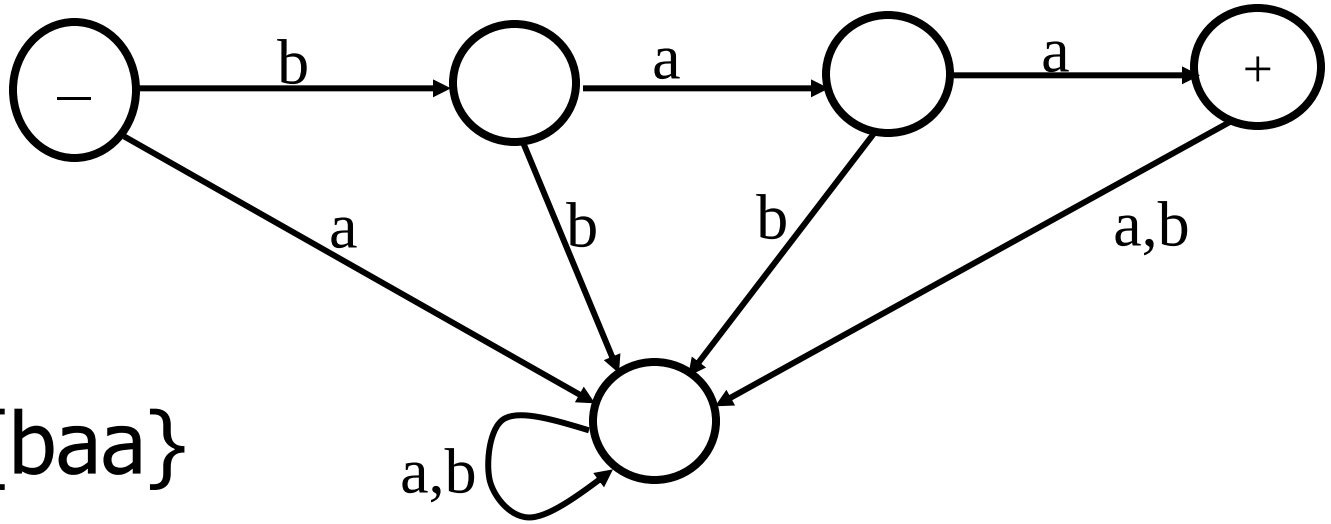
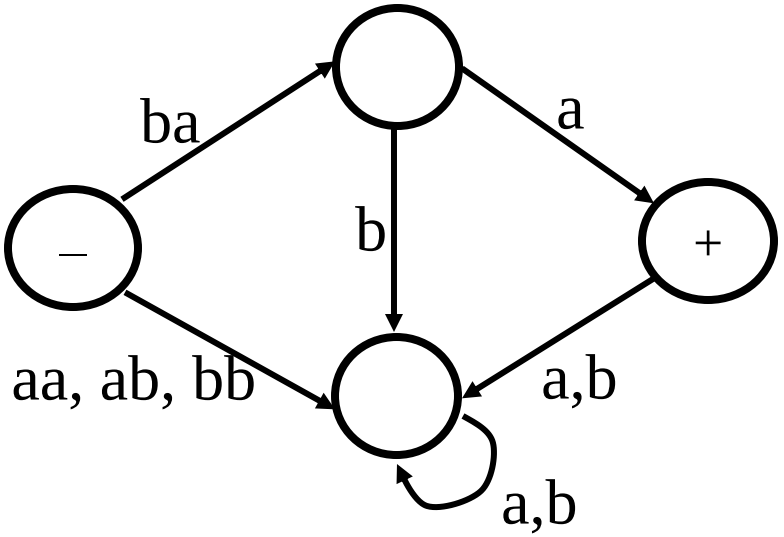
Chapter 6: Transition Graphs

We introduce the first non-deterministic but simple theoretical machine: Transition Graph.



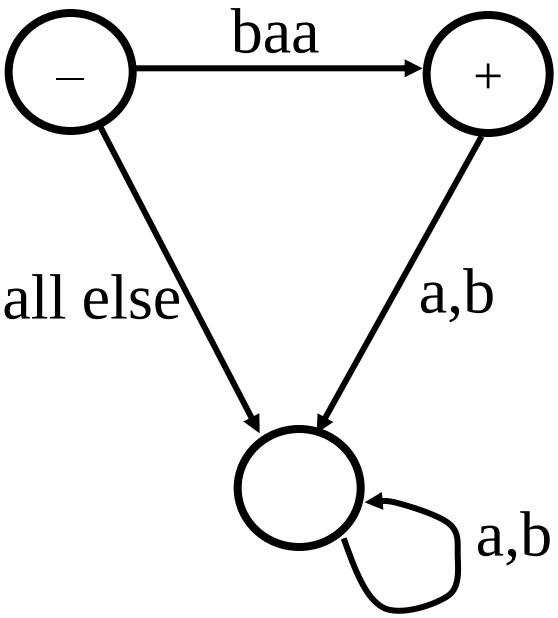
- An FA: {baa}
- The word a? The word baabb?
- The input fails, or the machine fails on the input. The input is rejected.

