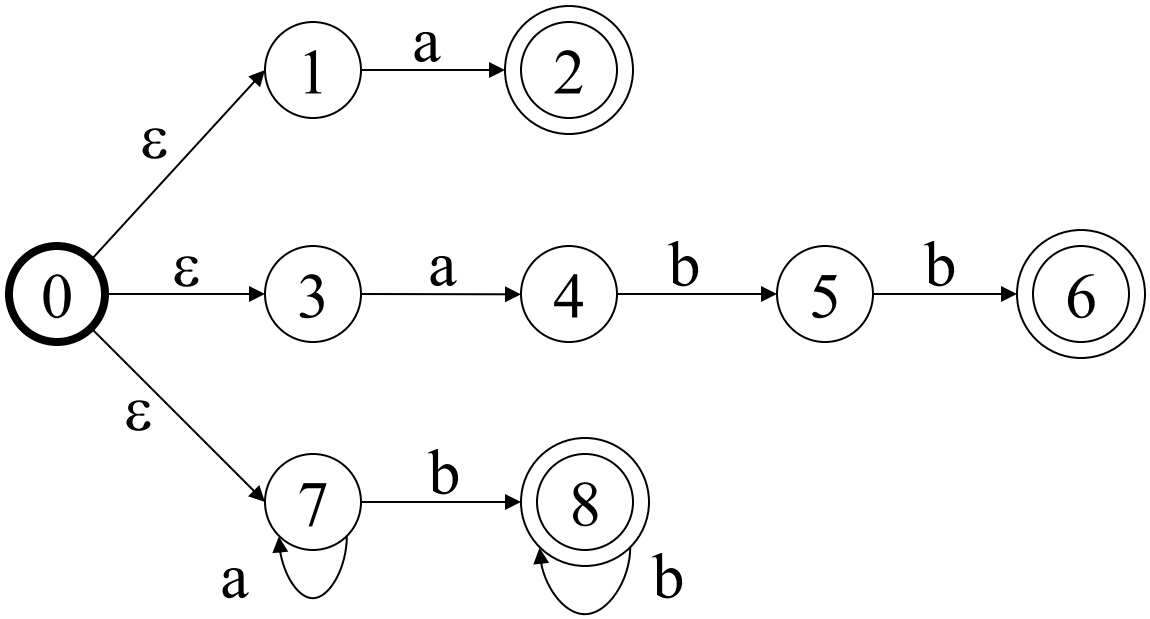

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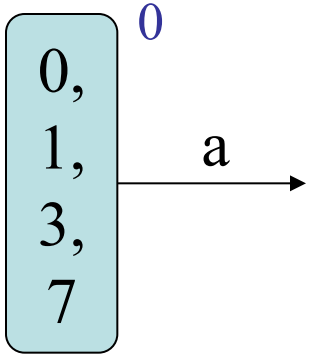

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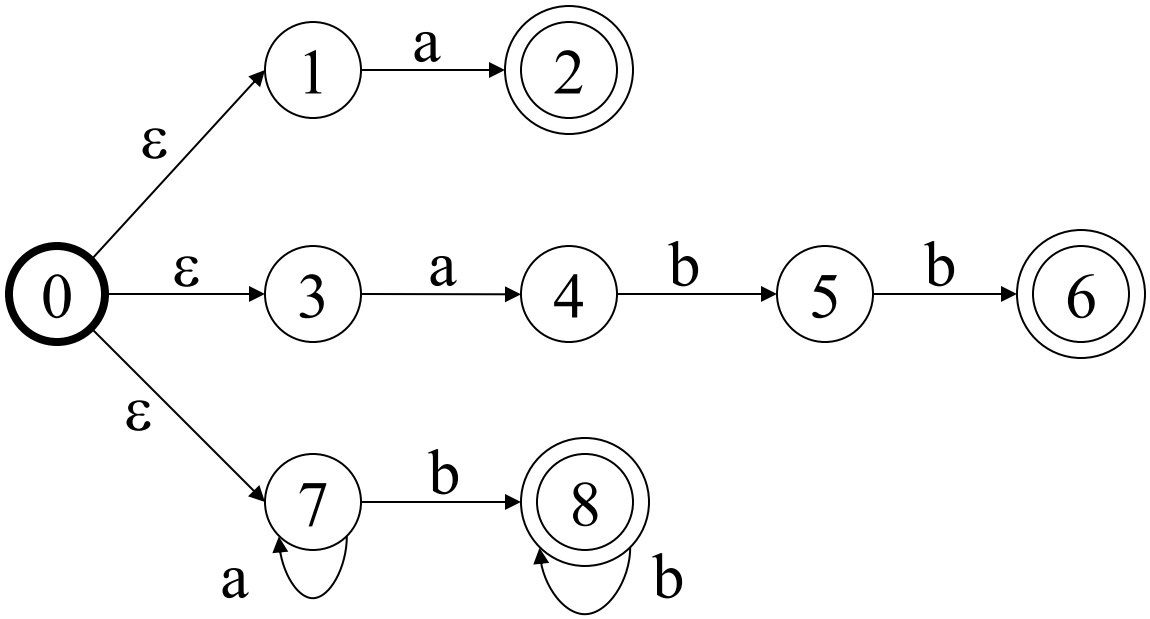

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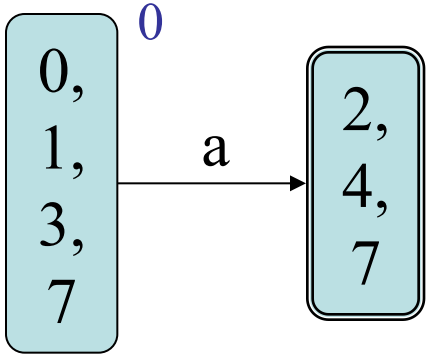

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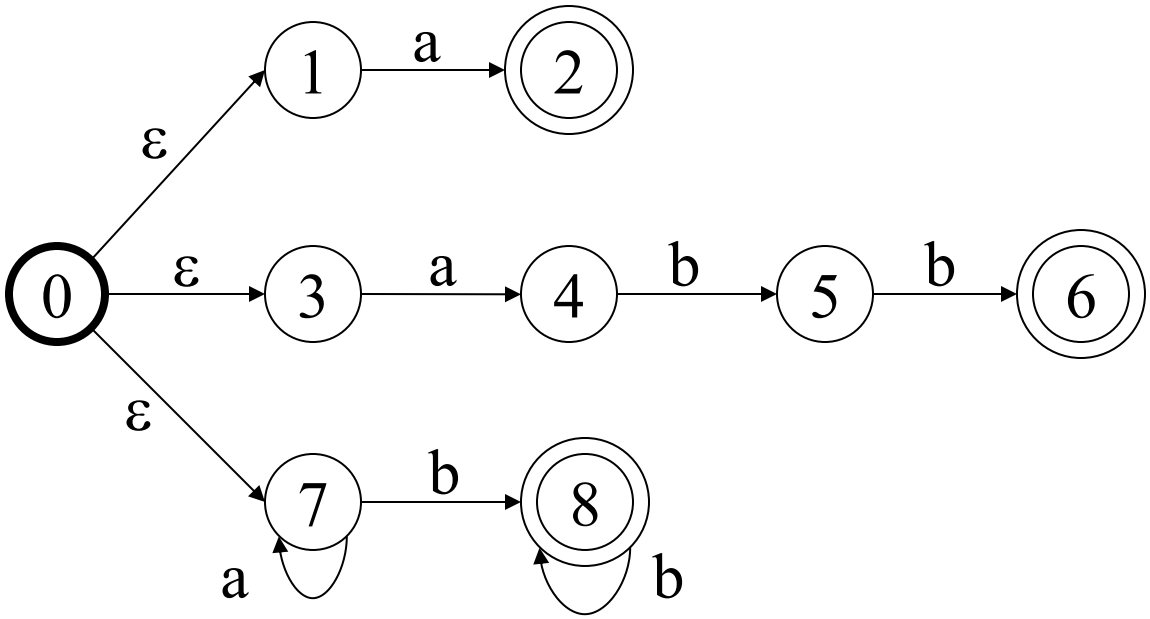

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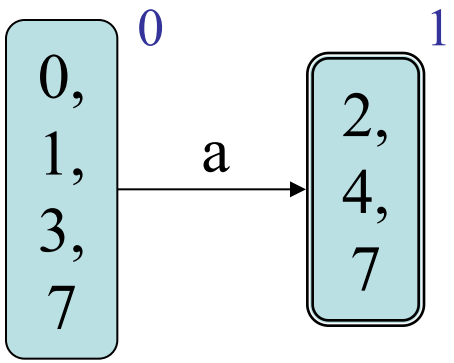

