Department of Computer Science   **University of San Francisco**

Computer Science 411
Homework 9: Turing Machines II
Fall 2015
Due 11/9/2015

1. (8 points) Give a diagram for a non-deterministic Turing machine that accepts the language $L = \{ww : w \in \{a, b\}^*\}$. (Write this out by hand, since the Turing simulator does not allow for non-deterministic Turing machines)

2. From Hopcraft, Motwani, and Ullman. Assume that a Turing Machine has a two-way infinite tape. Somewhere on that tape is the symbol \$ – either to the left or the right of the current tape head position. The rest of the tape is blank.

   (a) (6 points) Write a Non-deterministic Turing Machine that will erase the tape. That is, write a non-deterministic Turing Machine such that there is some computational path that erases the tape and halts, and all computational paths that halt erase the tape.

   (b) (6 points) Write a Deterministic Turing Machine that will erase the tape. That is, write a deterministic Turing machine that always halts and erases the tape.

   For both parts of this question, write your solutions out by hand. (The Visual Turing software allows for neither non-determinism nor two-way infinite tapes)

3. (8 points) Using the Turing Machine software for the class,

   write a machine that semi-decides (that is, halts and says "yes" for all strings in the language, and runs forever for all strings not in the language) the language $L =$ all strings over $\{a, b, c\}$ that have more a's than b's and more b's than c's. Submit the file as <lastname>.9.tm (so I would submit it as galles.9.tm)