

Homework #2: Regular Expressions, Pumping Lemma, Closure of Regular Languages
Due Date: Thursday, 21 September 2006

Problem 1. [22 points]

Do problems 1.4 and 1.15 from Sipser.

Problem 2. [12 points]

Do problem 1.23 from Sipser.

Problem 3. [9 points]

True or false (prove your answer):

- (a) All subsets of a regular language are regular.
- (b) All supersets of a regular language are non-regular.
- (c) All finite languages are regular.

Problem 4. [10 points]

Are these languages regular? Prove your answer. x^R is x written backwards.

- (a) $\{xwx^R \mid x, w \in (0+1)^+\}$
- (b) $\{xx^Rw \mid x, w \in (0+1)^+\}$

Problem 5. [10 points]

Do problem 1.24 from Sipser.

Problem 6. [20 points]

Do problem 1.31 from Sipser.

Problem 7. [20 points]

Let L be any language, and define

$$L_{\frac{1}{2}} = \{x \mid \exists y \text{ such that } |x| = |y| \text{ and } xy \in L\}.$$

$L_{\frac{1}{2}}$ is the set of all *first halves* of strings in L . Prove that if L is regular, so is $L_{\frac{1}{2}}$.