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CSCI 410 - Programming Languages
Problem 6b, 12, 23(a&c) pg. 163 - 165

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

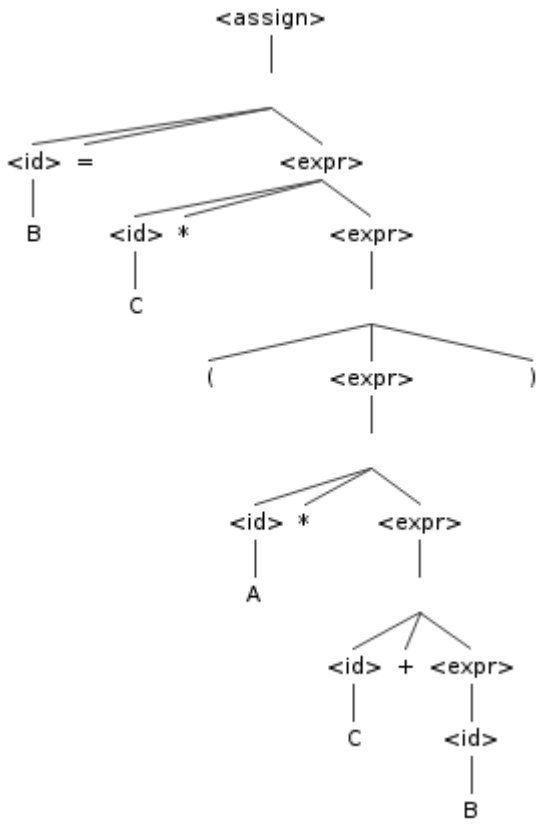
The grammar:

```
<assign> → <id> = <expr>
<id> → A|B|C
<expr> → <id> + <expr>
       | <id> * <expr>
       | ( <expr> )
       | <id>
```

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

<assign> → <id> = <expr>
→ B = <expr>
→ B = <id> * <expr>
→ B = C * <expr>
→ B = C * (<expr>)
→ B = C * (<id> * <expr>)
→ B = C * (A * <expr>)
→ B = C * (A * <id> + <expr>)
→ B = C * (A * C + <expr>)
→ B = C * (A * C + <id>)
→ B = C * (A * C + B)

as a parse tree:
[<assign> [[<id> [B]] [=] [<expr> [<id> [C]] [*] [<expr> [[(] [<expr> [[<id> [A]] [*] [<expr> [[<id> [C]] [+] [<expr> [<id> [B]]]]]]] [)]]]]]]



12. Consider the following grammar:

```
<S> → a <S> c <B>
    | <A>
    | b
<A> → c <A>
    | c
<B> → d
    | <A>
```

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

a. abcd	True <S> → a <S> c <B> → a b c <B> → a b c d
b. acccbd	False <S> → a <S> c <B> → a <A> c <B> → a c <A> c <B> → a c c c <B> → a c c c <A>

	→ a c c c <A> ***can't evaluate out a 'b'**
c. acccbcc	False <S> → a <S> c <B> → a <A> c <B> → a c <A> c <B> → a c c c <B> → a c c c <A> ***can't evaluate out a 'b'**
d. acd	False <S> → a <S> c <B> → a <S> c <B> ***<S> can't evaluate to null**
e. accc	True <S> → a <S> c <B> → a <A> c <B> → a c <A> c <B> → a c c c <B> → a c c c <A> ***<A> can't evaluate to null**

23. Compute the weakest precondition for each of the following assignment statements and postconditions:

a. a = 2 * (b - 1) - 1 {a > 0}
{2 * (b - 1) - 1 > 0}
{2 * b - 3 > 0}
{b > 3/2 }

c. a = a + 2 * b - 1 {a > 1}
{a + 2 * b - 1 > 1}
{a + 2b > 2}
{2b > 2 - a}
{b > (2 - a)/2}