Regular Languages and Automata: Problems for Week 1

Note: when we ask for a DFA, we are happy for you to supply a partial DFA. Indeed that's usually better, because it's more efficient.

Exercise 1. *Give a regexp over the alphabet $\Sigma = \{a, b, c\}$ for the set of words in which "a" occurs precisely twice.*

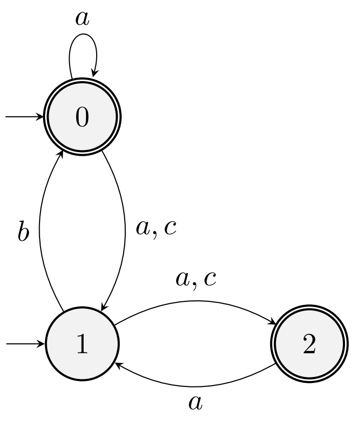
Exercise 2. *Build a DFA that checks whether a string is equal to "`Goo....gle`" with arbitrarily many `o`'s following the initial two.*

Exercise 3. *Design DFAs for the following regular expressions:*

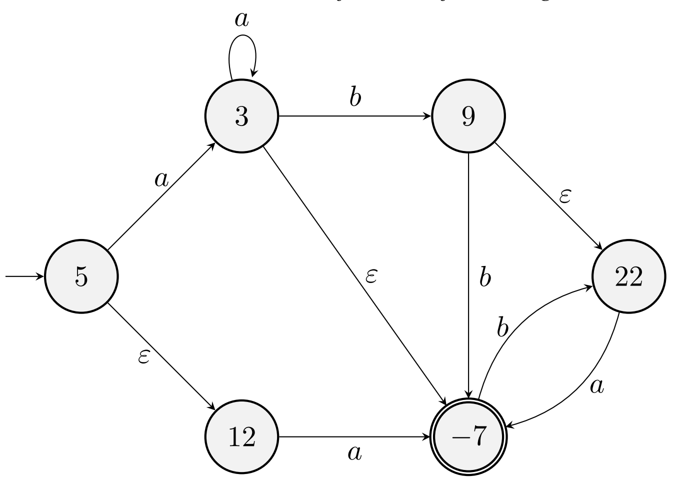
1. `(a|b)c`
2. `ab|bc`
3. `ab|ac` *(Careful! Remember that from any state there must be at most* one *transition labelled with a particular letter.)*
4. `c(a|b)*c`

Exercise 4. *An online shop requires users to provide a password during registration. Every password is a string of lowercase letters and digits. It must contain at least one letter and at least one digit, and it must be at least three characters long. Give a regular expression for passwords. You can use* `[a-z]`*, which matches any lowercase letter, and* `[0-9]`*, which matches any digit.*

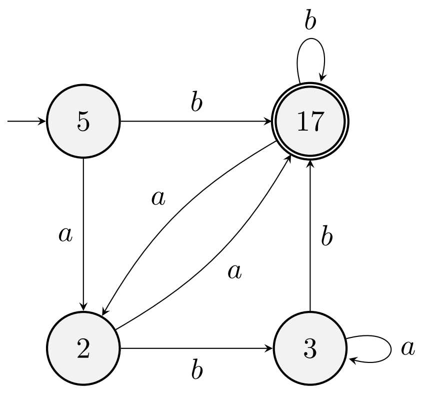
Exercise 5. *Determinize the following NFA.*



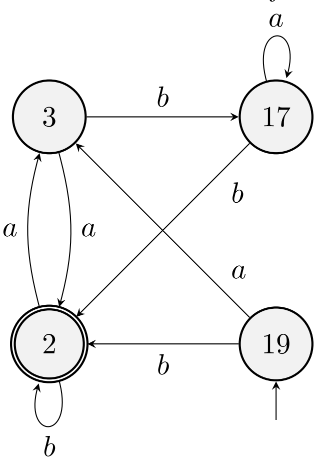
Exercise 6. *Remove ε-transitions from the following.*



Exercise 7. *Let Automaton A be the following DFA:*

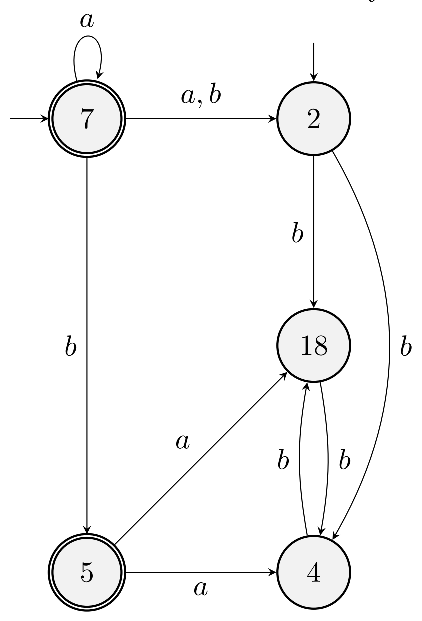


Let Automaton B be the following DFA:

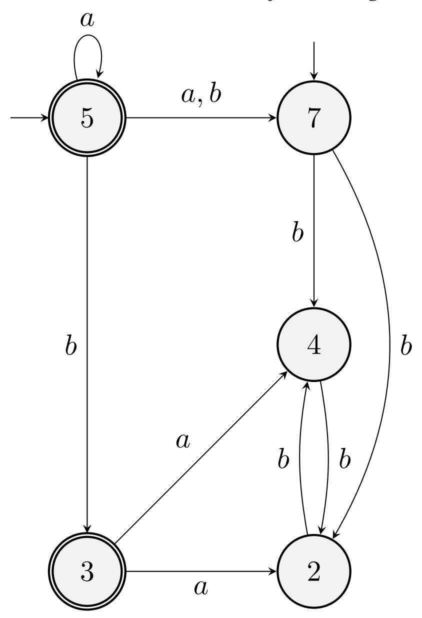


Give an isomorphism between these automata.

Exercise 8. *Let Automaton A be the following NFA.*



Let Automaton B be the following NFA.



Give two isomorphisms between these automata.