CSCI 431: Programming Languages
Midterm #1 -- open book section

The entire exam is to be turned in at 4:20 PM. Turn in the closed book section before you consult your books and notes to work on the open book section.

Problem 1. (12 points)
Using the grammar of Example 3.4 on page 102 of the text, show a derivation of the following <assign>:
\[ B := A * B \]

Problem 2. (12 points)
Give a grammar for the language consisting of all numbers (strings of digits) which contain at least one 7.

Problem 3. (12 points)
Describe, in English, what the following BNF specifies.
\[
\text{<DOLOOP>} \quad \text{DO <ID> = <ID>, <ID> [ , <ID>]}
\]
\[
\text{<ID>} \quad \text{X, Y, Z}
\]

Problem 4. (12 points)
Show that the following grammar is ambiguous.
\[
S \quad b \mid bS \mid Sb
\]

Problem 5. (20 points)
Compute the following weakest preconditions
\[
\text{wp(``A := A * 2'', \{ A = 40 \})}
\]
\[
\text{wp(``X := 5'', \{ A = 40 \})}
\]
\[
\text{wp(``A := B +2 ; X := A + B'', \{ X = 22 \})}
\]
\[
\text{wp(``if X =0 then Y := 5 else Y := 6'', \{ Y = 5 \})}
\]