HW 9 CMSC 452. Morally Due April 18

1. (5 points) What is your name? Write it clearly. Staple the HW.

2. (20 points) Assume $L_1 \in DTIME(T_1(n))$ and $L_2 \in DTIME(T_2(n))$. Show that $L_1L_2 \in DTIME(n(T_1(n) + T_2(n)))$. (You can write pseudo code and note how long the program runs. We ignore additive constants.)

3. (25 points) Formally define a 2-tape Turing Machine that has a head on each tape.

4. (25 points) A *Graph* is a set (V, E) where $E \subseteq \binom{V}{2}$ (set of pairs of elements from V). Fix k. A *k-hypergraph* is a set (V, E) where $E \subseteq \binom{V}{k}$ (set of k-sized sets of V). A *hypergraph* is a set (V, E) where $E \subseteq 2^V$ (the set of all subsets of V).

   For any of these objects let $n = |V|$ and $m = |E|$.

   SO n is the NUMBER OF VERTICES and m is THE NUMBER OF EDGES. (Recall that $|A|$ is the NUMBER OF ELEMENTS IN THE SET A.)

   You an also assume that $V = \{1, \ldots, n\}$.

   (a) Describe two ways to store a graph in a computer. How much space does it take as a function of n and m?

   (b) Describe two ways to store a k-hypergraph in a computer. How much space does it take as a function of n and m?

   (c) Describe two ways to store a hypergraph in a computer. How much space does it take as a function of n and m?

5. (25 points) Let $L \in DTIME(T(n))$. Find a polynomial p such that $L^* \in DTIME(p(T(n))$. Give the algorithm that achieves this (it can use the algorithm for $L \in DTIME(T(n))$ and should be in pseudocode).