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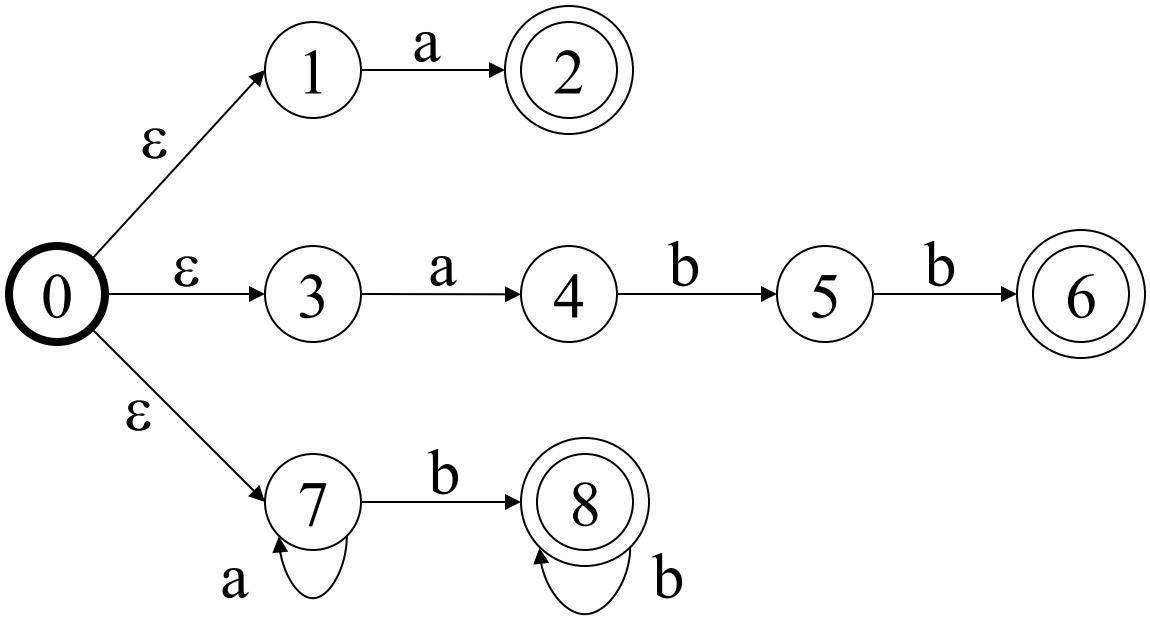

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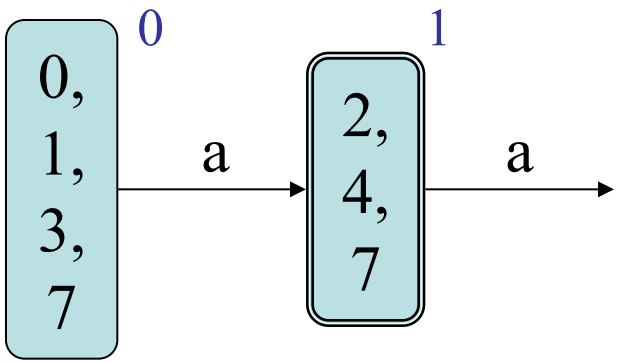

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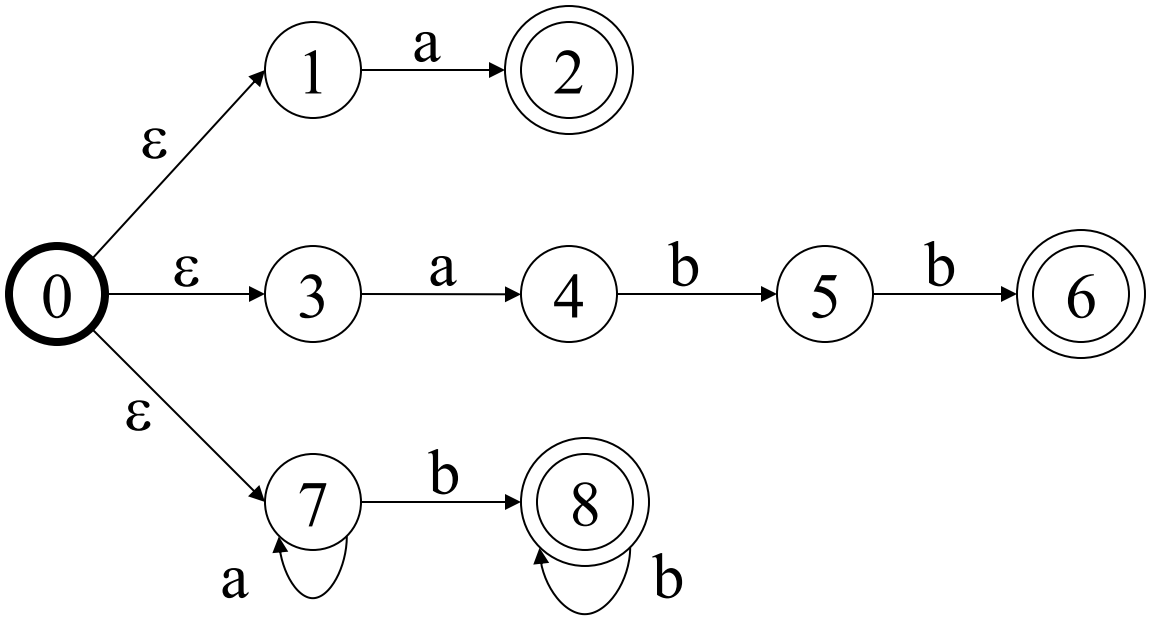

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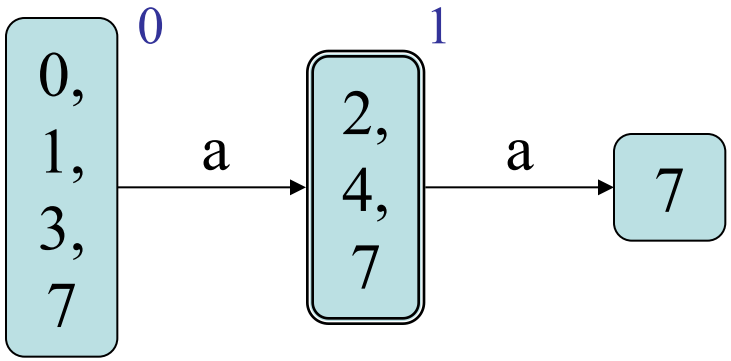

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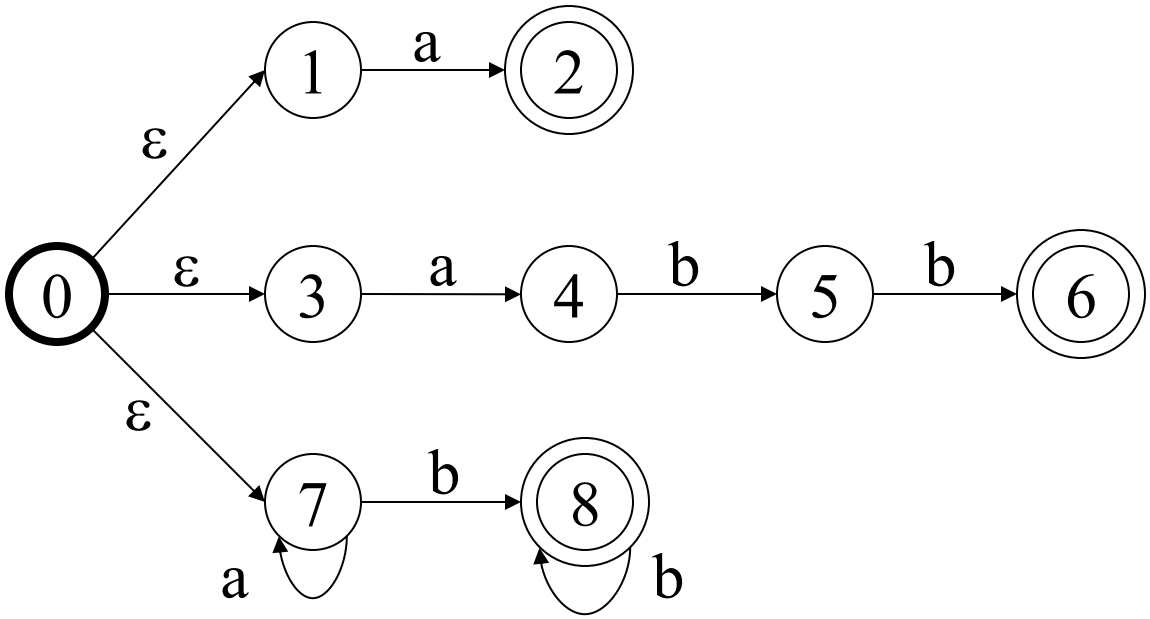

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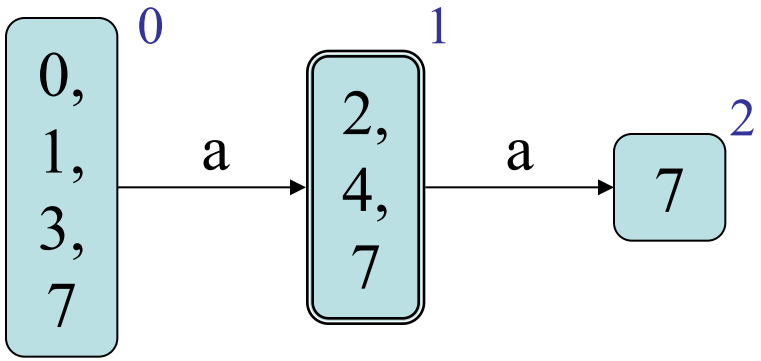