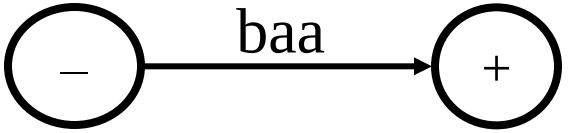


- A transition graph that accepts the language {baa}

What it seems to be a More Powerful Machine

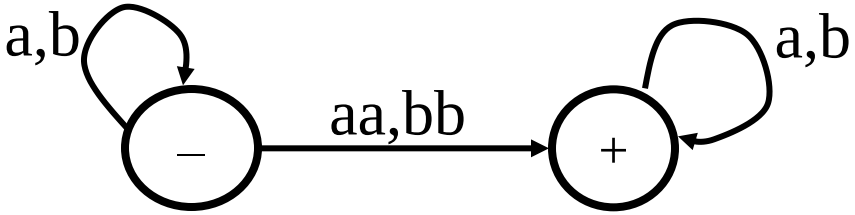
Two other equivalent Transition Graphs with fewer states





- The word a? The word baabb?
- The input crashes. The machine crashes. The input is rejected.

(2 ways for an input to be rejected)

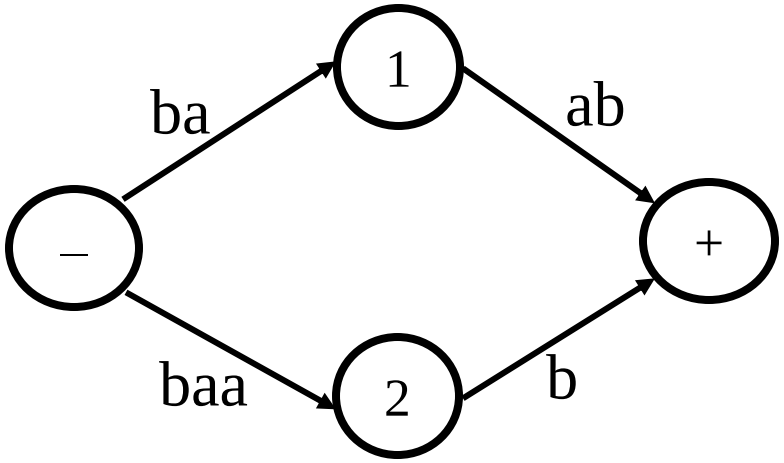


- baa?
- a choice, a decision

  2 possible paths — b|aa - accepted

  b|a|a - rejected

  1 way to crash — ba|a – rejected
- The machine represents a language L. baa $\in$ L?
- For all w, $w \in L$ if there exists a path that arrives at a final state.

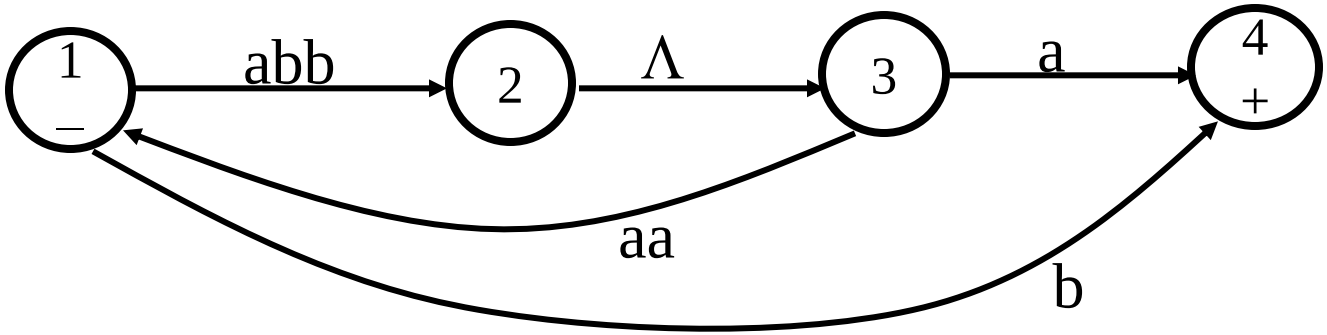


- baab? 2 possible paths, both end in a final state.

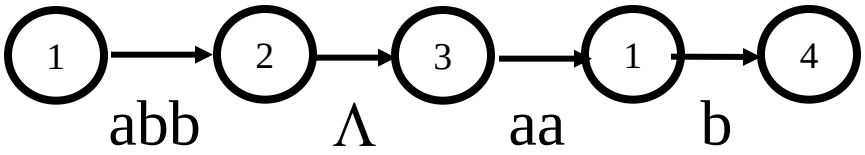
- A transition graph (TG) is the following 3 things:
  1. a finite set of states, at least one of which is designated as the start state, and some (maybe none) of which are designated the final states (or accepting states)
  2. an alphabet Σ of input letters
  3. a finite set of transitions that show how to go to a new state, for some pairs of state and substrings of letters (or Λ). (One pair can have 0, 1, or more next-states.)

- A successful path is a series of edges beginning at some start state and ending at a final state.
- The concatenation of all the substrings that label the edges in the path is a word accepted by this machine.
- The set of words accepted is the language of the transition graph.

