Problem 1

Find all strings in $L((a+bb)^*))$ of length 5

- zero instances of bb
  1. aaaaa
- one instance of bb
  2. aaabb
  3. aabba
  4. abbaa
  5. bbaaa
- two instances of bb
  6. bbbba
  7. bbabb
  8. abbbb

Problem 3

Find an NFA that accepts the language $L(aa^*(ab+b))$.

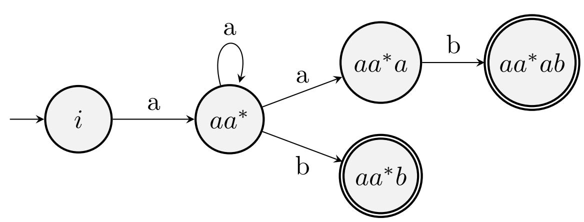


Figure 1: Accepts $L(aa^*(ab+b))$

Problem 7

Find a regular expression for the set $\{a^n b^m : n \geq 3, m \text{ is odd}\}$.

Answer: $(aaaa^*)(b(bb)^*)$

Problem 18

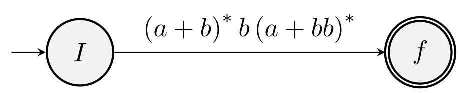
Find a regular expression for:

$$L = \left\{ w \in \{0,1\}^* \ : \ w \text{ has exactly one pair of consecutive zeroes} \right\}$$

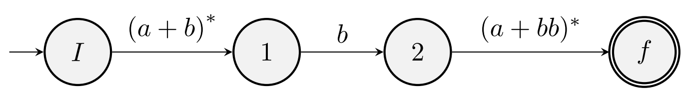
Answer: $(0+\lambda)\left((1+101)^*\right)(00)\left((1+101)^*\right)(0+\lambda)$

Problem 5

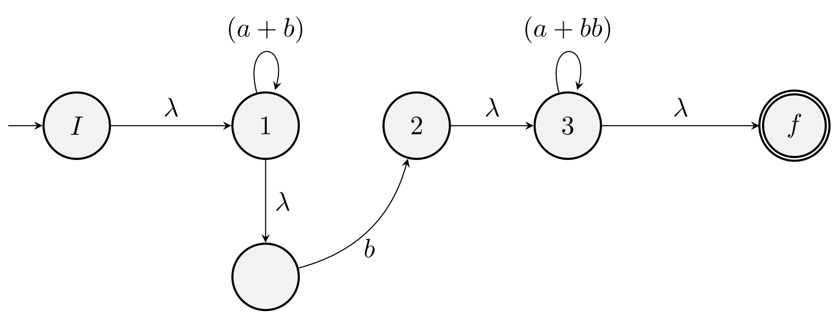
Give an nfa that accepts the language $L\left((a+b)^*\, b\, (a+bb)^*\right)$



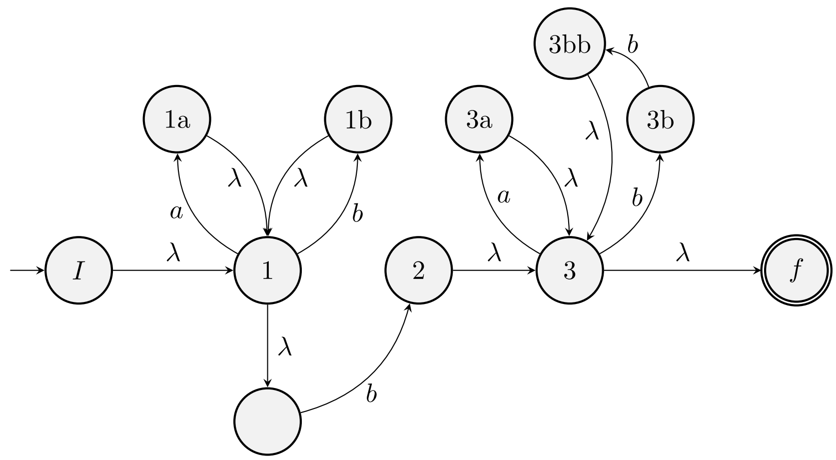
Step 1, make a trivial NFA



Step 2, split off the concats



Step 3, expand kleene stars



Step 4, break off unions.

All labels are now single symbols, so the NFA is complete.
Leaving node 1 we have $(a+b)^*$.
Leaving node 2 we have $(a+b)^* b$
And leaving node 3 we finish with $(a+b)^* b (a+bb)^*$

Problem 7(b)

Find a DFA to accept $L = L(ab^*a^*) \cap L(b^*ab)$

Because this is the intersection of two languages, any string in the language must be accepted by both regular expressions. The first language *must* start with a, so the b^* in the second language can be ignored. The *only* string that begins with a that is accepted by the second language is ab, which is also accepted by the first language, so this must be the only string in the language. Thus, we have a trivial DFA.