Homework 1: Theory (20 pts)
Programming Languages (CSCI 3300), Fall 2018
Due: Thursday, Sept. 6 by 5:15pm

1 Grammars (20 pt)

0. (5 pt) For the following grammer:

$$\begin{array}{lcl} S & \rightarrow & 0\#1 \mid 1\#0 \\ S & \rightarrow & 0S1 \mid 1S0 \mid 0B1 \mid 1B0 \\ B & \rightarrow & 1\#1 \mid 0\#0 \end{array}$$

   Do the following:

   a. Define the set of all terminals.

   b. Define the set of all non-terminals.

   c. Write a complete derivation for the word 10101#01010.

1. (15 pt) Consider the grammar for a toy PL:

$$\begin{array}{rl} \text{(booleans)} & b ::= \mathsf{true} \mid \mathsf{false} \mid b \wedge b \mid b \vee b \mid \neg b \mid e > e \\ \text{(expressions)} & e ::= y \mid 0 \mid e + 1 \mid e * e \mid e + e \mid e - e \\ \text{(command)} & c ::= \mathsf{skip} \mid x := e \mid \mathsf{if}\, b\, \mathsf{then}\, c\, \mathsf{else}\, c \mid \mathsf{while}\, b\, \mathsf{do}\, c \mid c_1; c_2 \end{array}$$

   Derive the following program from the above grammar:

$$x := 5; y := 42; \mathsf{while}\, y > x\, \mathsf{do}\, x := x + 1; y := y - 1$$