- Example:

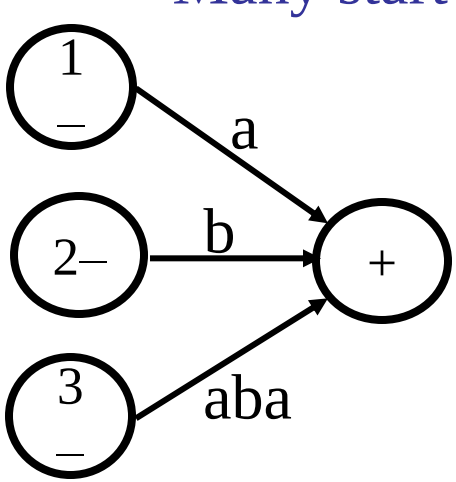


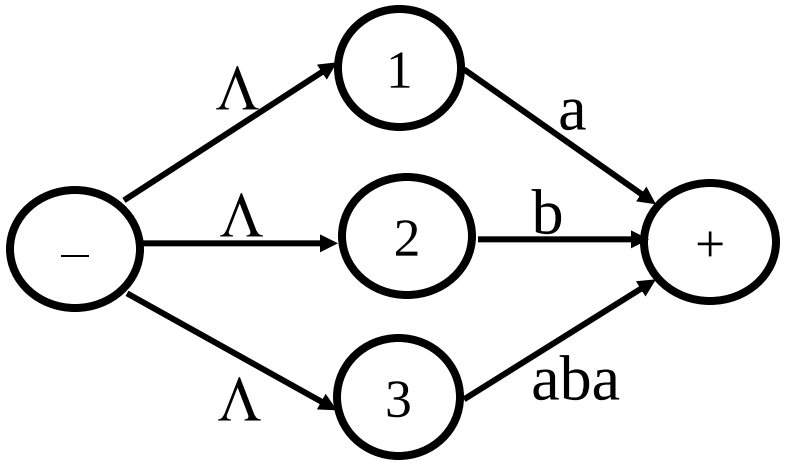
abbaab



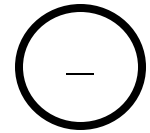
abbab crashes.

Many start states

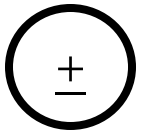




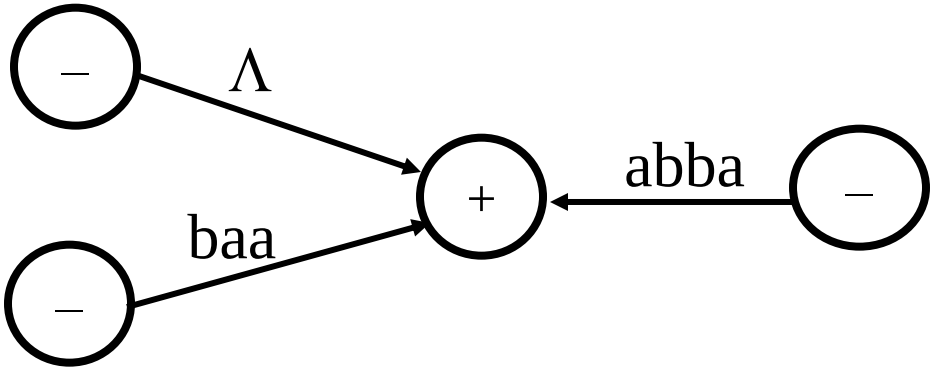
- These two machines are clearly equivalent.
- <u>Remark:</u> Every finite automaton is a transition graph.