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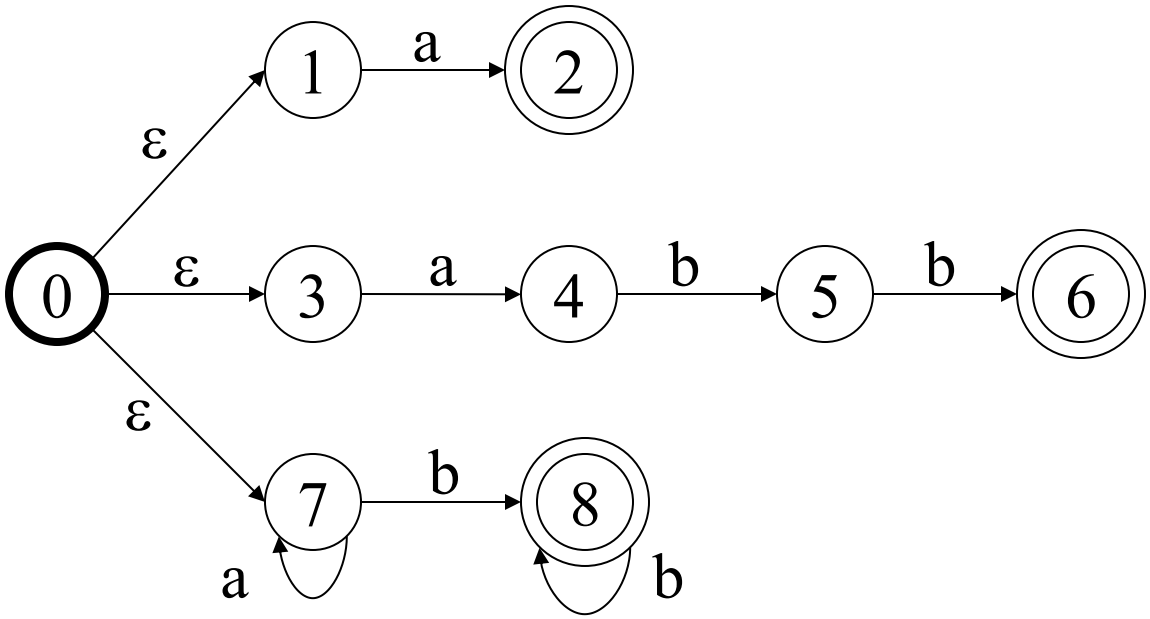

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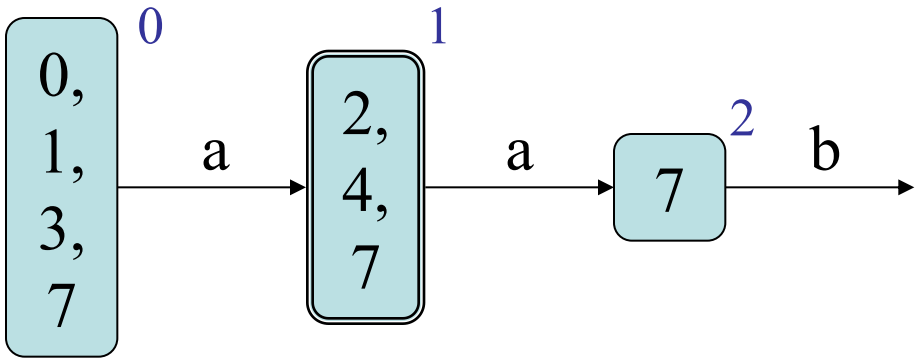

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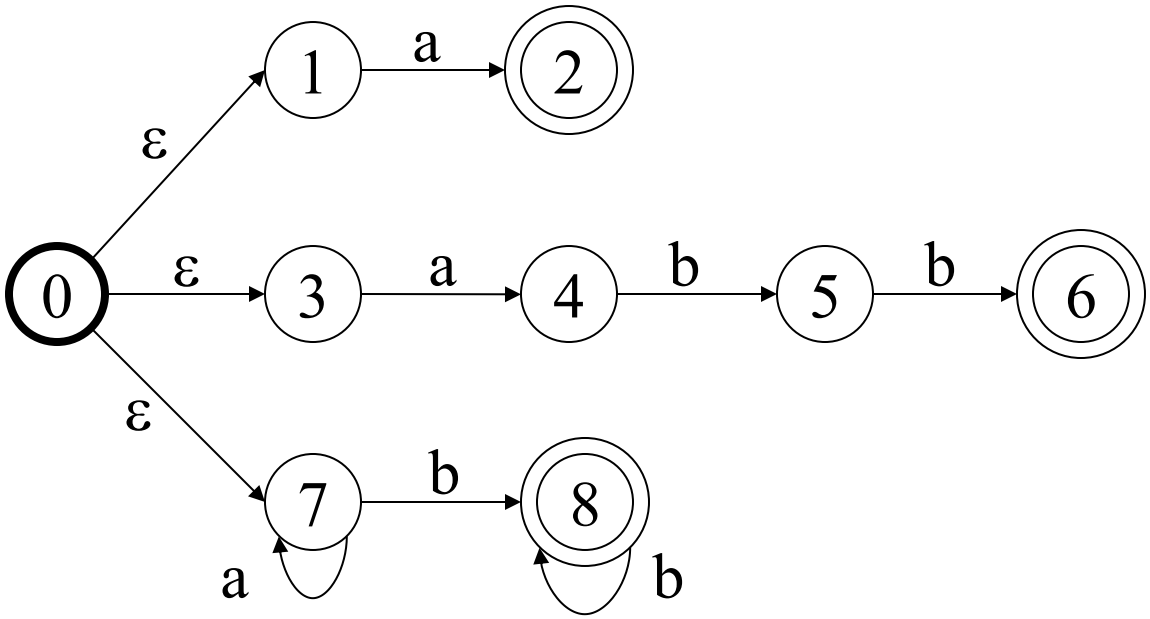

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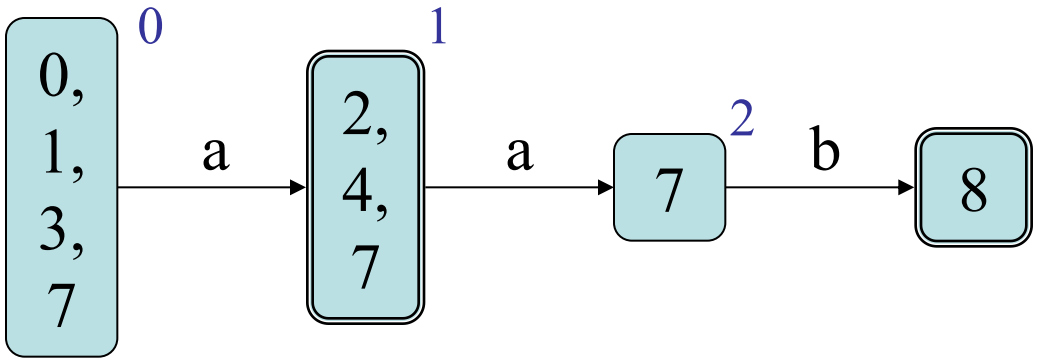

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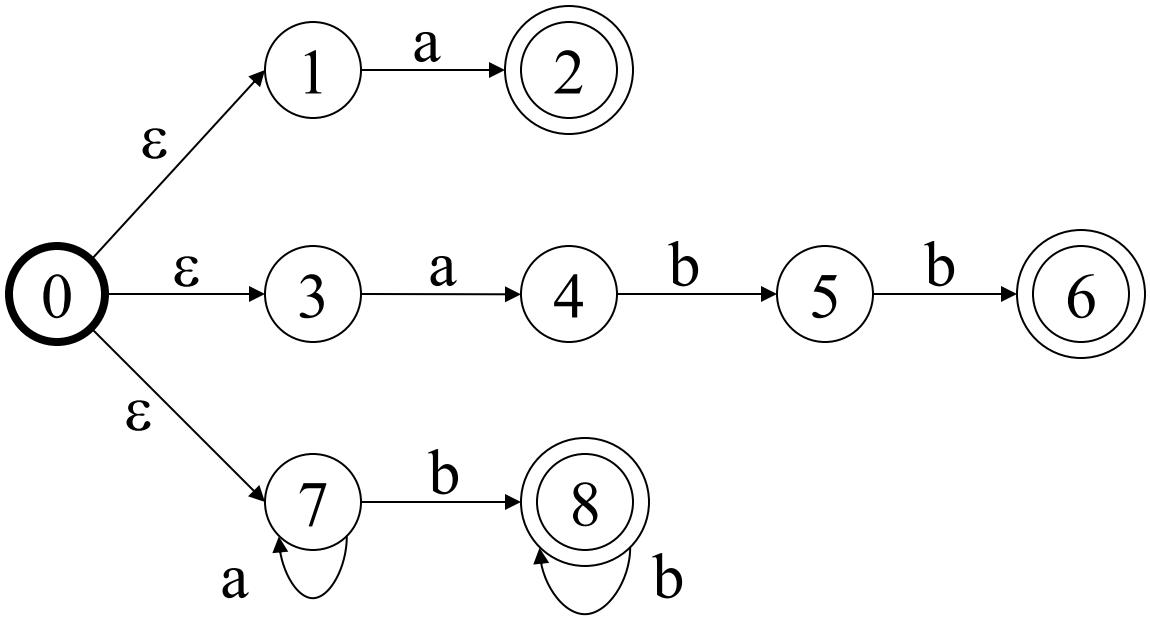

