

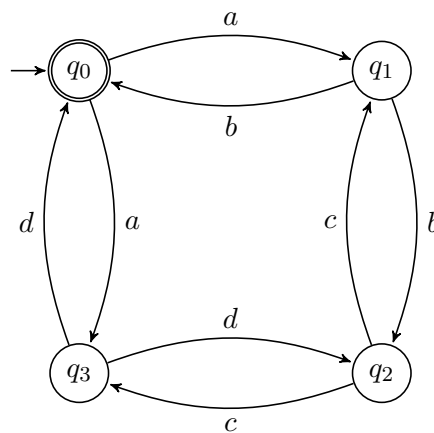
Exercise Sheet 1

Exercise 1.1 REG \Rightarrow NFA

Use the method discussed in class to construct an NFA accepting $((we)^*l(co)^* + (me)^*)^*$.

Exercise 1.2 NFA \Rightarrow REG

Use equations and Arden's Lemma to find a regular expression for the following NFA:



Exercise 1.3 Arden's Lemma

Consider the following extension: If $U, V \subseteq \Sigma^*$ and $\varepsilon \in U$ then all solutions $L \subseteq \Sigma^*$ of the equation $L = UL \cup V$ are precisely the elements of $\mathcal{L} = \{U^*V' \mid V \subseteq V' \subseteq \Sigma^*\}$.

Prove the extension by solving (a) and (b) below:

- (a) Show that if L is a solution of $L = UL \cup V$ then $L \in \mathcal{L}$.
- (b) Show that every $L \in \mathcal{L}$ satisfies $L = UL \cup V$.

Exercise 1.4 Languages & Formulas

Provide some arguments with your solution for the following tasks:

- (a) Find a formula φ such that $L(\varphi) = \Sigma^*a\Sigma^*b^+$.
- (b) What is the language described by $\exists y \forall x \forall z. x < y \wedge y < z \rightarrow \neg P_a(x) \wedge P_b(y)$?