L = ϕ

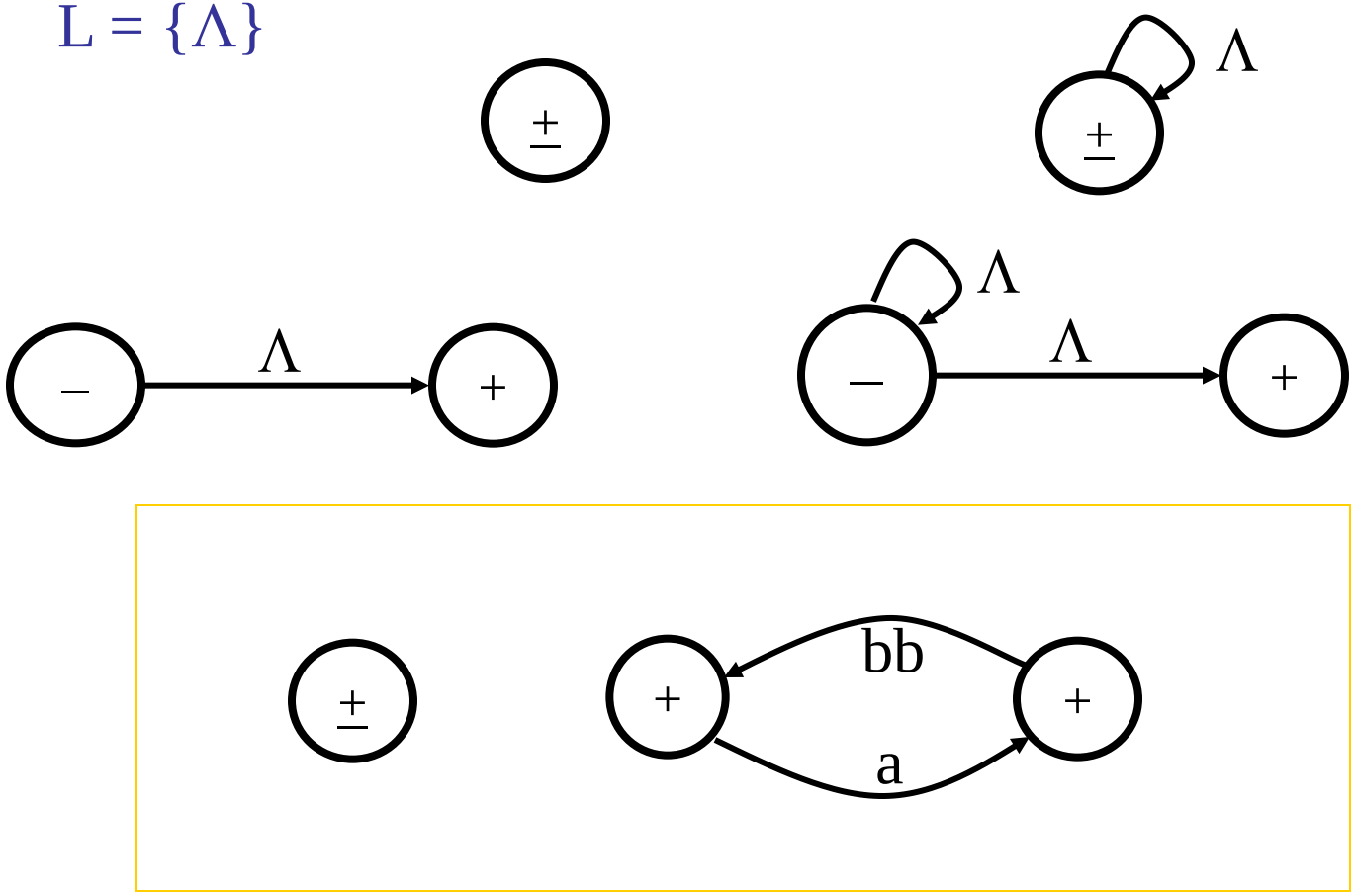


L = {Λ}

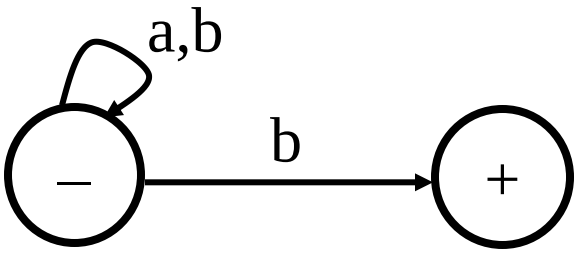


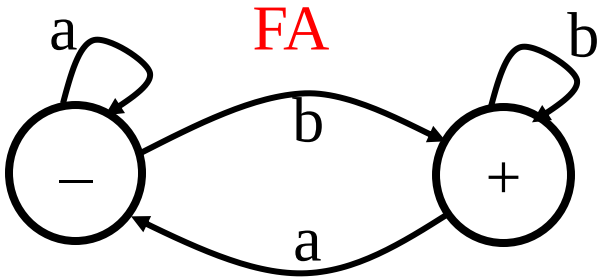
L = {Λ, abba, baa}

L = {Λ}



