

Non-Deterministic Finite Automata (NFAs)

aka: why we want (need) λ

NFAs are finite automata with less strict requirements than DFAs:

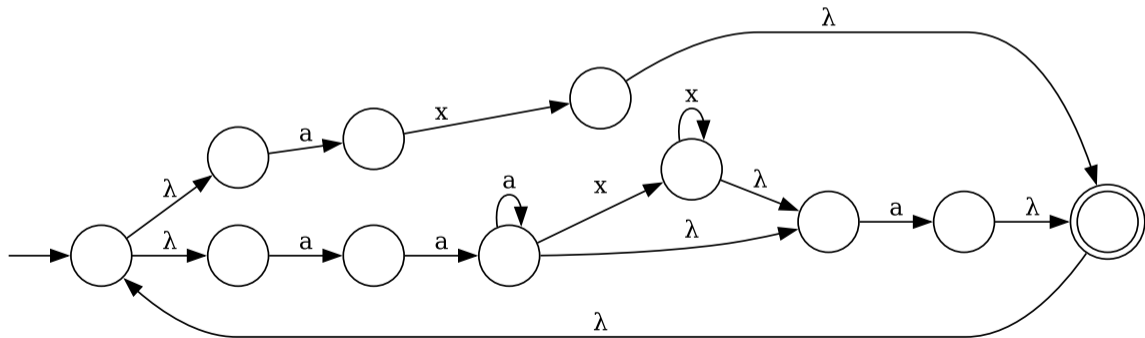
- ▶ NFAs have " λ edges" (DFA edges are letters from Σ)
- ▶ NFAs can have more than one transition from a state for the same letter (DFAs can have only one)

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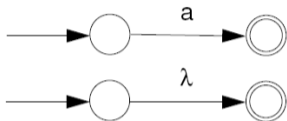
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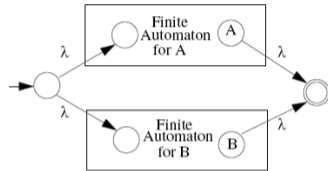


RE $(ax|aa^+x*a)^+$ (from the challenge question) as an NFA

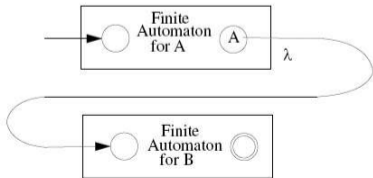
NFAs for Fundamental REs



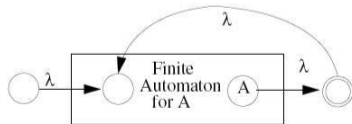
NFAs for REs a and λ ($a \in \Sigma$)



NFA for RE $A|B$ (A, B arbitrary REs)

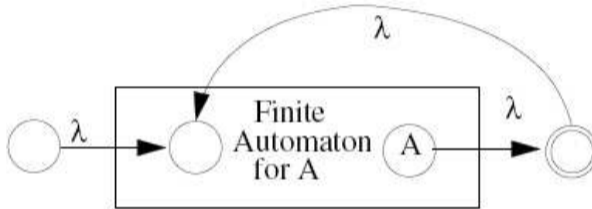


NFA for RE AB (A, B arbitrary REs)



NFA for RE A^+ (A an arbitrary RE)

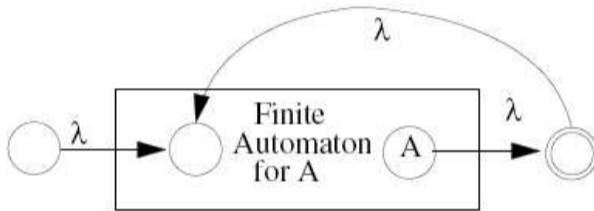
NFAs for Fundamental REs



NFA for RE A^+ (A an arbitrary RE)

What about an NFA for A^* ?

NFAs for Fundamental REs



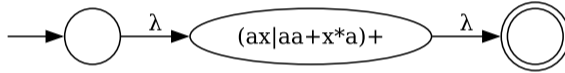
NFA for RE A^+ (A an arbitrary RE)

What about an NFA for A^* ?

BEWARE: figure 3.22 of the text is missing this lambda transition!

