Homework Assignment #2
Due: March 31, 2009

2. Let $L = \{0^i 1^j 0^i : i, j \in \mathbb{N}\}$.

(a) Determine the time complexity of deciding L on a single-tape Turing machine. In other words, find a function $T(n)$ such that some single-tape Turing machine decides L in $O(T(n))$ time and every single-tape Turing machine that decides L requires $\Omega(T(n))$ time.

(b) Determine the space complexity of deciding L on a multi-tape Turing machine. In other words, find a function $S(n)$ such that some multi-tape Turing machine decides L in $O(S(n))$ space and every multi-tape Turing machine that decides L requires $\Omega(S(n))$ space.

Hint: You can use a crossing sequence argument (on which tape?). But each element of the crossing sequence may have to be more than merely the state of the TM. What information do you have to put in the crossing sequences to make the argument work?