CSE 322 Spring 2004

Homework Assignment # 4

Due Date: Friday, April 30 (at the *beginning* of class)

1. (40 points) Give regular expressions that generate the following languages. In all cases, the alphabet is $\Sigma = \{0,1\}$.
   a. $\{w \mid w$ contains an odd number of 0s$\}$
   b. $\{w \mid w \neq \varepsilon$ and every even position of w is a 0$\}$
      (Note: Use $w = w_1w_2\ldots w_n$ ($w_i \in \Sigma$) for determining position)
   c. $\{w \mid w$ contains no 0s and $|w| < 3\}$
   d. $\{w \mid w$ begins and ends in the same symbol and $|w| > 1\}$
   e. $\{w \mid w$ contains no 1s or each 1 in w is immediately followed by a 0$\}$
   f. $\{w \mid 01$ occurs at least twice in w$\}$
   g. $\{w \mid w$ is not 00 or 11$\}$
   h. $\{w \mid w$ has neither 00 nor 11 as a substring$\}$

2. (20 points) Convert the following regular expressions to NFAs using the procedure discussed in class (see lecture slides and Lemma 1.29 in the text):
   a. $1^*((0 \cup 1)(00 \cup 11))^* \cup 0$
   b. $(1 \cup \varepsilon)\varnothing$

3. (10 points) Convert the DFA in Example 1.5 in the textbook (page 39) to a regular expression using the GNFA procedure discussed in class (see lecture slides and Lemma 1.32 in the text).

4. (20 points) Show that the following languages over $\Sigma = \{0,1\}$ are <u>not regular</u>:
   a. $\{0^m10^n10^{m+n} \mid m, n \geq 1\}$
   b. $\{w \mid w$ contains more 0s than 1s$\}$

5. (10 points) Show that for any regular language L over Σ, the language: $MAX(L) = \{w \mid w \in L$ and for all non-empty strings $x \in \Sigma^*$, $wx \notin L\}$ is also regular. Give the formal description of any finite automata you use in your proof.