**Chapter 3 Homework Solutions**

MTH 135

*Review Questions:*

1. Syntax is the form of a language’s expressions, statements, and program units. Semantics is the meaning of those expressions, statements, and program units.

7. Being able to denote an optional part of a RHS in brackets; use of braces in a RHS to indicate that the enclosed part can be repeated indefinitely or left out altogether; multiple choice items can be placed in parentheses and separated by |

12. The primary use of attribute grammars is to describe more of the structure of a programming language than can be described with a context free grammar.

27. To use axiomatic semantics to prove the correctness of a program tou use the preconditions and postconditions to show that a program performs the computation described. You start with the last postcondition of the last statement and use it to determine the weakest precondition of the last statement, working backwards up the proof repeating the process until the weakest precondition of the first statement is determined and if it matches the given precondition of the program, the program is correct.

*Problem Set:*

6. (a) <assign> => <id> = <expr>

=> A = <expr>

=> A = <id> \* <expr>

=> A = A \* <expr>

=> A = A \* ( <expr> )

=> A = A \* ( <id> + <expr> )

=> A = A \* ( B + <expr> )

=> A = A \* ( B + ( <expr> ) )

=> A = A \* ( B + ( <id> \* <expr> ) )

=> A = A \* ( B + ( C \* <expr> ) )

=> A = A \* ( B + ( C \* <id> ) )

=> A = A \* ( B + ( C \* A ) )



7. (a) <assign> => <id> = <expr>

=> A = <expr>

=> A = <term>

=> A = <factor> \* <term>

=> A = ( <expr> ) \* <term>

=> A = ( <expr> + <term> ) \* <term>

=> A = ( <term> + <term> ) \* <term>

=> A = ( <factor> + <term> ) \* <term>

=> A = ( <id> + <term> ) \* <term>

=> A = ( A + <term> ) \* <term>

=> A = ( A + <factor> ) \* <term>

=> A = ( A + <id> ) \* <term>

=> A = ( A + B ) \* <term>

=> A = ( A + B ) \* <factor>

=> A = ( A + B ) \* <id>

=> A = ( A + B ) \* C



8. The following two distinct parse tree for the same string prove that the grammar is ambiguous.



23.

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

2 \* (b - 1) - 1 > 0

2 \* b - 2 - 1 > 0

2 \* b > 3

b > 3 / 2

(b) b = (c + 10) / 3 {b > 6}

(c + 10) / 3 > 6

c + 10 > 18

c > 8

24.

(a) a = 2 \* b + 1

b = a - 3 {b < 0}

a - 3 < 0

a < 3

Now, we have:

a = 2 \* b + 1 {a < 3}

2 \* b + 1 < 3

2 \* b + 1 < 3

2 \* b < 2

b < 1

(b) a = 3 \* (2 \* b + a);

b = 2 \* a - 1 {b > 5}

2 \* a - 1 > 5

2 \* a > 6

a > 3

Now we have:

a = 3 \* (2 \* b + a) {a > 3}

3 \* (2 \* b + a) > 3

6 \* b + 3 \* a > 3

2 \* b + a > 1

n > (1 - a) / 2

28. (see attached)