

### Week 3: regular expressions

1. Take  $\Sigma = \{a, b\}$ . Give a regular expressions for the set of words containing an even number of  $as$  and one for words containing an odd number of  $as$ . (Hint: it may be easier to first compute a NFA, and then compute the regular expression from this NFA.)

Compute a regular expression for strings with even length. For strings whose length is a multiple of 3.

2. Simplify each regular expressions:

$$\epsilon + ab + abab(ab)^*$$

$$aa(b^* + a) + a(ab^* + aa)$$

$$a(a + b)^* + aa(a + b)^* + aaa(a + b)^*$$

3. Prove the following equalities

$$b + ab^* + aa^*b + aa^*ab^* = a^*(b + ab^*)$$

$$a^*(b + ab^*) = b + aa^*b^*$$

4. Take  $\Sigma = \{a, b\}$ . Give a regular expression for the strings that do not contain the substring  $aa$
5. Compute all derivates of  $(01 + 10)^*$ . What is a DFA corresponding to this regular expression?