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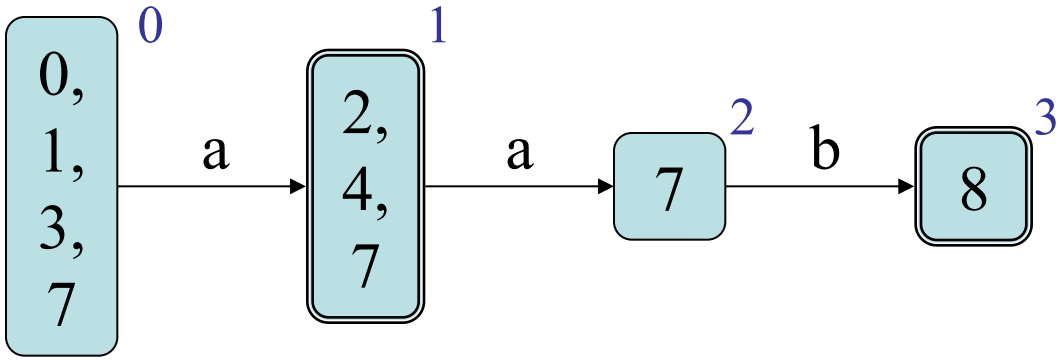

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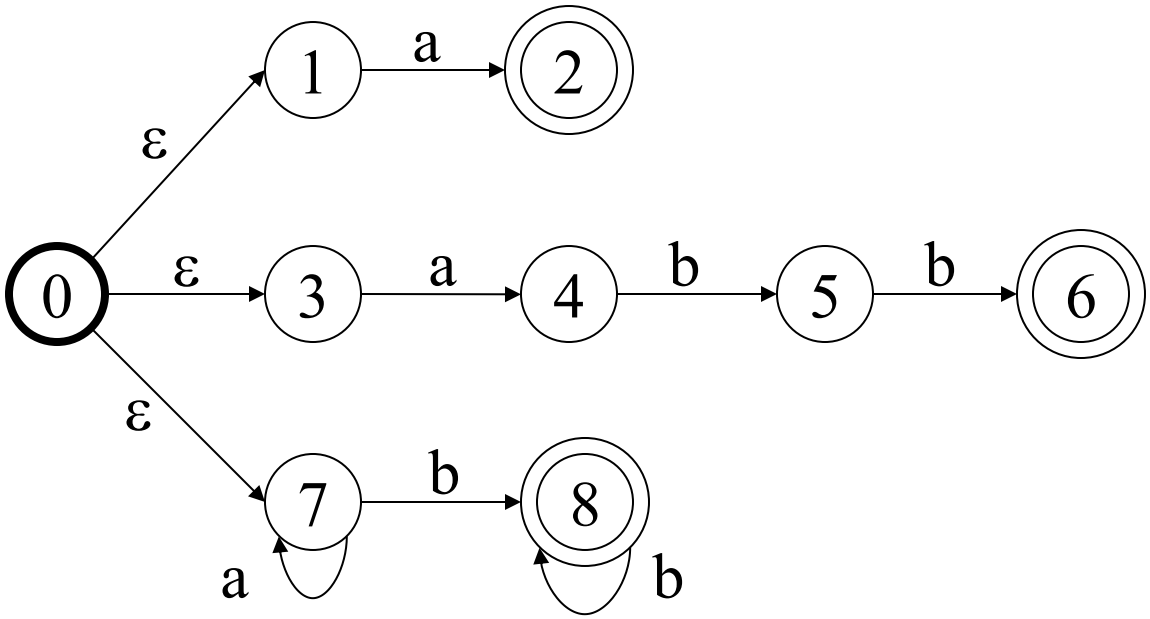

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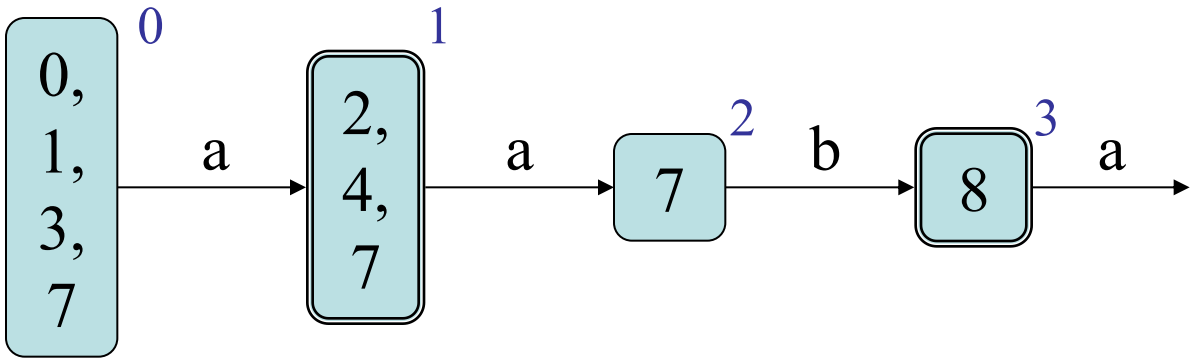

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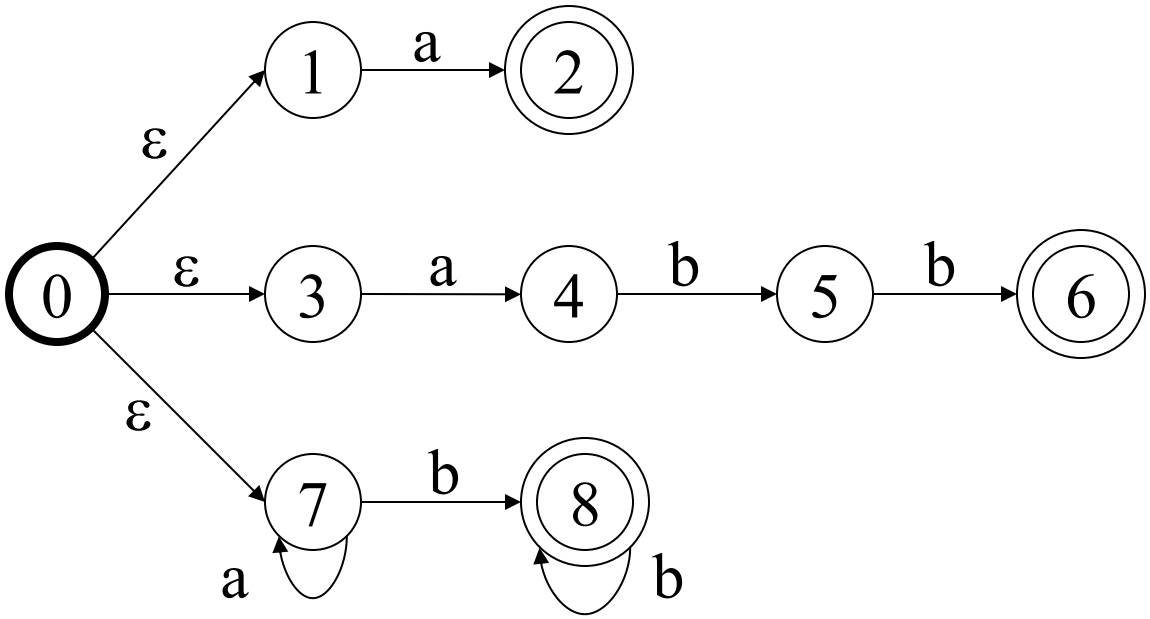

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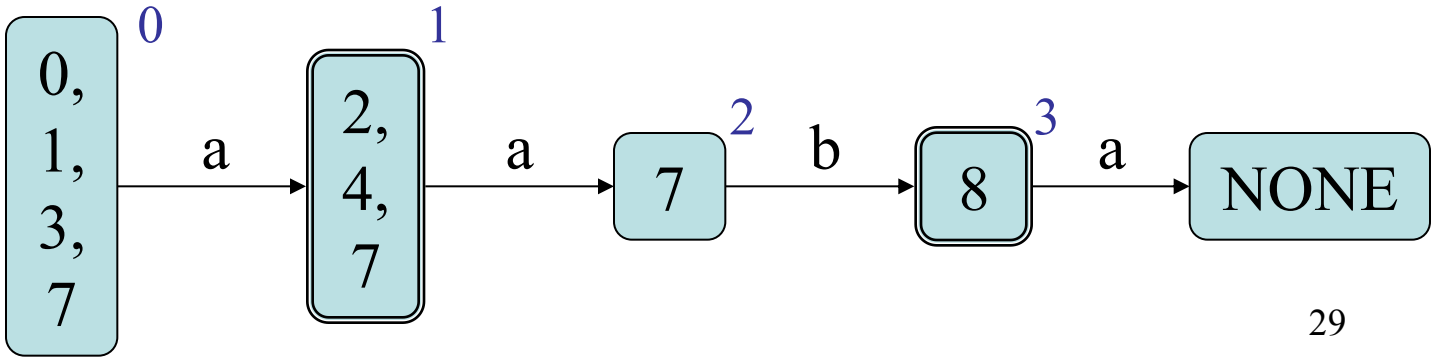