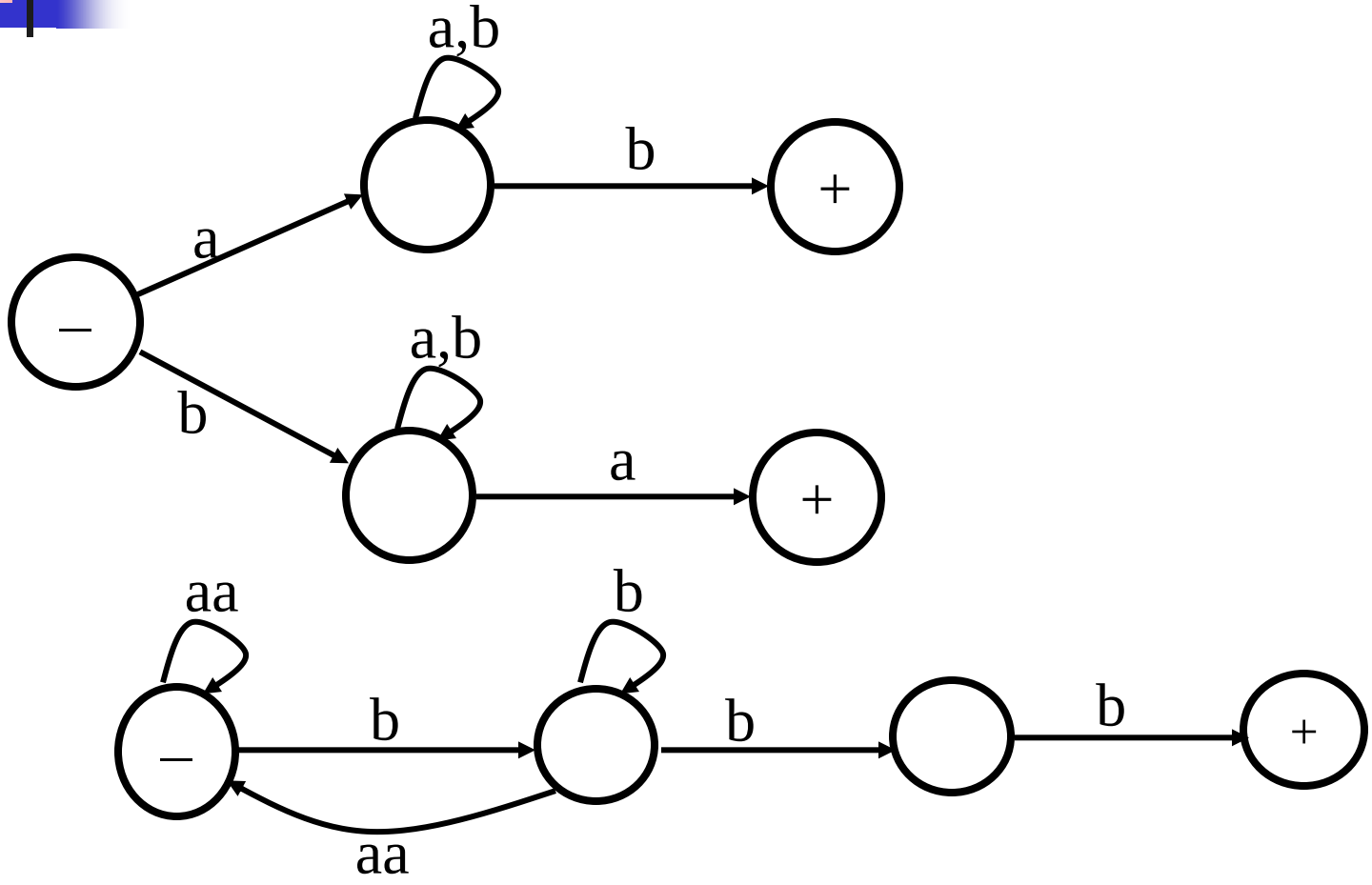
All words ending in b: **(a+b)*b**





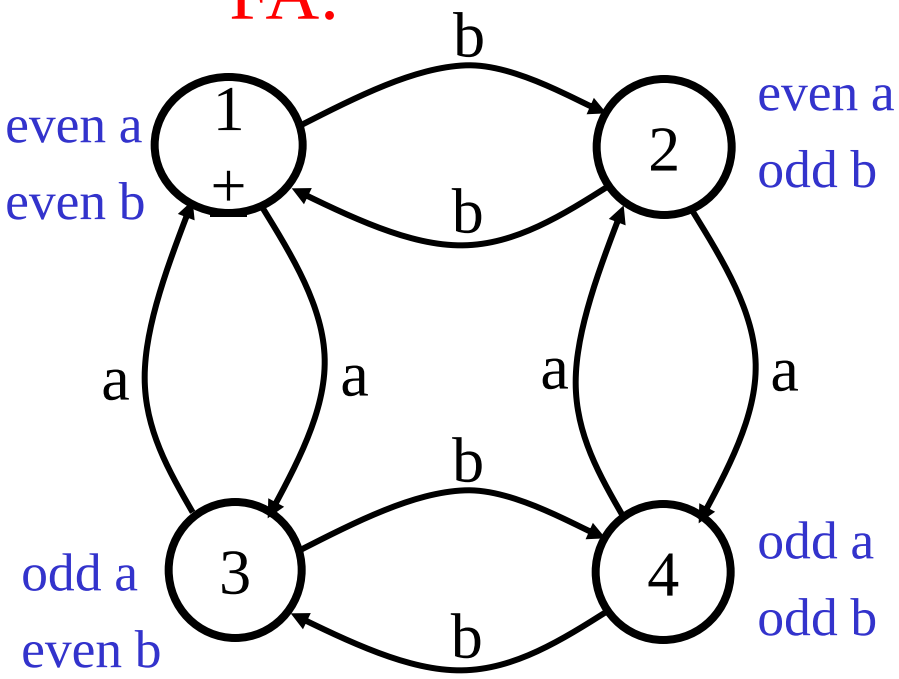
transition graph:

Some words can fail, crash, and succeed: abab.

