CSCI 485 Programming Languages
Assignment 3

Due Monday, February 8

1. Write EBNF descriptions for the following:

   (a) A Java class definition header statement

   (b) A Java method call statement

   (c) A C switch statement

   (d) C float literals

2. Rewrite the BNF of Example 3.4 in the textbook to give + precedence over $*$ and force + to be right associative.

3. Using the grammar in Example 3.2 in the textbook, show a parse tree and a leftmost derivation for each of the following statements:

   (a) $A = A * (B + (C * A))$

   (b) $B = C * (A * C + B)$

4. Show that the following grammar is ambiguous:

$$<S> \rightarrow <A>$$
$$<A> \rightarrow <A> + <A> |<id>$$
$$<id> \rightarrow a \mid b \mid c$$

5. Consider the following grammar:

$$<S> \rightarrow a<S>\ c<B> |<A> \mid b$$
$$<A> \rightarrow c<A> \mid c$$
$$<B> \rightarrow d|<A>$$

   Which of the following sentences are in the language generated by this grammar?

   (a) abcd

   (b) acccbd

    (c) acccbcc

    (d) acd

    (e) accc

6. Convert the following EBNF to BNF:

$$S \rightarrow A\{bA\}$$
$$A \rightarrow a[b]A$$

    where S and A are non-terminals, and a and b are terminals.

7. (Extra Points) Using the virtual machine instructions given in Section 3.5.1.1, give an operational semantic definition of the following:

    (a) Java do-while

    (b) C++ if-then-else

8. (Extra Points) Write a denotational semantics mapping function for the following statements:

    (a) Java do-while

    (b) C++ switch

9. (Extra Points) Compute the weakest precondition for each of the following assignment statements and postconditions:

    (a) $a = 2 * (b - 1) - 1 \ \{a > 0\}$

    (b) $x = 2 * y + x - 1 \ \{x > 11\}$