

## CS 172 Spring 2007 — Discussion Handout 2

### 1. The friends...

Show that the following languages are regular by giving regular expressions for them:

- (a) The set of binary strings with at most one pair of consecutive 1s.
- (b) The set of binary strings with an equal number of zeroes and ones, such that the difference between the number of zeroes and number of ones never exceeds 2 in any prefix.
- (c) The set of all binary strings not containing 101 as a substring.

### 2. The foes...

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

- (a)  $\{a^{2^n} \mid n \geq 0\}$ .
- (b) The set of all binary strings which are palindromes (i.e.  $\{w \in \{0, 1\}^* \mid w = w^R\}$ ).
- (c)  $\{0^i 1^j \mid \gcd(i, j) = 1\}$ .

### 3. ...and the impostor!

Consider the language  $F = \{a^i b^j c^k \mid i, j, k \geq 0 \text{ and if } i = 1 \text{ then } j = k\}$ .

- (a) Show that  $F$  acts like a regular language in the pumping lemma i.e. give a pumping length  $p$  and show that  $F$  satisfies the conditions of the lemma for this  $p$ .
- (b) Show that  $F$  is not regular.
- (c) Why is this not a contradiction?