4. Rewrite the BNF of Example 3.4 to add the ++ and -- unary operators of Java.
Answer:

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

11. Consider the following grammar:
<S> → <A> a <B> b
<A> → <A> b | b
<B> → a <B> | a
Which of the following sentences are in the language generated by this grammar?
a. baab
b. bbbab
c. bbaaaaa
d. bbaab

Answer:
a, d

Problem 11:
11. Consider the following grammar:

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

Which of the following sentences are in the language generated by this grammar?
a. babb
b. bbbabb
c. bbaaaaabc
d. aaaaaa

Answer:
a b

21. 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. Ada for
c. C++ if-then-else
d. C for
e. C switch

a. java do while
Psuedocode:

```
do {<expr1>}while(<expr2>)
```

Answer:

```
Do <expr1>
Loop:  If <expr2> == False, go out
go to loop
Out
```

b. Ada (for)

Psuedocode:

```
for I in Integer range <first> to <last> loop
        <state>
end loop
```

Answer:

```
If <first> <= <last> Goto Line1
Goto Line2
Line1:
for I in <first>..<last> loop
I= <first>
loop: if I <  <last>  go out
        <state>
```

```
I=I+1
goto loop
```

Line2:

```
for I in <first> .. <last> loop
I= <first>
loop: if I> <last>  go out
        <state>
I=I-1
goto loop

out: …
```

c. C++ if-then-else

Psuedocode:

```
if(<expr1>){ <expr2>} else{<expr3>}
```

Answer:

```
if <expr1> == True  Goto Line1
Goto Line2

Line1: <expr2>
Line2: <expr3>
```

d. C for

Psuedocode:

```
for(<expr1> ; <expr2>;  <expr3>){
        <state>
}
```

Answer:

```
<expr1>
L1:     if <expr2> == false goto out
<expr3>
<state>
```

```
goto L1
go out: ...
```

e. C switch

Psuedocode:

stat1, stat2 … statN can include “break” or no

```
switch(condition){
case 1:
            stat1;
case2:
            stat2;
case3:
            stat3;
…
default:
            statN;
}
```

Answer:

```
R1 =  condition
if (R1 = case1) goto S1
if(R1 = case2) goto S2
 if(R1 = case3) goto S3
…
goto SN

S1: stat1
S2: stat2
S3: stat3
…
SN: stat4

go out
```