Exercises for FLL, Fall 2017, sheet 1

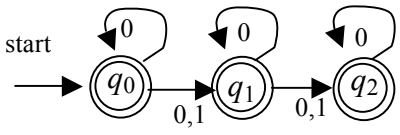
Return Thursday Sep 28, in class

Note: you may work in teams of 2 if you wish. If you do, hand in a single solution sheet for both of you.

Exercise 1 (a) How many words exist over the alphabet $\Sigma = \{1\}$? and over the alphabet $\Sigma = \{a, b\}$? **(b)** How many words of length n exist over an alphabet of size k? **(c)** How many languages exist over the alphabets from (a) and (b)? **(d)** How many languages of words of length n exist over an alphabet of size k? **(e, a bit more difficult, optional)** Show that there are countably infinite many *finite* languages over $\Sigma = \{a, b\}$? *Hint: show two things. First, that there are* ***at least*** *as many finite languages as there are natural numbers – show this by giving an injective map from* $\mathbb{N}$ *to the set of finite languages. Second, show that there are* ***at most*** *as many finite languages as there are natural numbers – show this by giving an injective map from the set of finite languages to* $\mathbb{N}$.

Exercise 2. Design a DFA which accepts the language $L = \{ w \in \{a, b\}^* \mid |w| > 0$, *and the last symbol in w is equal to the first*$\}$. Describe your DFA both by a complete transition table and through a graphical transition diagram.

Exercise 3. Describe the language accepted by the NFA shown below in plain English.



Exercise 4. Construct a DFA equivalent to the NFA depicted above, *using the subset construction*. Present your DFA by a transition diagram.