Name: _____

Exam 2
CSc 75010: Theoretical Computer Science
Graduate Center of CUNY
22 November 2002
(Blue Version)

Question 1	
Question 2	
Question 3	
Question 4	
Question 5	
Question 6	
Total	

Do five of the following six problems. Write each answer on a separate piece of paper.

1. (a) Define *computable function* and give an example of a function that is not computable.

    (b) Assume that the alphabet and tape alphabet are: $\Sigma = \Gamma = \{0, 1\}$. Give an implementation level description of a Turing machine that copies the input string on the tape. That is, if the input to the machine is the string w, the output is ww.

2. (a) Show that for any finite set Σ, the set of all finite strings of Σ, Σ^* is countable.

    (b) Let $\Sigma = \{0, 1\}$. Show that the set of all infinite strings over Σ is uncountable.

3. (a) Show that the Halting Problem is undecidable, using the diagonalization method.

    (b) Show that the set of all finitely defined computable functions (that is, the set of all functions that diverge for all but a finite set) is not decidable.

4. (a) Show that the set of decidable languages is closed under intersection.

    (b) Show that if A and $\bar{A}$ are Turing-recognizable, then A is decidable.

5. (a) State Rice's Theorem.

    (b) Prove Rice's Theorem.

6. (a) Show that if A Turing-recognizable and $A \leq_m \bar{A}$, then A is decidable.

    (b) Show that if $A \leq_T B$ and $B \leq_T C$ implies $A \leq_T C$.