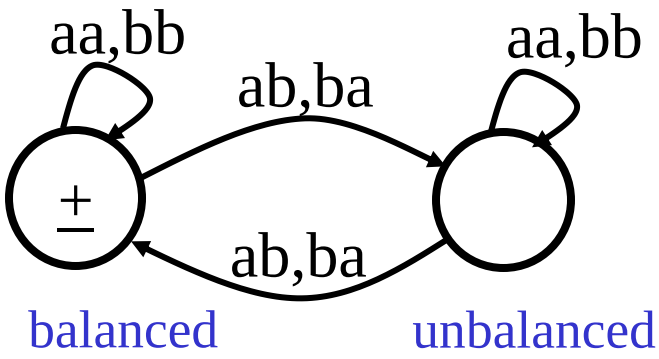

a,b
b
+
a
–
a,b
b
a
+
aa
b
b
b
b
+
–
aa

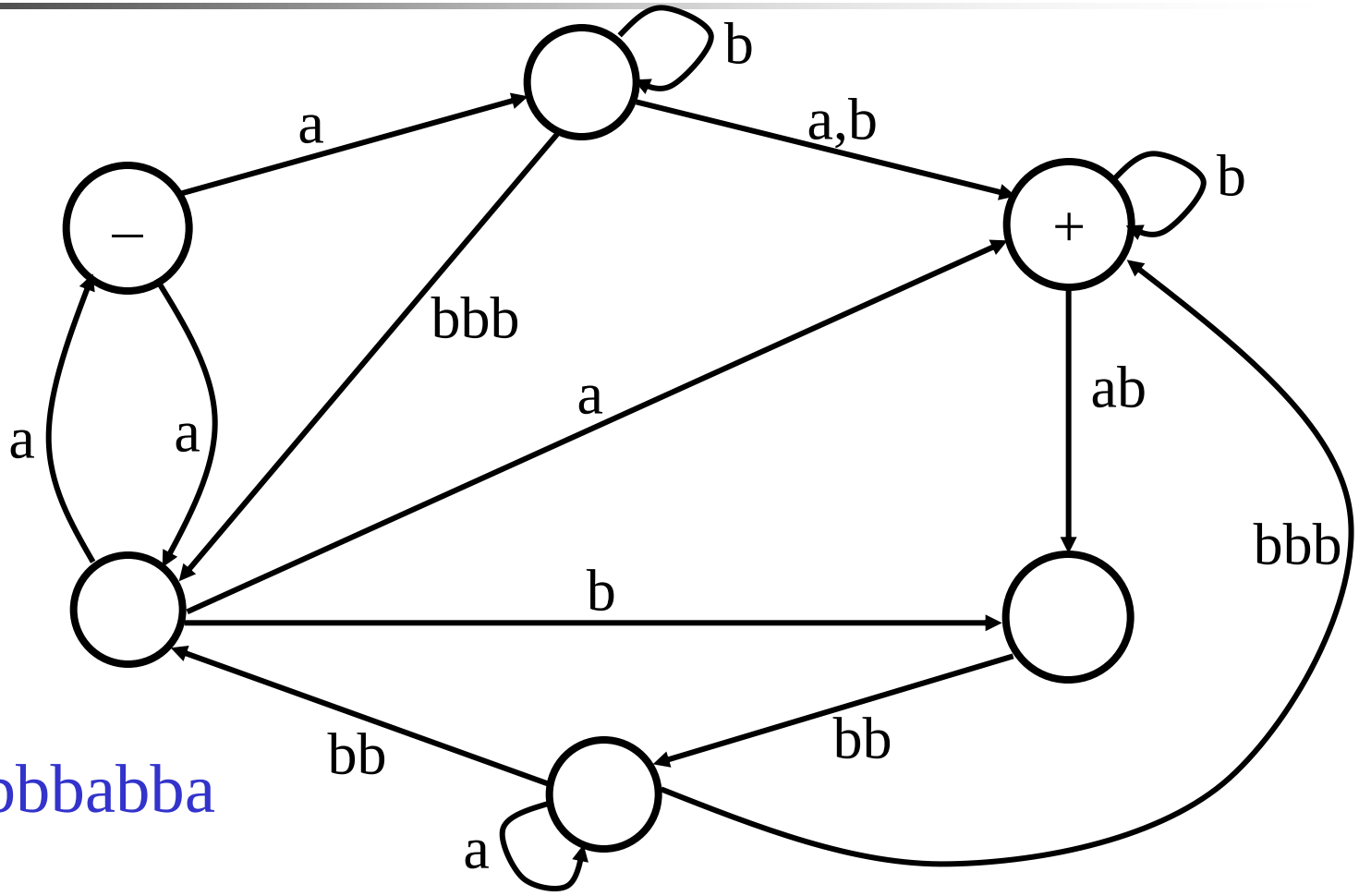
Language EVEN-EVEN

FA:

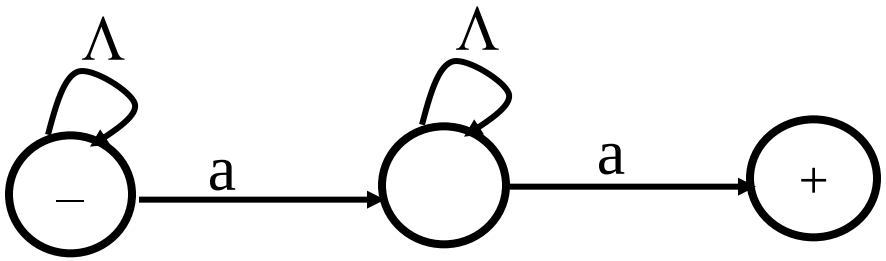


Transition Graph:

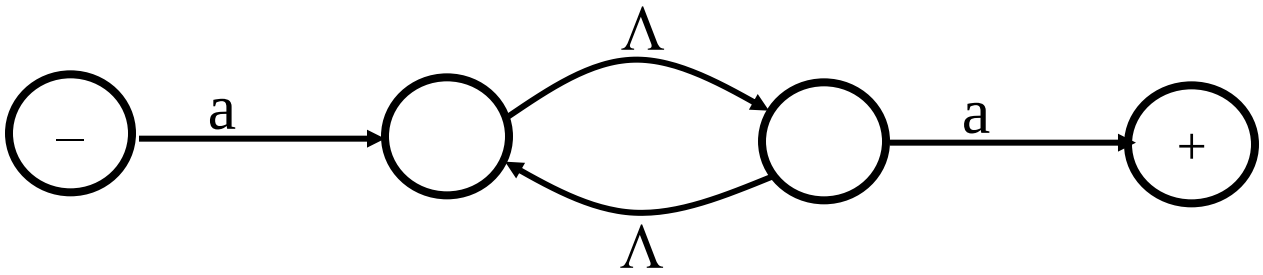




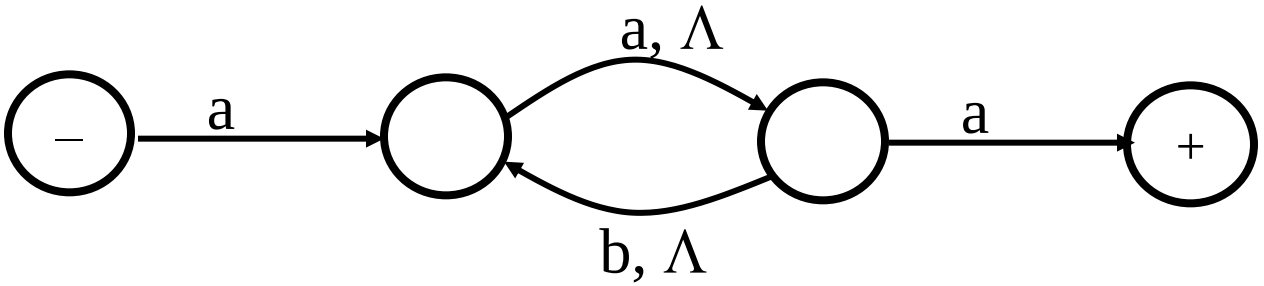
abbbabbbabba



- Infinitely many paths for aa
- Is there an algorithm to determine if a word is accepted?