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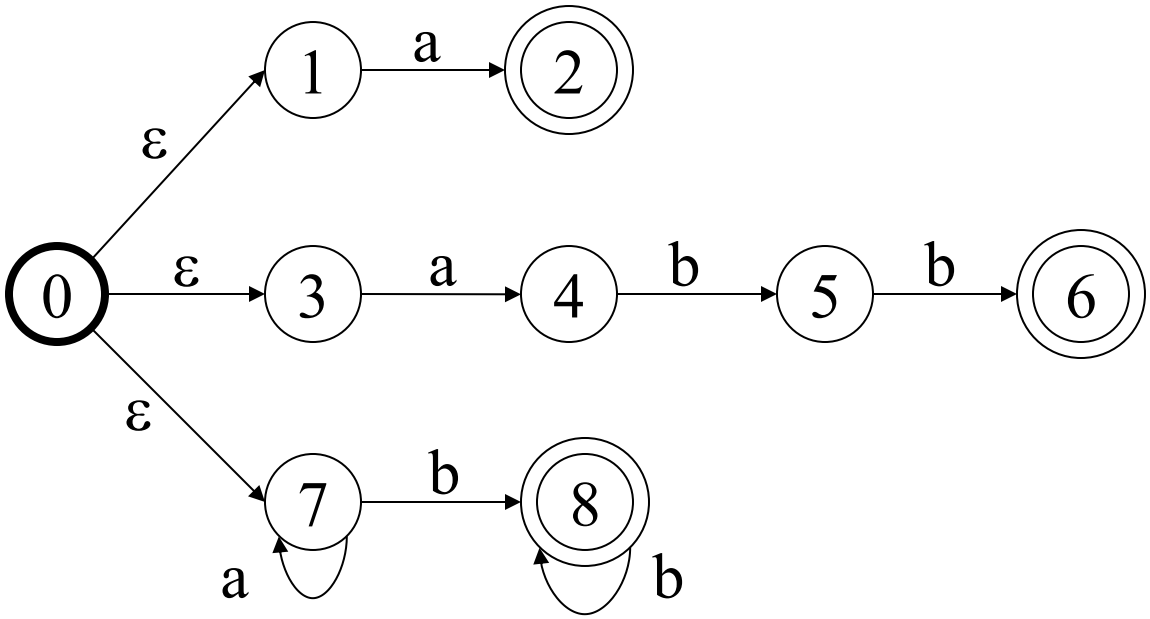

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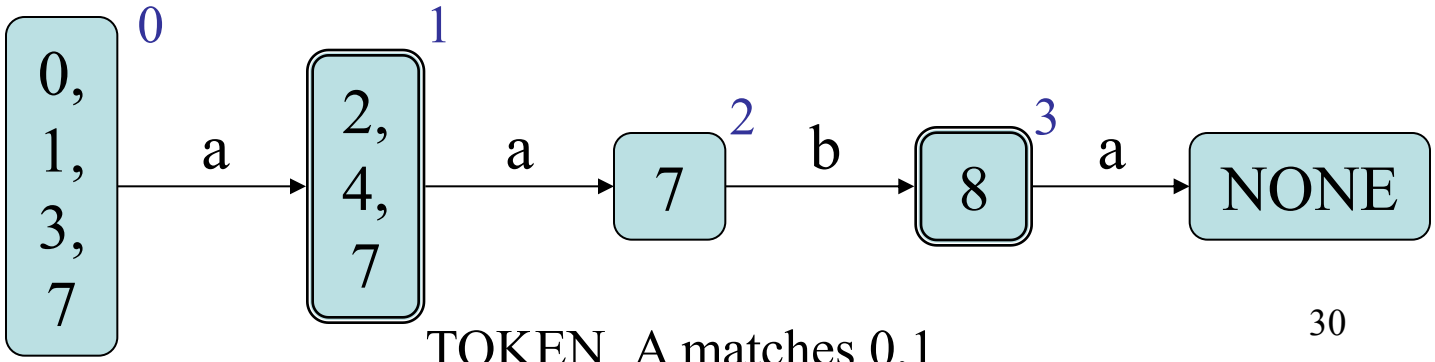
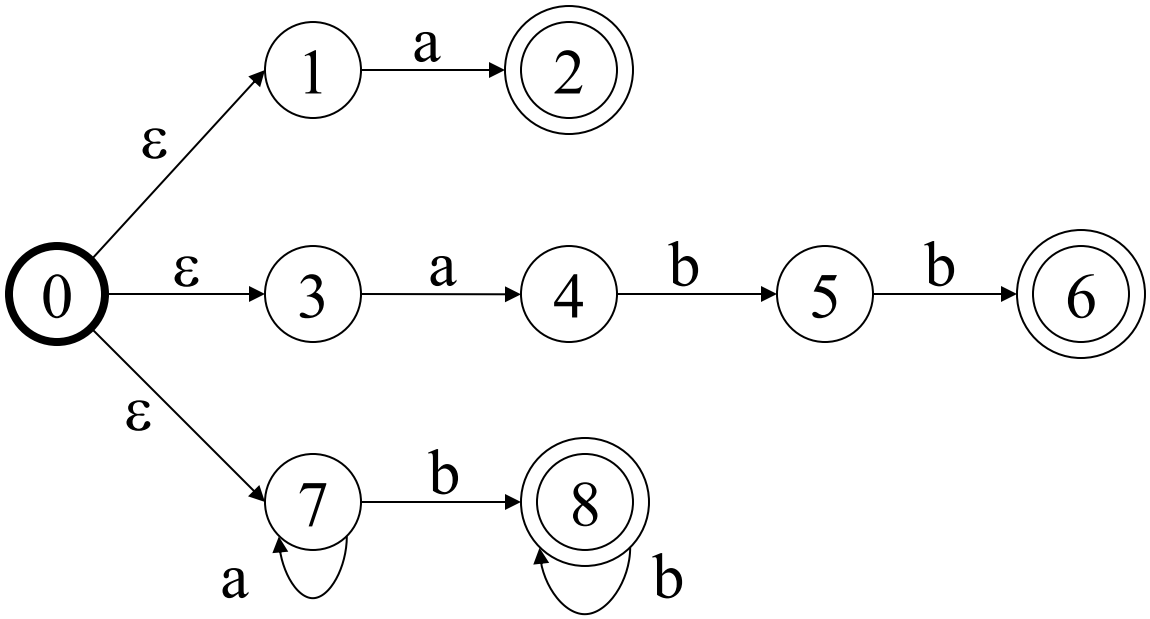


TOKEN_A matches 0,1

Lexical Analysis using NFAs



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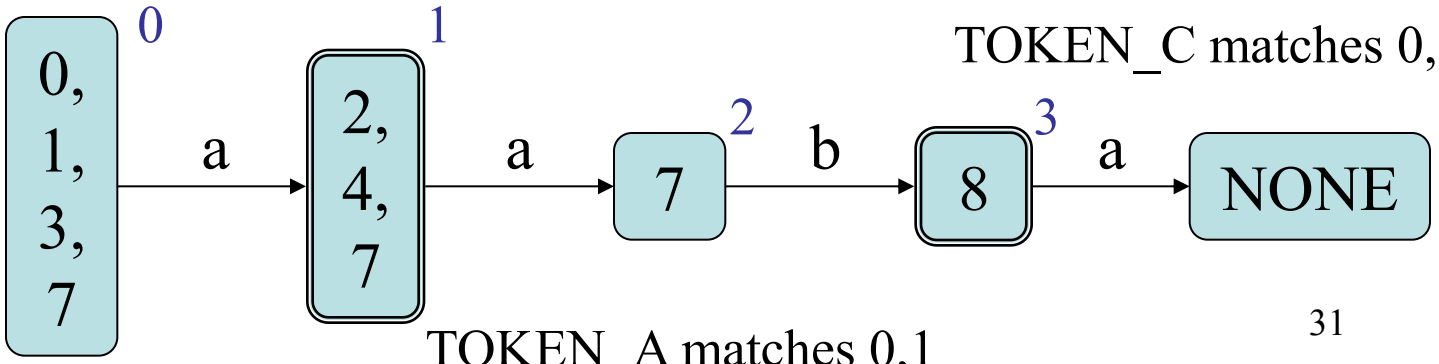
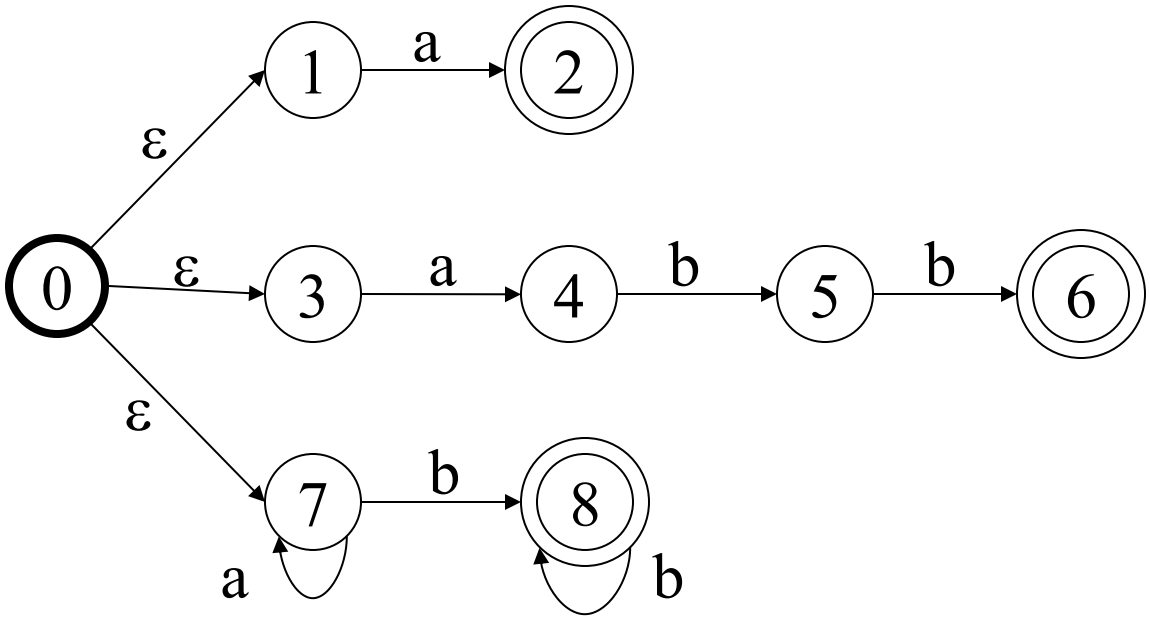


