Lab 3

Crafting a Compiler
4.7

7. A grammar for infix expressions follows:

```
1 Start → E $
2 E     → T plus E
3       | T
4 T     → T times F
5       | F
6 F     → ( E )
7       | num
```

(a) Show the leftmost derivation of the following string.

num plus num times num plus num $

(b) Show the rightmost derivation of the following string.

num times num plus num times num $

(c) Describe how this grammar structures expressions, in terms of the precedence and left- or right- associativity of operators.

a)

Start
E$
T plus E $
F plus E $
(E) plus E $
num plus E $
num plus T plus E $
num plus T times F plus E $
num plus F times F plus E $
num plus (E) times F plus E $
num plus num times F plus E $
num plus num times (E) plus E $
num plus num times num plus E $
num plus num times num plus T $
num plus num times num plus F $
num plus num times num plus (E) $
num plus num times num plus num $

Lab 3

b)

Start
E$
T plus E $
T plus T $
T plus T times F$
T plus T times (E)$
T plus T times num$
T plus F times num $
T plus (E) times num $
T plus num times num $
T times F plus num times num $
T times (E) plus num times num $
T times num plus num times num $
F times num plus num times num $
(E) times num plus num times num $
num times num plus num times num $

c)
The grammar is unambiguous because a left derivation matched the right derivation.

Lab 3

Dragon
4.2.1 a, b,c

Exercise 4.2.1: Consider the context-free grammar:

$$S \rightarrow S\,S\,+ \mid S\,S\,* \mid a$$

and the string $aa + a*$.

a) Give a leftmost derivation for the string.

b) Give a rightmost derivation for the string.

c) Give a parse tree for the string.

! d) Is the grammar ambiguous or unambiguous? Justify your answer.

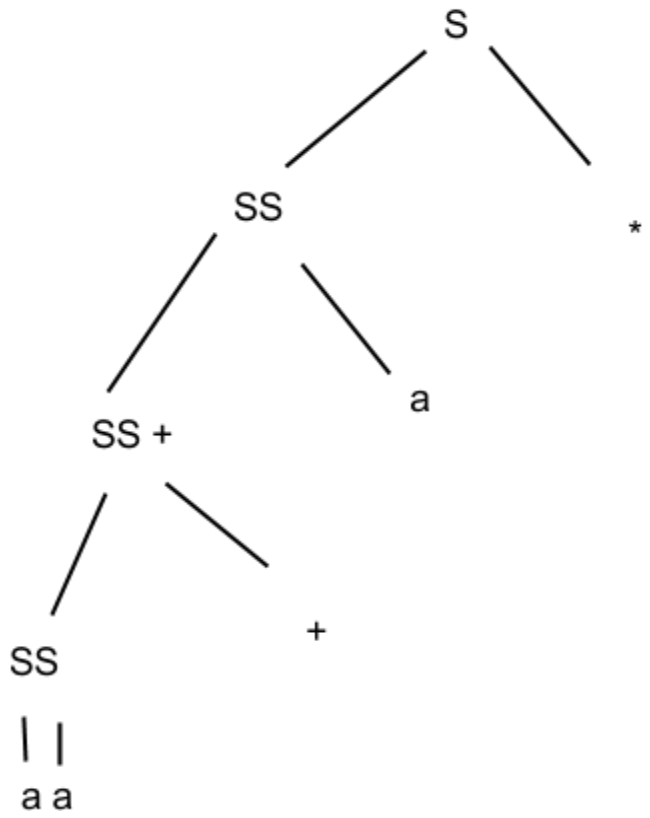
! e) Describe the language generated by this grammar.

a)

S
SS*
SS+S*
aS+S*
aa+S*
aa+a*

b)
S
SS*
S a*
SS + a*
Sa +a*
aa+a*

c)


S
SS
*
a
SS +
+
SS
a a