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**Metropolitan State University**

**ICS-365-01 —Organization of Programming Languages**

**Homework #3**

1. Parse Tree for D=C\*B

Given this BNF:

<assign> → <id> = <expr>

<id> → A | B | C | D

<expr> → <id> + <expr>

| <id> \* <expr>

| ( <expr> )

| <id>

Answer:

<assign>

<id> = <expr>

D <id> \* <expr>

C <id>

B

1. Parse Tree for A=(A+B) / (C+D) - same BNF as 1

Answer:

<assign>

<id> = <expr>

A <expr> / <expr>

(<expr>) <expr>

(<id> + <expr>) <expr>

A <expr> <expr>

<id> <expr>

B (<expr>)

( <id> + <expr> )

C <expr>

<id>

D

1. Parse Tree for A=A+D\*C+BD - same BNF as 1

Answer: .

<assign>

<id> = <expr>

A <id> + <expr>

A <expr> + <id>

<id> \* <expr> BD

D <id>

C

1. What is the difference between synthesized and inherited attributes?
   1. Inherited attributes depend on information from descendants in the parse tree.
   2. Synthesized attributes are not computed.
   3. Inherited attributes are useful only in object-oriented languages.
   4. Synthesized attributes depend on information from descendants in the parse tree.

Answer: a.

Because inherited attributes pass semantic information **down** and **across** a tree , but synthesized attributes are used to pass semantic information **up** a parse tree.

1. Some features that cannot be captured and/or enforced by BNF, can be done using Attribute grammars.
   1. TRUE
   2. FALSE

Answer: a.

Because Attribute grammar is one formal approach to describing and checking the correctness of static semantics rules of a program. Then some characteristics of programming languages that are difficult to describe with BNF, and some that are impossible.