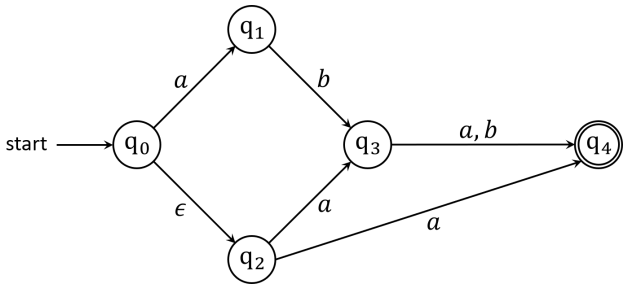
Homework #2

(Due: Oct 5)

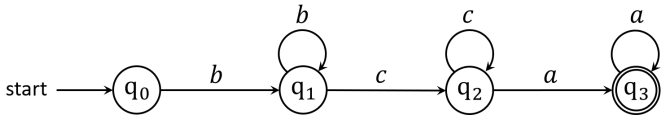
Task 1. [40 Points] NFA to DFA

Convert each of the following NFAs to an equivalent DFA.

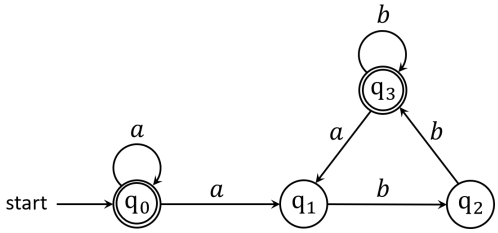
(a) [**10 Points**] Alphabet, $\Sigma = \{a, b\}$.



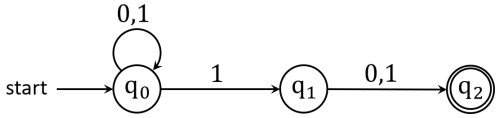
(b) [**10 Points**] Alphabet, $\Sigma = \{a, b, c\}$.



(c) [**10 Points**] Alphabet, $\Sigma = \{a, b\}$.



(d) [**10 Points**] Alphabet, $\Sigma = \{0, 1\}$.



Task 2. [20 Points] Regular expressions

Find regular expressions to describe the following languages.

(*a*) [**5 Points**] $L = \{w|$ binary number w is divisible by $3\}$, $\Sigma = \{0, 1\}$

(*b*) [**5 Points**] The language represented by the NFA in Task $1(c)$.

(*c*) [**5 Points**] The language represented by the NFA in Task $1(a)$.

(*d*) [**5 Points**] $L = \{w|$ length of w is not divisible by $6\}$, $\Sigma = \{a, b\}$

Task 3. [30 Points] Non-regular languages

Use the pumping lemma to show that the following languages are not regular.

(*a*) [**10 Points**] $L = \{a^m b^n c^{m+n} |\ m, n \geq 0\}$, $\Sigma = \{a, b, c\}$

(*b*) [**10 Points**] $L = \{a^f |\ f$ is a Fibonacci number$\}$, $\Sigma = \{a\}$

(*c*) [**10 Points**] $L = \{a^m b^{n^3} |\ m, n \geq 0\}$, $\Sigma = \{a, b\}$

Task 4. [10 Points] More non-regular languages

Prove that the following languages are not regular. You are not required to use the pumping lemma but you can build on results we have already proved in the class.

(*a*) [**5 Points**] $L = \{a^m |\ m$ is a composite number$\}$, $\Sigma = \{a\}$

(*b*) [**5 Points**] $L = \{a^m |\ m$ is neither a prime nor divisible by $3\}$, $\Sigma = \{a\}$