CS 360 Assignment 4

Due Date Thursday, April 1st, at the beginning of class.

All questions are worth the same amount. Please ensure that your name and student number appear, in ink, on each page of your assignment.

Work is to be done individually.

Assignment Questions

1. Consider the Turing machine
   $M = (\{q_0, q_1, q_2, q_f\}, \{0, 1\}, \{0, 1, B\}, \delta, q_0, B, \{q_f\})$.
   Informally but clearly describe the language $L(M)$ if
   $\delta(q_0, 0) = (q_0, B, R); \delta(q_0, 1) = (q_1, B, R); \delta(q_1, 1) = (q_1, B, R); \delta(q_1, B) = (q_f, B, R)$.

2. Informally, but clearly, describe a multi-tape Turing machine that accepts the language $\{a^n b^n c^n | n \geq 1\}$. Can you make a machine that works in time proportional to the input length?

3. Suppose L_1 and L_2 are turing recognizable languages. Is $L_1 \cup L_2$ turing recognizable? Is $L_1 \cap L_2$ turing recognizable? Explain your answers.

4. A k-head Turing machine has k tape heads reading cells on one tape. A move of one of these machines depends on the state and on the symbol scanned by each head. In one move, such a machine can change state, write a new symbol on the cell scanned by each head, and can move each head left, right, or keep it stationary. Since several heads may be scanning the same cell, assume the heads are numbered 1 through k, and the symbol written by the highest number head scanning a given cell is the one that actually gets written there. Give a convincing argument explaining that the languages accepted by k-head deterministic Turing machines are also accepted by 1DTM's.