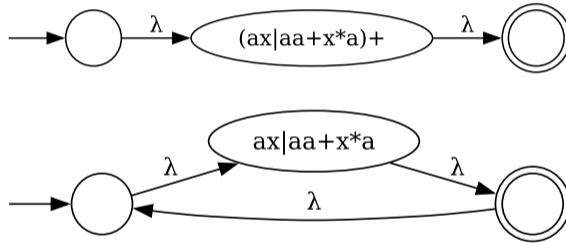
From REs to NFAs

$(ax|aa^+x^*a)^+$ (from the challenge question) as an NFA



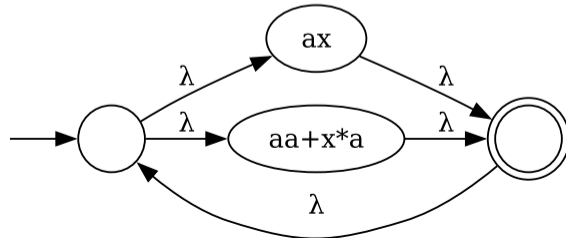
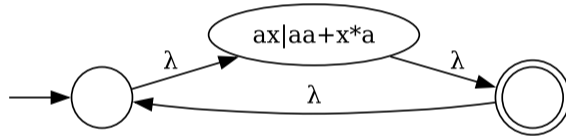
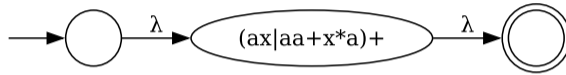
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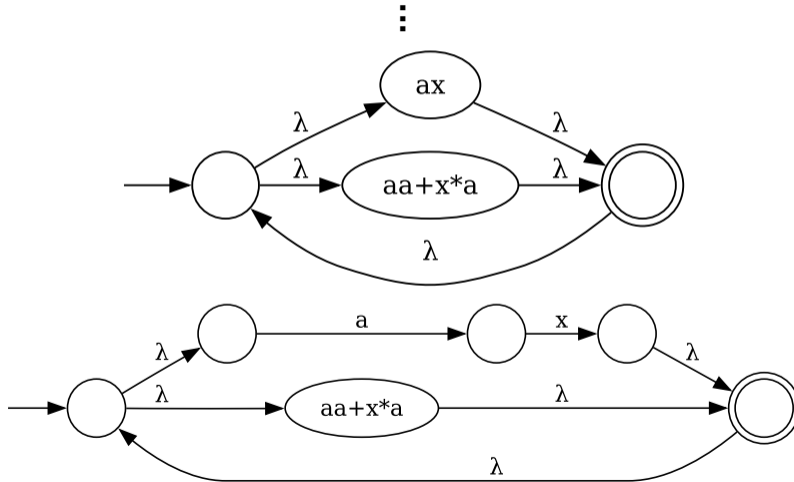
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From REs to NFAs

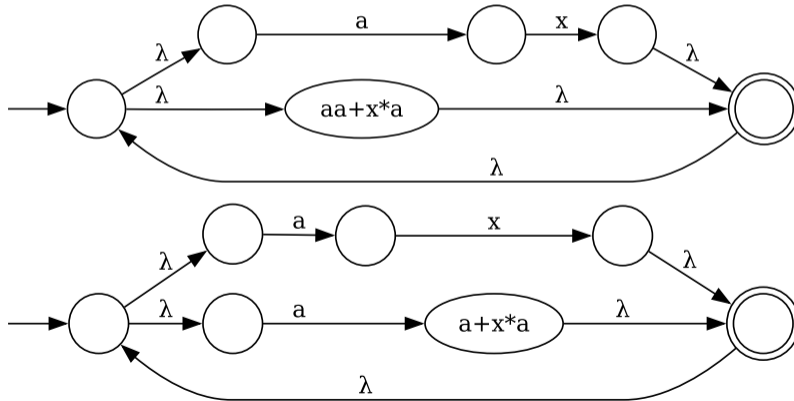
$(ax|aa^+x^*a)^+$ (from the challenge question) as an NFA