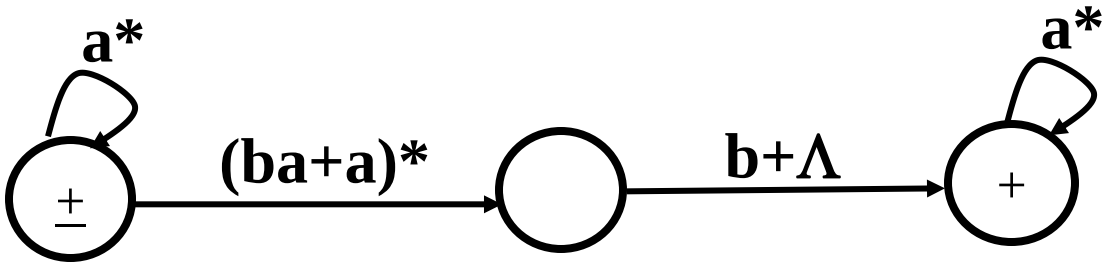
We can delete the Λ transition



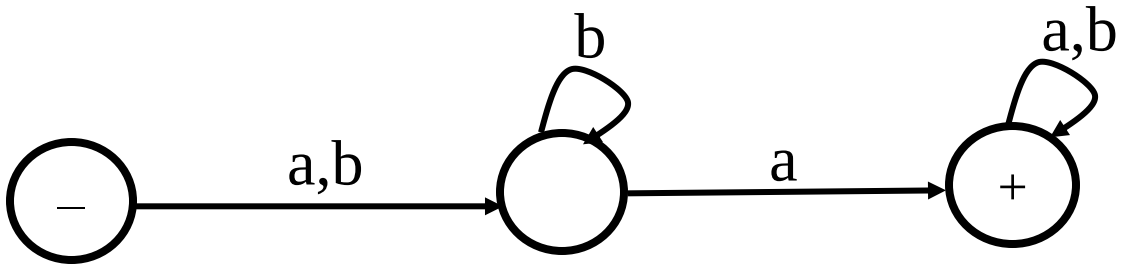
But not here

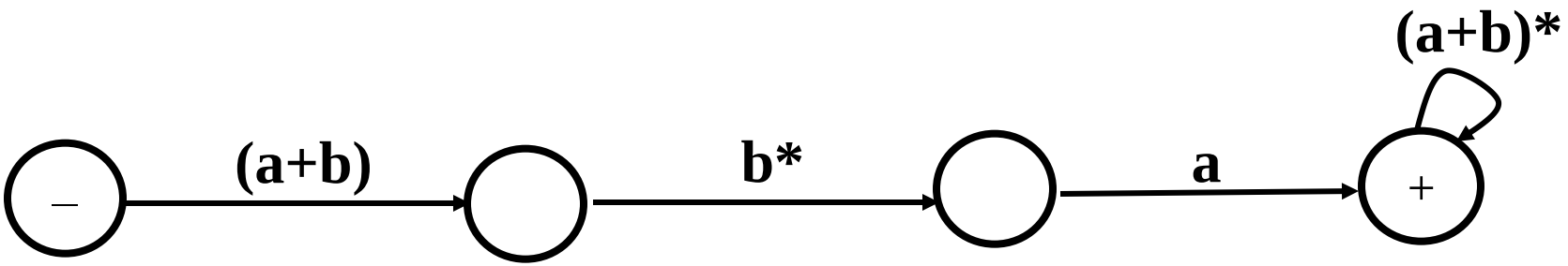
- A generalized transition graph (GTG) is the following 3 things:
  1. a finite set of states, at least one of which is designated as the start state, and some (maybe none) of which are designated the final states (or accepting states)
  2. an alphabet Σ of input letters
  3. a finite set of edges connecting some pairs of states, each labeled with a regular expression

Words without 2 b's in a row:

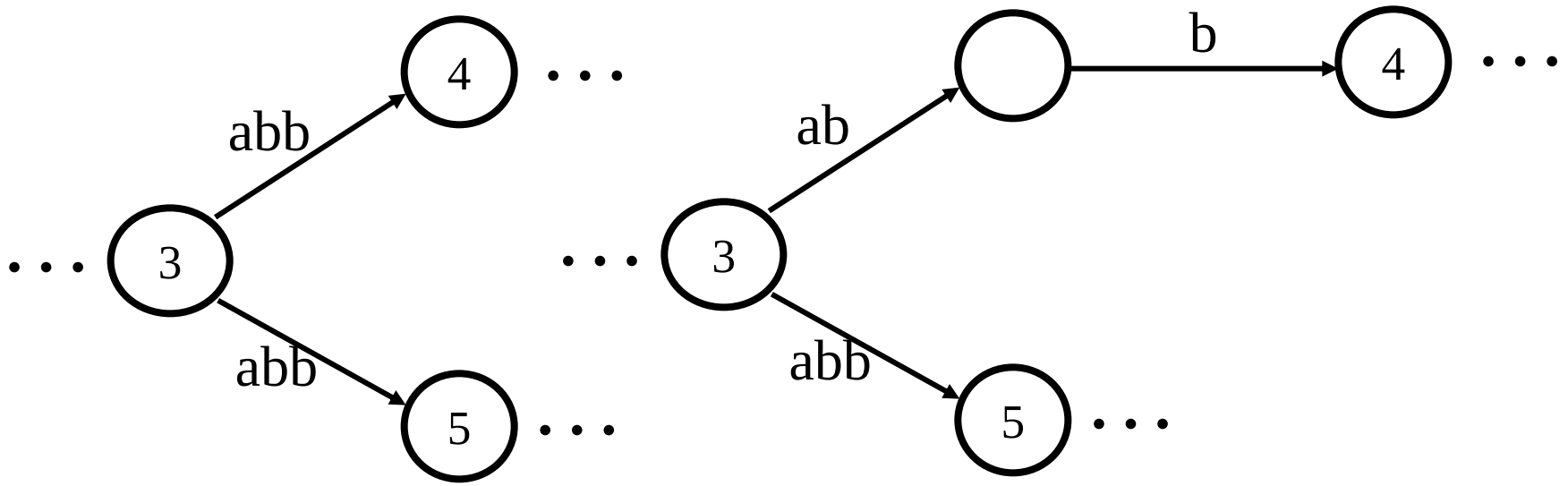


Kleene Star Closure and Loops

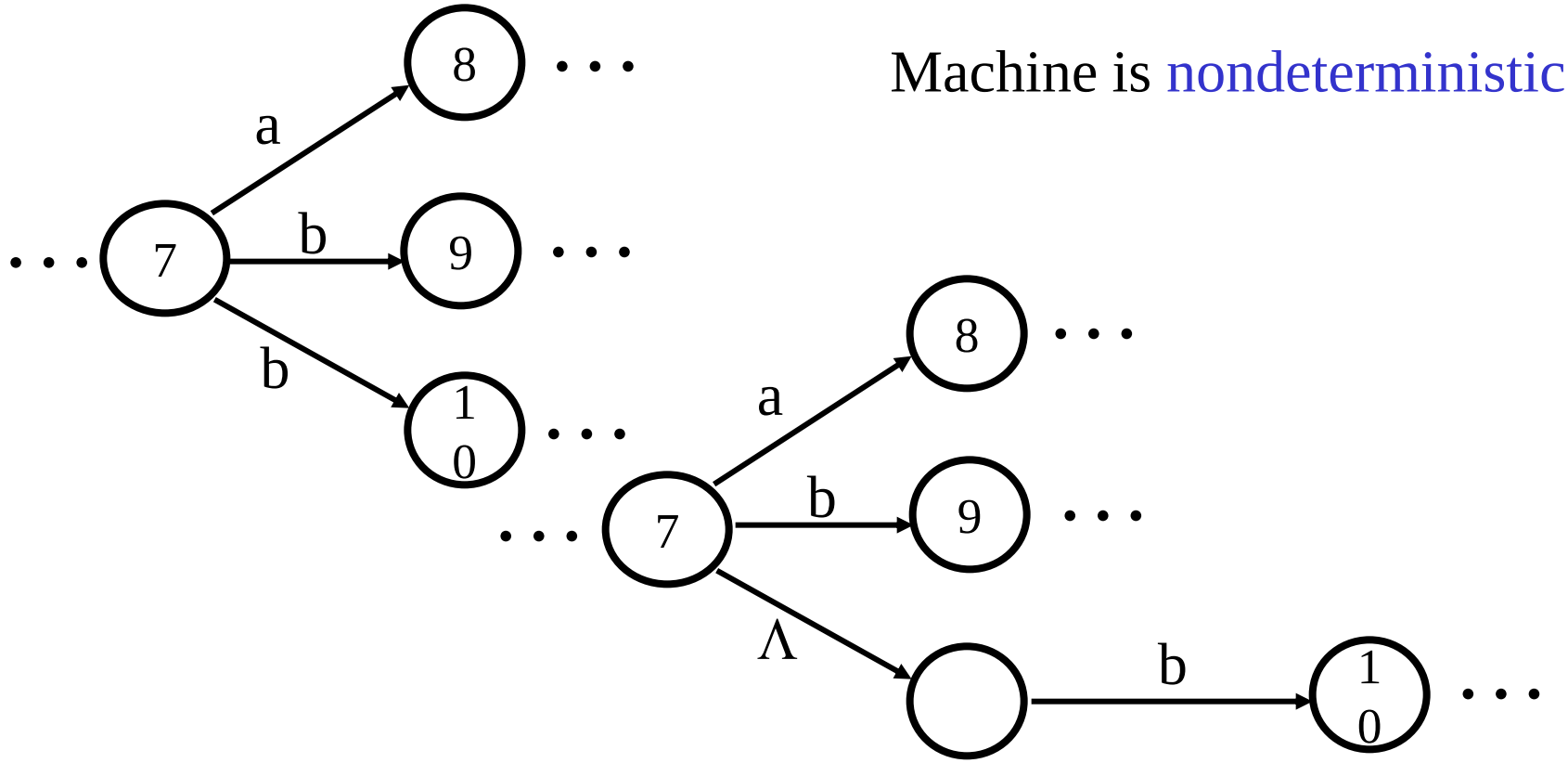




Choosing Transitions



Choices even with restriction of 1 letter per edge



Machine is nondeterministic