

# Introduction to the Theory of Computation

## Homework 4

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Due January, 13th

1. Exercise 1.15.
2. Exercise 1.29(b).
3. Use the pumping lemma to show that  $\{a^i b^k \mid 2k \leq i \leq 3k\}$  is not regular.
4. Clearly state whether each the of the following statements is true or false. You do not have to prove the true statements, but you do have to give counterexamples for the false statements.
  - (a) If  $L_1 \subseteq L_2$  and  $L_1$  is not regular, then  $L_2$  is not regular.
  - (b) If  $L_1 \subseteq L_2$  and  $L_2$  is not regular, then  $L_1$  is not regular.
  - (c) If  $L$  is nonregular, then  $\bar{L}$  is nonregular.
  - (d) If  $L_1$  and  $L_2$  are nonregular, then  $L_1 \cup L_2$  is nonregular.
  - (e) If  $L_1$  and  $L_2$  are nonregular, then  $L_1 \cap L_2$  is nonregular.