# Homework 3

**due Friday Oct 26 in class**

1. Suppose $L$ is a regular language with alphabet $\Sigma$. Give an algorithm to tell whether $L = \Sigma^*$, i.e., all strings over its alphabet.

2. Give an algorithm to tell whether two regular languages $L_1$ and $L_2$ have at least one string in common.

3. Consider the following transition table for a DFA.

| | 0 | 1 |
|---|---|---|
| $\rightarrow A$ | $B$ | $E$ |
| $B$ | $C$ | $F$ |
| $*C$ | $D$ | $H$ |
| $D$ | $E$ | $H$ |
| $E$ | $F$ | $I$ |
| $*F$ | $G$ | $B$ |
| $G$ | $H$ | $B$ |
| $H$ | $I$ | $C$ |
| $*I$ | $A$ | $E$ |

   (a) Draw the table of distinguishabilities for this automaton.

   (b) Construct the minimum-state equivalent DFA.

4. Design context-free grammars for the following languages:

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

   (b) $\{a^i b^j c^k \mid i \neq j \text{ or } j \neq k\}$

   (c) The set of all strings of $a$'s and $b$'s that are *not* of the form $ww$, that is, note equal to any string repeated.

   (d) The set of all strings with twice as many 0's as 1's.

5. Consider the following grammar.

$$\begin{array}{lcl} A & \rightarrow & A1B \\ A & \rightarrow & 0A \mid \epsilon \\ B & \rightarrow & 0B \mid 1B \mid \epsilon \end{array}$$

   Give parse trees for each of the following strings:

   (a) 00101.

   (b) 1001.

   (c) 00011.