

CSc 30400 Introduction to Theory of Computer Science 4th Homework Set

1. Give the language on the alphabet $\Sigma = \{0, 1\}$ that each of the following regular expressions represent
 - (a) 0^+1
 - (b) $11 \cup 01$
 - (c) $1(\varepsilon \cup (0 \cup 1)1)$
 - (d) 1^*01
 - (e) $(0^+10^+)^*$
2. Give a regular expression that represents the following language on $\Sigma = \{0, 1\}$.
 - (a) $L_1 = \{10, 110, 111\}$
 - (b) $L_2 = \{w \mid w \text{ contains an even number of 1s}\}$
 - (c) $L_3 = \{w \mid w \text{ ends with } 01\}$
3. Convert the regular expressions of exercise 1 into equivalent NFA_ε .
4. Convert the DFAs of exercise 3 of homework set 2 (skip 3a) into equivalent regular expressions. See the solution of homework set 2 for those DFAs.
5. Prove or disprove that the following regular expressions represent the same language on the alphabet $\Sigma = \{0, 1\}$. If they are not equivalent give one common string (string that belongs in both languages that are represented by the not equivalent reg. expr.)

To prove that are equivalent you can:

- find the languages that represent (set of strings) and show that they are equal (remember that to show that two sets L_1 and L_2 are equal we should show that $L_1 \subseteq L_2$ and $L_2 \subseteq L_1$)
- use several properties, such as the definition of the $^+$ operation (for example $1^+ = 11^* = 1^*1$), the distributive law (for example $(1 \cup 0)1 = 11 \cup 01$), the definition of the union operation in sets ($1 \cup 1 = 1$), the commutative law (for example $1 \cup 0 = 0 \cup 1$) or the associative law (for example $(0 \cup 1) \cup 1 = 0 \cup (1 \cup 1)$, or $(01)0 = 0(10)$).

- find the minimum dfas that are equivalent to the regular expressions and show that they are the same (the minimum dfa that recognizes a language is unique)

To disprove that they are equivalent you can

- find a string that is contained in the language that is represented by the one and isn't contained in the language that is represented by the other. For example $0^*1 \neq 0^+1$ because the first can produce 1 but the second cannot.
- find the minimum equivalent dfas and show that they are different.

- 0^*1^* and $(01)^*$
- $(0^*1)^*$ and 0^*1^*
- $(0^*1)^*$ and $(0^*1^*)^*$
- $(0^*1)^+$ and $(0^*1^+)^+$
- $(0^*1^*)^*$ and $(0 \cup 1)^*$
- $(0 \cup 0)^*$ and $(00)^*$
- $(0 \cup 1)^*$ and $(0 \cup 1)^*(00((10)^*1)^+010)^*$
- $(0^*1)^+0^*$ and $(0^*10^*)^+$
- $(0 \cup 1)^*10$ and $(0^*1^+0)^+$
- $r\varepsilon$, r , where r is any regular expression on Σ .
- $r \cup \varepsilon$, r , where r is any regular expression on Σ .
- $r\emptyset$, r , where r is any regular expression on Σ .
- $r \cup \emptyset$, r , where r is any regular expression on Σ .