

Homework 3

Cpt S 317, Spring 2009

Due Date: February 18, 2009

Total points: 46

1. (9 points)

Give a regular expression for the following languages:

- a) The set of strings over alphabet $\{a,b,c\}$ containing at least one a and at least one c .
- b) The set of strings over alphabet $\{0,1\}$ *not* containing consecutive 1's.
- c) The set of strings over alphabet $\{0,1\}$ with *at most* one pair of consecutive 1's — i.e, if 11 is present it has to occur exactly once.

2. (6 points)

Give English descriptions of the languages represented by the following regular expressions:

- a) $0^*(10 + 0)^*0^*$
- b) $(0 + 10)^*1^*$

3. (6 points)

Convert the following regular expressions to ϵ -NFAs.

- a) $(0 + 1)01$
- b) $00(0 + 1)^*$

4. (12 points)

Let R, S and T be any three regular expressions. State True or False for the following.

If your answer is false, show a counterexample by making your own assignments to the regular expressions that will make the statement fail.

a) $R(S + T) = (S + T)R$

b) $R^* + S^* = (R + S)^*$

c) $(R + S)^* = (R^*S)^*$

5. (5 points)

Simplify the following regular expression using algebraic laws for regular expressions:

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

After simplification, give an English description to the language.

6. (8 points)

Prove that the following languages are not regular using the pumping lemma.

a) $\{0^n1^{2n} \mid n \geq 1\}$

b) The set of strings of balanced parentheses. These are the strings over the alphabet $\{(,)\}$ that can appear in a well-balanced arithmetic expression — i.e., for every “(” there is a corresponding ”” that follows it.

E.g., string “ $((()))()$ ” is a valid string in the language, whereas strings “ $((()))()$ ” or “ $)()()$ ” are not.