CSC236 Fall 2016
Assignment #3
due Dec 2nd, 10 p.m.

Your assignment must be typed to produce a PDF document **a3.pdf** (hand-written submissions are not acceptable). You may work on the assignment in groups of **1 or 2** and submit a single assignment for the entire group on MarkUs. Your teammates must be **different** than all teammates you had in Assignments 1 and 2.

1. Proof of Correctness for iterative algorithms.
   (a) Design an iterative closest pair algorithm for finding the closest pair of points in 2D.
   Precondition: Input is a list of n points in the form (x_i, y_i), where $x_i, y_i \in \mathbb{R}$
   Postcondition: Return a closest pair of points
   (b) Find complexity class
   (c) Prove correctness:
      i. Define Loop Invariant
      ii. Prove Partial Correctness
      iii. Termination (use either theorem 2.5 in the notes or POW)
2. DFSAs and their operations
   (a) Define and draw DFSAs on binary alphabet $\Sigma = \{0, 1\}$ for 2 languages: $L_1(M_1) = \{$all strings with even number of characters in a string$\}$, $L_2(M_2) = \{$all strings that have even number of 1s$\}$
   (b) Identify DFSA M_3 for the union of languages $L_1 \cup L_2$ - you can define it formally (don't need to draw).
   (c) Identify DFSA M_4 for the intersection of languages $L_1 \cap L_2$ - you can define it formally (don't need to draw).
   (d) Find and prove a state invariant for M_3.
3. Equivalence of languages and regular expressions
   Language L over alphabet $\Sigma = \{a, b\}$ consists of all strings that start with a and have odd lengths or start with b and have even lengths: $\{s | s$ starts with a and has odd length, or starts with b and has even length$\}$.
   (a) What is a regular expression R corresponding to language L?
   (b) Prove that your regular expression R is indeed equivalent to L