TOKEN_C matches 0,3

TOKEN_A matches 0,1

Lexical Analysis using NFAs



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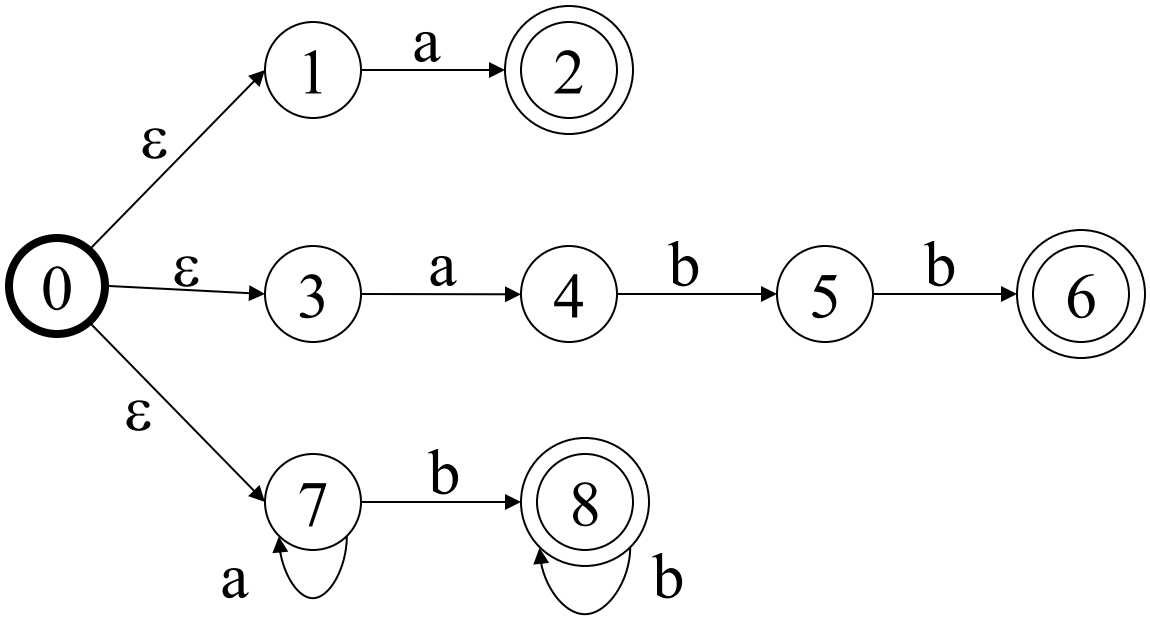

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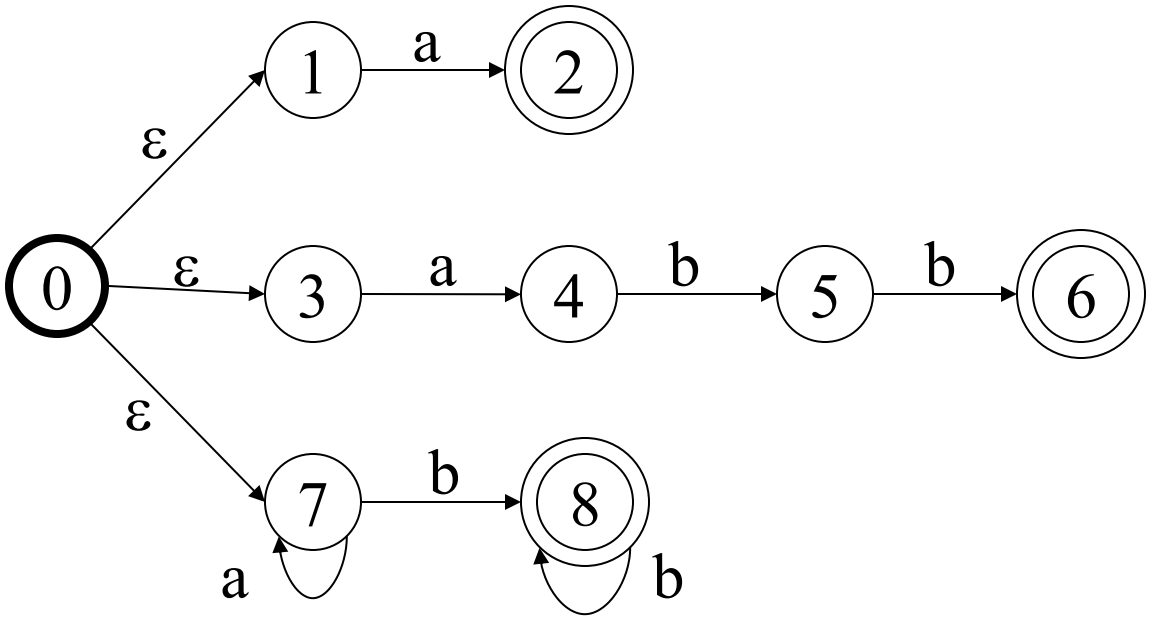

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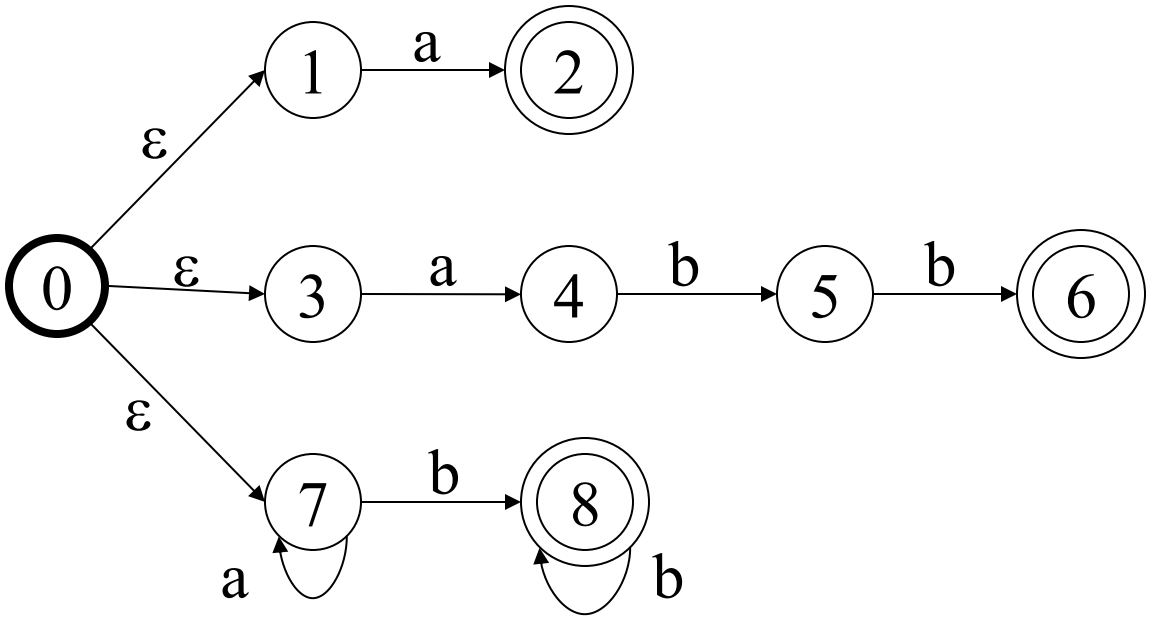
3

Lexical Analysis using NFAs



TOKEN_A = a

TOKEN_B = abb

TOKEN_C = a*b+

Input: aaba

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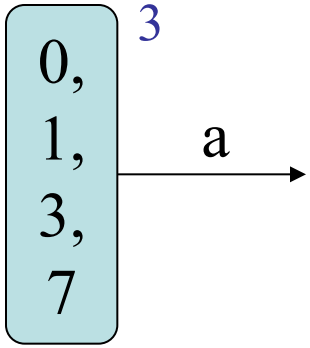

