Ph.D. Qualification Examination

Computation Theory (Nov. 2011)

(1) (20%) Draw the diagram for a TM that accepts $\{0^n 1^m : n < m\}$.

(2) (20%) A 2-PDA is like a PDA except that it has two stacks. Show that a TM can simulate a 2-PDA.

(3) (20%) Show that, if $P = NP$ then every language $A \in P$, $A \neq \emptyset$ and $A \neq \Sigma^*$, is NP-complete.

(4) (20%) Show that if L is accepted by a nondeterministic TM that always halts (on any sequence of moves), then L is recursive.

(5) (20%) Is each of the following countable or uncountable?
   (a) The set of all functions from $\mathbf{N}$ to $\{0, 1\}$.
   (b) The set of all functions from $\{0, 1\}$ to $\mathbf{N}$.