CS303 Homework Assignment 4
Due November 10th, 2014 at Noon.

1. **10 points** Construct a PDA that will accept the language given below, then create a DPDA that uses only one additional marker symbol.

   \[ L = \{(0^n1^n)^+|n \geq 1\} \]

2. **10 points** Begin with the grammar below and then perform a-d.

   \[
   \begin{align*}
   S & \rightarrow ASB | \epsilon \\
   A & \rightarrow aAS | a \\
   B & \rightarrow SbS | A | bb
   \end{align*}
   \]

   (a) Eliminate \( \epsilon \)-productions.
   (b) Eliminate any unit productions in the resulting grammar.
   (c) Eliminate any useless symbols in the resulting grammar.
   (d) Put the resulting grammar into Chomsky Normal Form

3. **10 points** Begin with the grammar below and then perform a-d.

   \[
   \begin{align*}
   S & \rightarrow aSa | bSb | D \\
   D & \rightarrow aAb | bAa | aB \\
   A & \rightarrow aA | bA | \epsilon \\
   B & \rightarrow bC \\
   C & \rightarrow aB
   \end{align*}
   \]

   (a) Eliminate \( \epsilon \)-productions.
   (b) Eliminate any unit productions in the resulting grammar.
   (c) Eliminate any useless symbols in the resulting grammar.
   (d) Put the resulting grammar into Chomsky Normal Form

4. **10 points** Let \( L = \{a^mb^mc^n|m \leq n\} \). Use the pumping lemma for CFLs to show that \( L \) is not a CFL.