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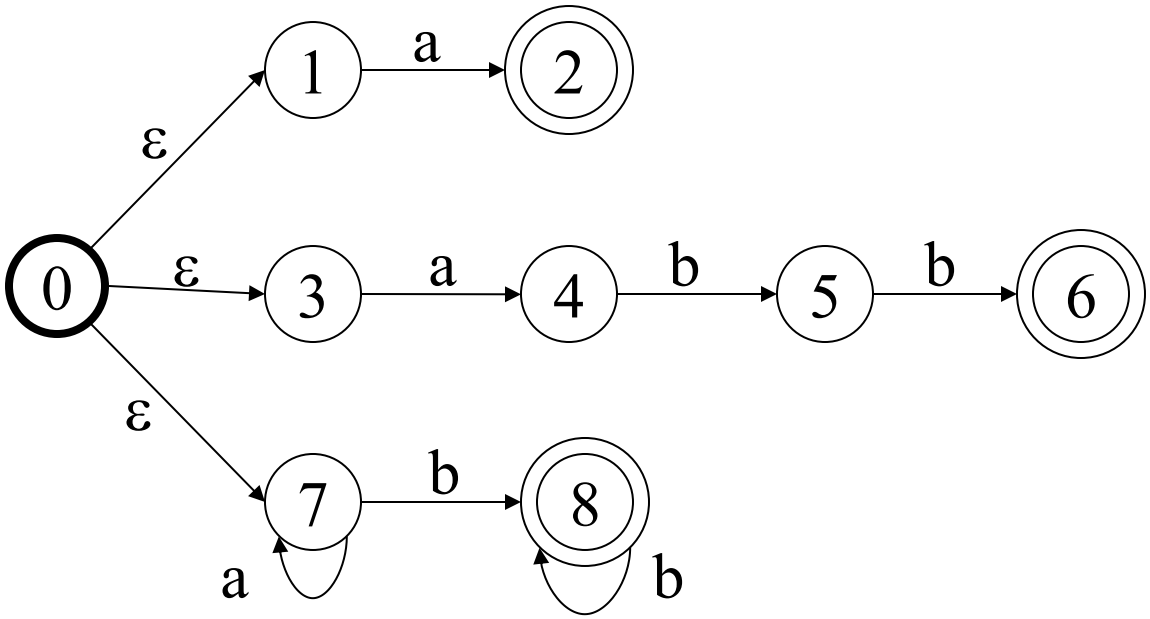

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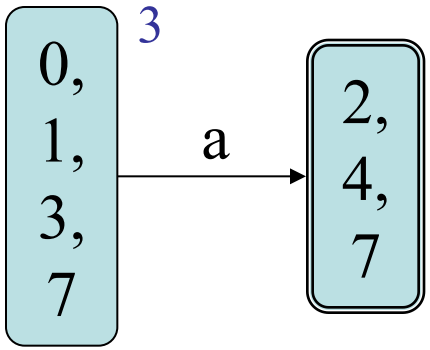

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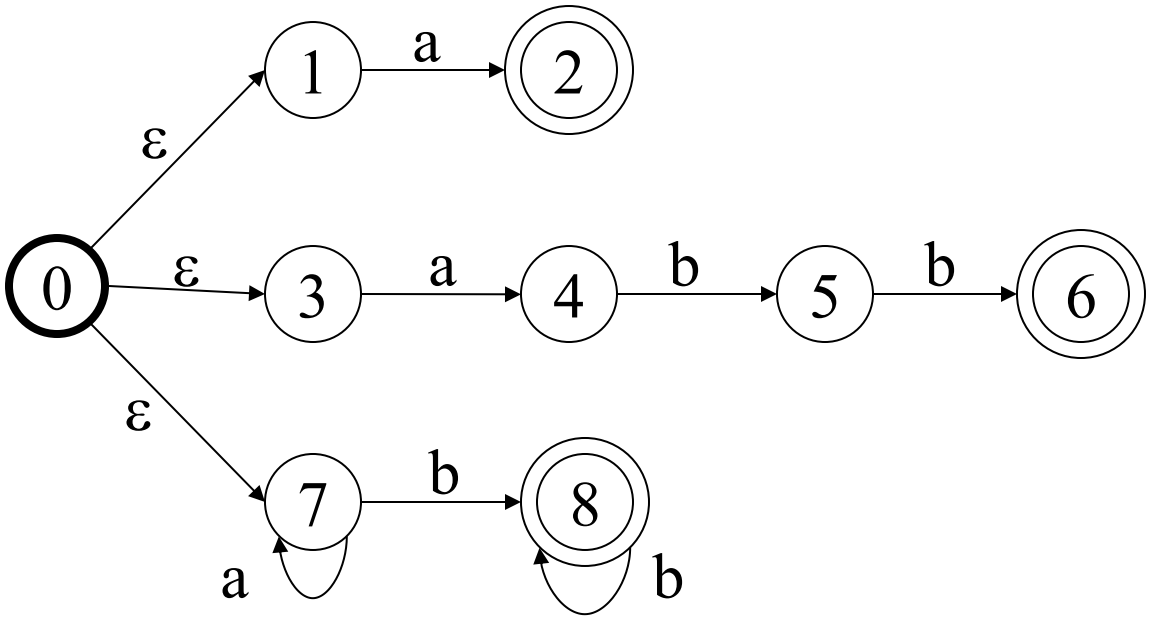

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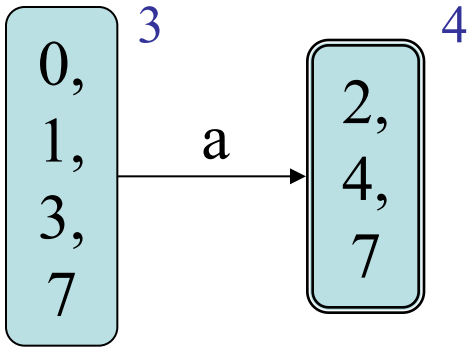

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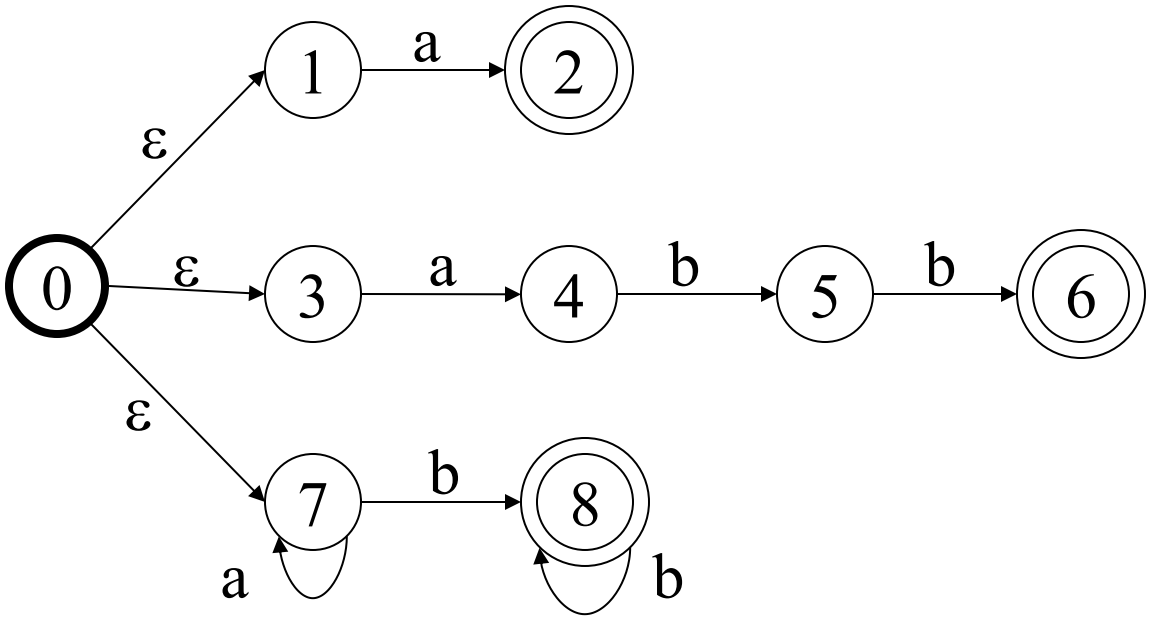

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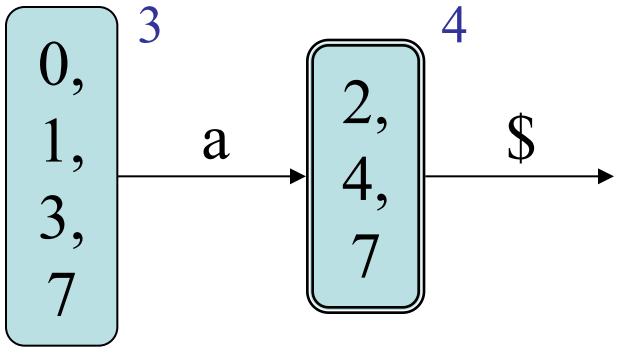

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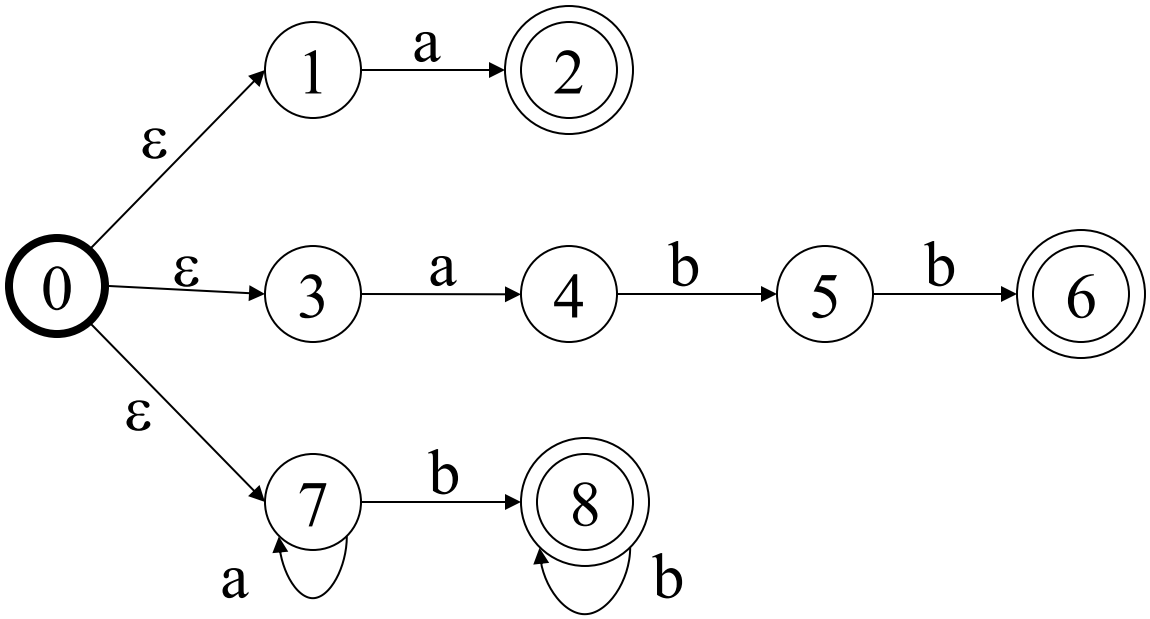

