CSE 6341, Written Assignment 1
Due Friday, September 2, 12:45 pm (8 points)

This assignment contains 4 questions, for a total of 8 points. Your submissions should be uploaded via Carmen. Create your answers using latex, Word, or plain text.

You can submit up to 24 hours after the deadline; if you do so, your score will be reduced by 10%. If you submit more than 24 hours after the deadline, the submission will not be accepted.

Q1 (2 points): Write a context free grammar to generate the following language

\[ \{ a^{n+3} b^{n+2} \mid n \geq 0 \} \]

This language contains strings \( aaabb, aaaaabbb \), etc. Make your grammar as simple as possible.

Q2 (2 points): In class we discussed a grammar for a simple language of expressions (slide 12 of the notes). We also showed the leftmost derivation of string \( \text{int } x = 1; y = x + 2; \)
Show the rightmost derivation of this string with this grammar.

Q3 (2 points): Consider the grammar from Q2, with the following modifications:

\[
\begin{align*}
\text{stmt} &::= \text{varDecl} ; | \text{varDecl} = \text{expr} ; | \text{ident} = \text{expr} ; \\
\text{varDecl} &::= \text{int ident} | \text{float ident} \\
\text{expr} &::= \text{intconst} | \text{floatconst} | \text{ident} | \text{expr} + \text{expr}
\end{align*}
\]

Consider the parse tree for

\( \text{float } a; \text{int } b = 1 + 2; \text{float } c = b + 3.14; \)

How many nodes are in this tree? How many of these nodes are leaf nodes?

Q4 (2 points): For the program from Q3, consider the AST from Project 1. There are 11 non-abstract classes in Java package ast. AST nodes in Project 1 are Java objects that are instances of some of these classes. For each of these 11 classes, show how many instances of this class exist in the AST for this program.