CSE 200
Computability and Complexity
Homework 1
Models of Computation and Undecidability
Due Monday, April 30

April 16, 2007

1. Consider a Turing Machine with an infinite two dimensional tape, an array of tape symbols indexed by pairs $(x, y), x, y \in Z, x, y \geq 0$. The tape head can move up, down, left or right in one step, i.e., from (x, y) to $(x, y+1), (x, y-1), (x-1, y), (x+1, y)$ respectively. The input is originally written on cells $(0, 1), ...(0, n)$, with all other cells having initial blank symbols. Show that polynomial time with respect to such machines, P_{2d-TM}, is the same as with respect to standard TMs.
2. Problem 7.14 from the textbook, page 295.
3. Consider the language $L = \{x+y = z |$ x, y, z are binary integers, so that $x+y = z\}$. This language was shown in class to be decideable in time $O(n^2)$ on a one-tape Turing Machine. Show that it is decideable in linear time on a multi-tape TM. Prove a matching lower bound ($\Omega(n^2)$) for one-tape TMs.
4. Let $L = \{< M, w > | M$ is a Turing Machine program and there is an input y so that $M(y) = w \}$ Is L recursive? Is L recursively enumerable? Is L co-r.e.?
5. Give an example of a language L that is neither R.E. nor co-R.E.