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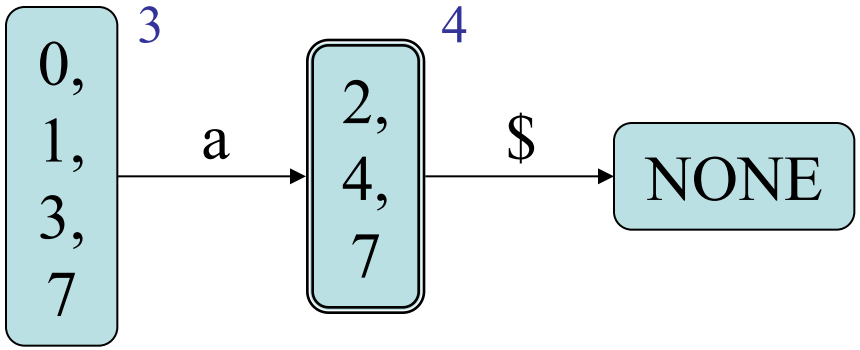

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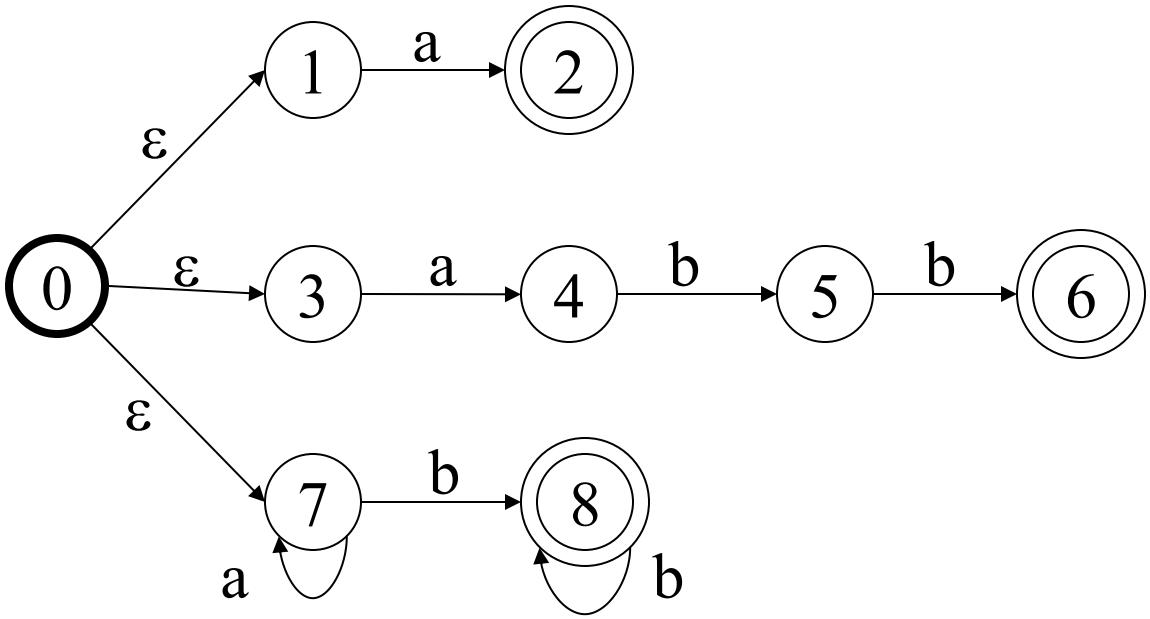

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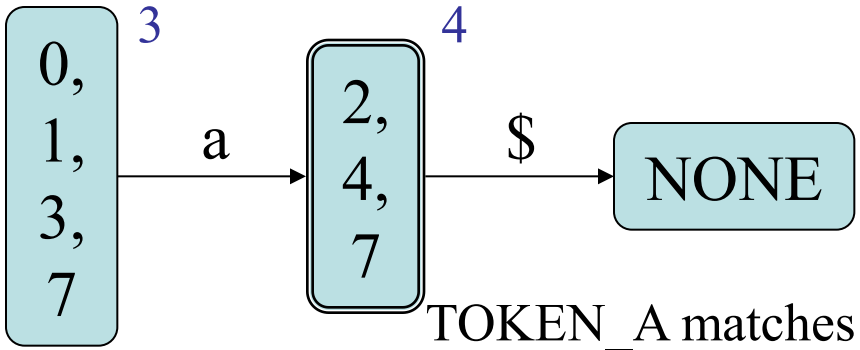

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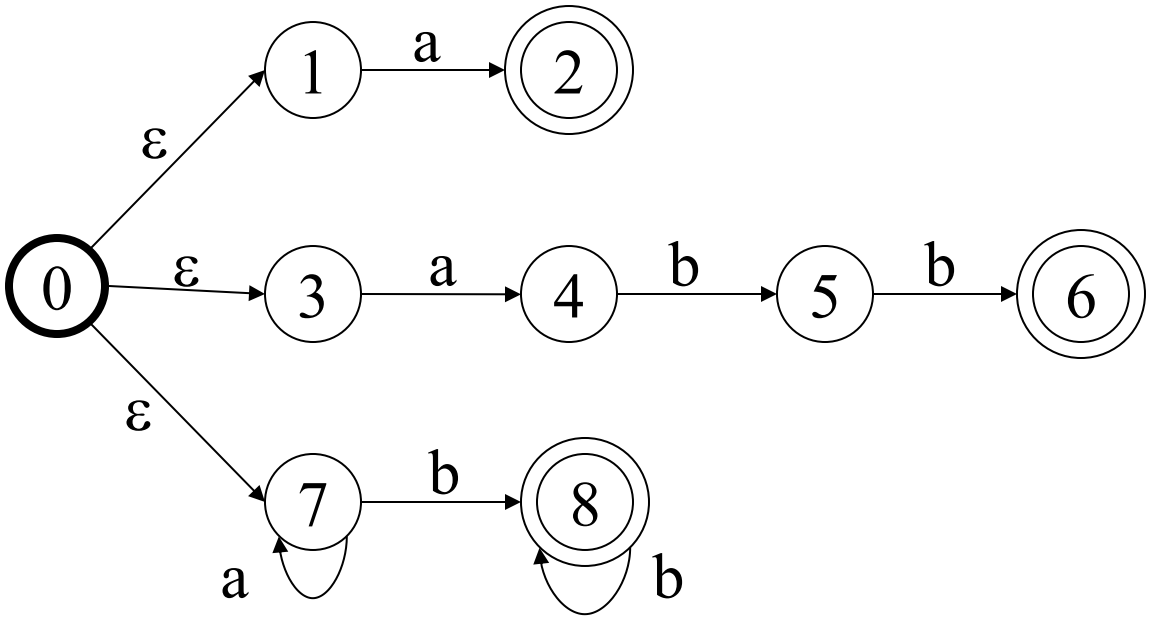

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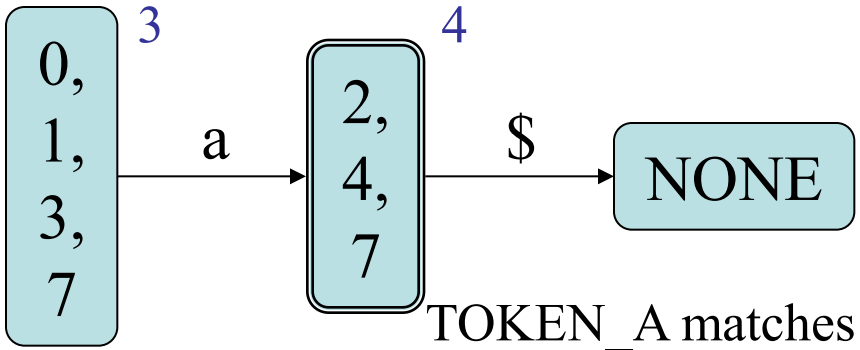

Output:
TOKEN_C aab [0,3]
TOKEN_A a [3,4]

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- Convert *R* to an NFA, then DFA, then minimize
  - remember orig NFA final states with each DFA state

Lexical Analyzer using DFAs

- The DFA recognizer has to find the *longest leftmost match* for a token
  - continue matching and report the last final state reached once DFA simulation cannot continue
  - e.g. longest match: <*print*> and not <*pr*>, <*int*>
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- If two patterns match the same token, pick the one that was listed earlier in R
  - e.g. prefer final state (in the original NFA) of r_2 over r_3

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- Reset to start state and start from position *p*

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$\Rightarrow$ Lexical Analyzer (multiple patterns)