Homework 7

Due Date: Friday April 8, 2005.

There is a possible 40 points for this homework assignment.

Problem 1. (24 pts.) Draw a transition diagram for a Turing machine accepting each of the following languages.
   a) \( \{a^ib^j | i < j \} \)
   b) \( \{a^nb^n | n \geq 0 \} \)
   c) \( \{x \in \{a, b, c\}^* | n_a(x) = n_b(x) = n_c(x) \} \)
   d) The language of balanced strings of parentheses.
   e) The language of all nonpalindromes over \( \{a, b\} \)
   f) \( \{ww | w \in \{a, b\}^* \} \)

Problem 2. (3 pts.) Describe the language (a subset of \( \{1\}^* \)) accepted by the TM provided in class.

Problem 3. (2 pts.) We do not define \( \epsilon \)-transitions for a TM. Why no? What features of a TM make it unnecessary or inappropriate to talk about \( \epsilon \)-transitions.

Problem 4. (5 pts.) Describe how can one construct TM \( T' \) from TM \( T \) such that \( L(T) = L(T') \) and \( T' \) never crashes.

Problem 5. (6 pts.) Draw a TM that computes the indicated function. Since both of these functions are from \( \mathbb{N} \) to \( \mathbb{N} \) you should use unary notation.
   a) \( f(x) = x + 2 \)
   b) \( f(x) = 2x \)