From REs to NFAs

$(ax|aa^+x^*a)^+$ (from the challenge question) as an NFA

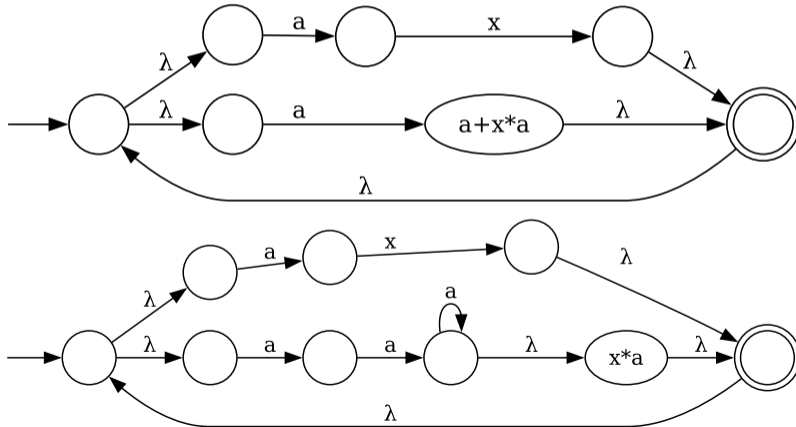
⋮



From REs to NFAs

$(ax|aa^+x*a)^+$ (from the challenge question) as an NFA

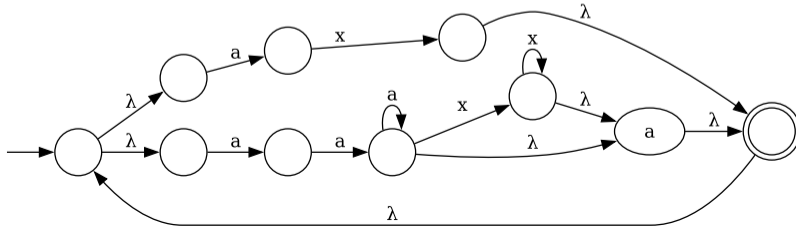
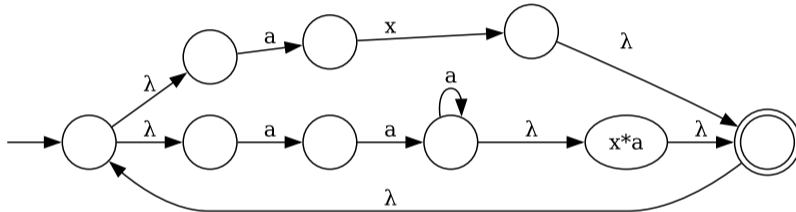
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From REs to NFAs

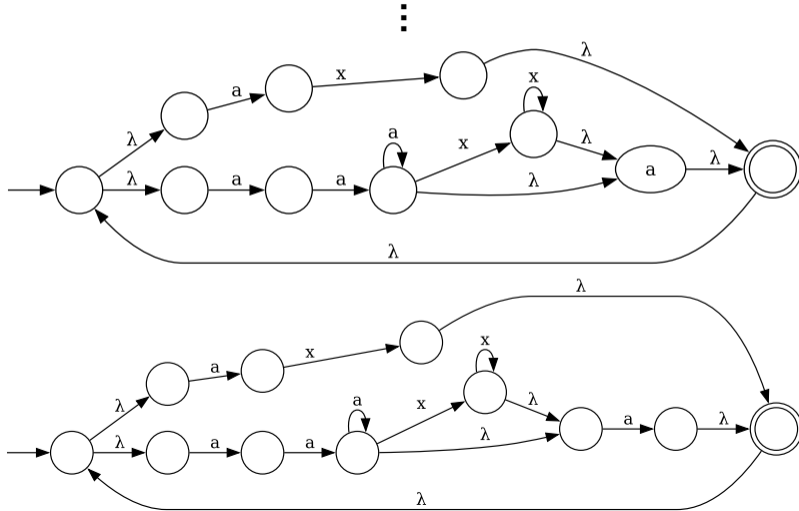
$(ax|aa^+x^*a)^+$ (from the challenge question) as an NFA

⋮



From REs to NFAs

$(ax|aa^+x*a)^+$ (from the challenge question) as an NFA



...next lecture

How might we convert this NFA to a DFA (\equiv **transition table**)?

