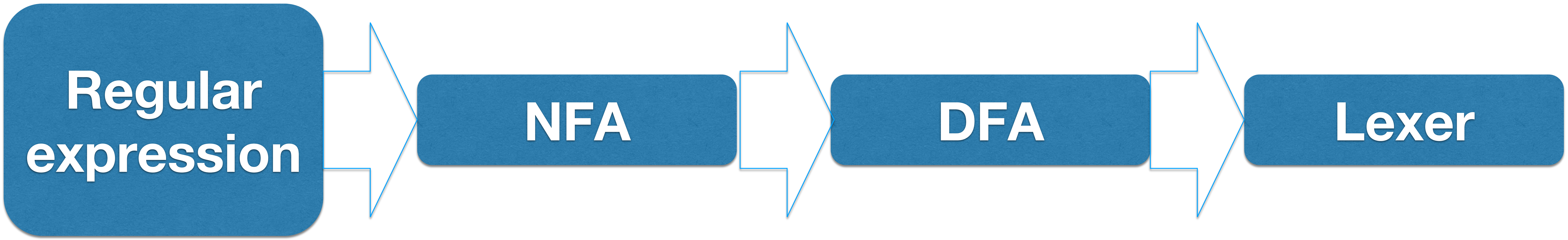
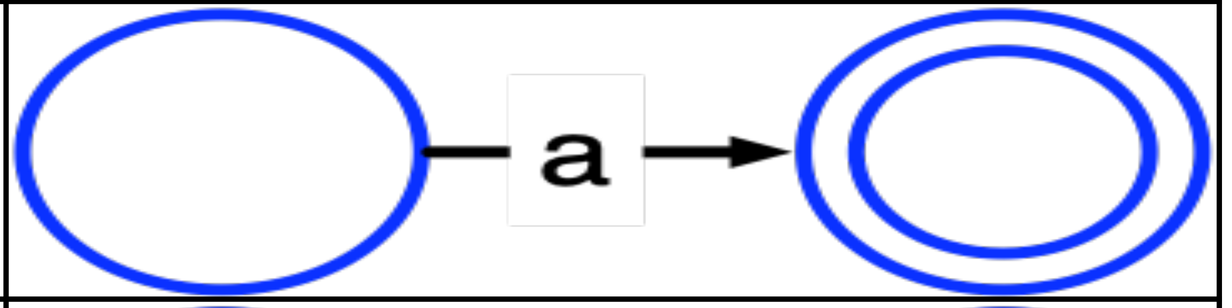
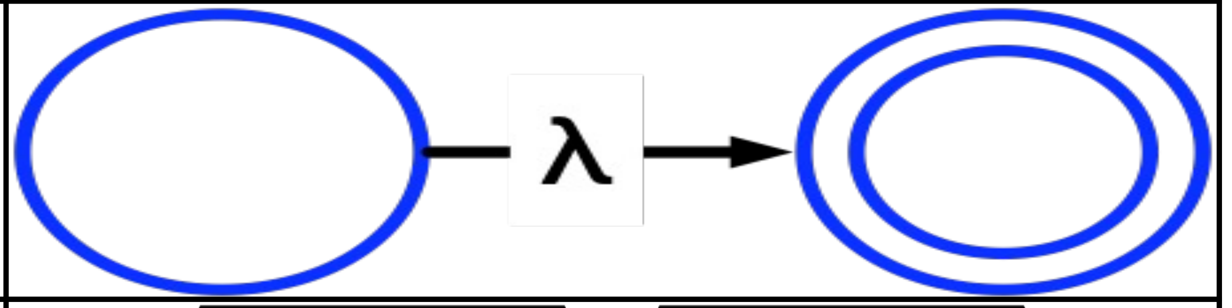
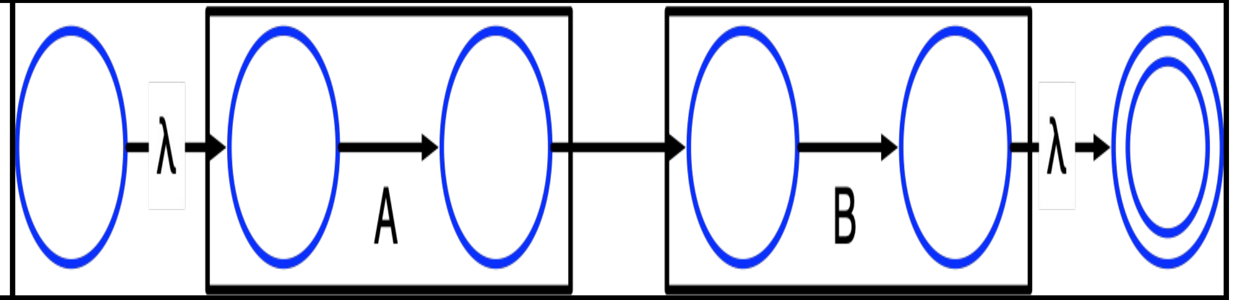
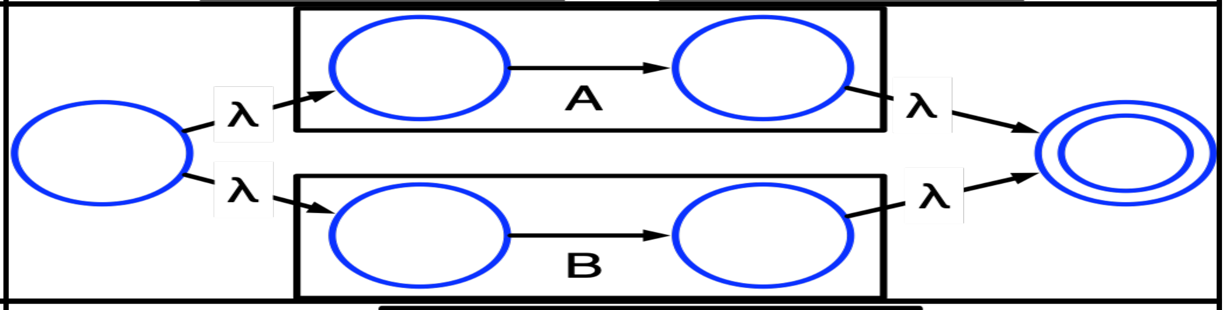
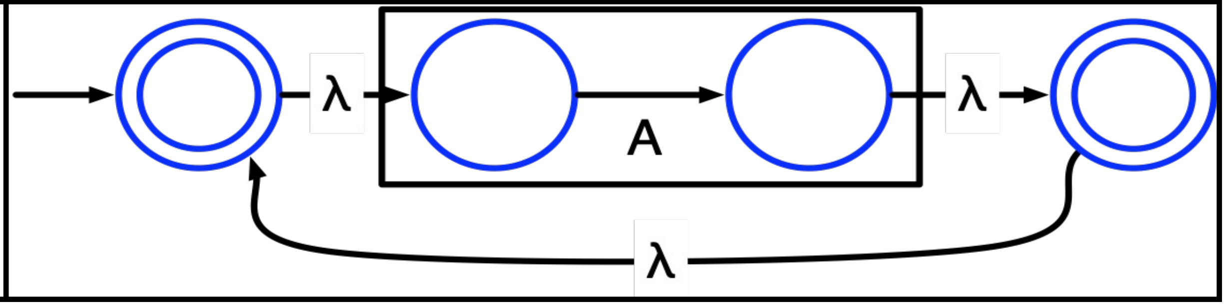
building an automaton


Regular expression
NFA
DFA
Lexer

building a non-deterministic automaton

- Can use the features of non-deterministic automata, especially λ-transitions, to build up an automaton automatically from a regular expression:

Expression	FA
a	
λ	
AB	
A|B	
A*	

example

- Build automaton for (a|b)*(b|c)*

pros and cons of nfas

power of NFAs

- NFAs are exactly as powerful as regular expressions
  - If you have a regular expression, there exists an NFA that matches it
  - If you have an NFA, there exists a regular expression that defines the set of strings that the NFA matches
- Alternate definition of regular languages: exactly the set of languages that can be accepted by a (non-deterministic?) finite automaton

problems with non-determinism

- Could just build a non-deterministic automaton and call it a day
- But non-determinism has some drawbacks
  - Unpredictable running time: what if you make the wrong choice and have to backtrack?
  - (Causes actual bugs in real code!)
- Turns out that non-deterministic finite automata and *deterministic* finite automata are equally powerful
  - Can automatically generate a deterministic finite automaton from a non-deterministic one