Due date: September 17, 2008

1. Give a DFA for each of the following language on $\Sigma = \{a, b\}$.
   (a) $L = \{w \mid |w| \mod 3 = 0\}$.
   (b) $L = \{w \mid n_a(w) \mod 3 > n_b(w) \mod 3\}$, where $n_a(w)$ ($n_b(w)$) denotes the number of a’s (b’s) in $w$.

2. A run in a string is a substring of length at least two, as long as possible and consisting entirely of the same symbol. For instance, the string $abbaab$ contains a run of b’s of length three and a run of a’s of length two. Find a DFA for each of the following.
   (a) $L = \{w \mid \text{every run of a's has length two or three}\}$.
   (b) $L = \{w \mid \text{there are exactly two runs of a's of length three}\}$

3. Show a DFA for the language $L = \{a^n \mid n \geq 4\}$.

4. Show a DFA that accepts strings on $\{0, 1\}$ if and only if the value of the string, interpreted as a binary representation of an integer, is zero modulo five. For example, 0101 and 1111, representing the integers 5 and 15, respectively, are to be accepted.