Syntax and Semantics
Exercise Session 4

Exercise 1

Consider the following regular expressions:

a) $(a^* \cup b^+) \cup b^*$

b) $(\epsilon \cup a)b^* \cup b^+b^*$

c) $(a \cup ba \ \cup bb)(a \cup b)^*$

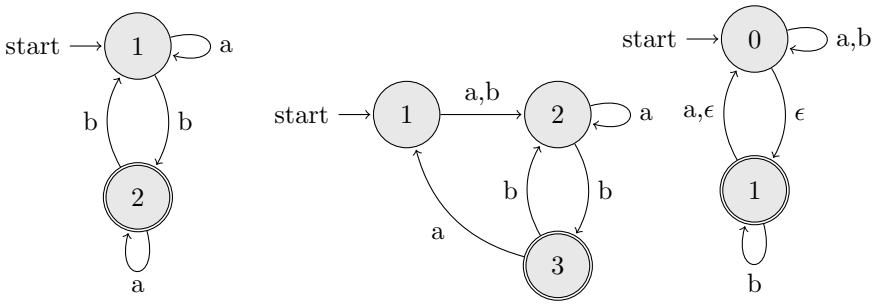
d) $(a^* \cup b^*)^+ \cup (b^+a^*)^* \cup (a^*b^+)^+$

i) For each of these, write five words that belong to their language and five words that do not belong to their language.

ii) Convert each of these expressions to NFAs.

Exercise 2

Using the algorithm from the course, convert the finite automata in Fig. 1 to regular expressions.



(a) M_1 (b) M_2 (c) M_3

Figure 1: Finite Automata for Exercise 2

Exercise 3

Give state diagrams of NFAs with the specific number of states recognizing each of the following languages with the alphabet $\{a, b\}$.

a) The language $a^*b^*a^+$ with three states

b) The language $a^*(bba^+)^*$ with three states

c) The language L_1 with five states $L_1 = \{w \mid w \text{ contains the string abab}\}$

d) The language L_2 with six states

$$L_2 = \{w \mid w \text{ contains an even number of a or exactly two b}\}.$$