

Derivation, Parse tree, Ambiguity.

①

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

Given the context free grammar, answer the following questions:

- a) Give a leftmost derivation for the string $a + a * b$
- b) Sketch a parse tree corresponding to the derivation you gave in (a).
- c) Give a rightmost derivation for the string $a + a * b$.
- d) Sketch a parse tree corresponding to the derivation you gave in (c).
- e) Demonstrate one more parse tree (apart from the one you already found in (b) and (d))

a) leftmost derivation

$$S \rightarrow S + S$$

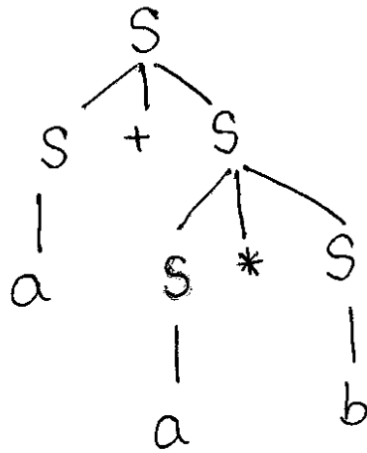
$$\rightarrow a + S$$

$$\rightarrow a + S * S$$

$$\rightarrow a + a * S$$

$$\rightarrow a + a * b$$

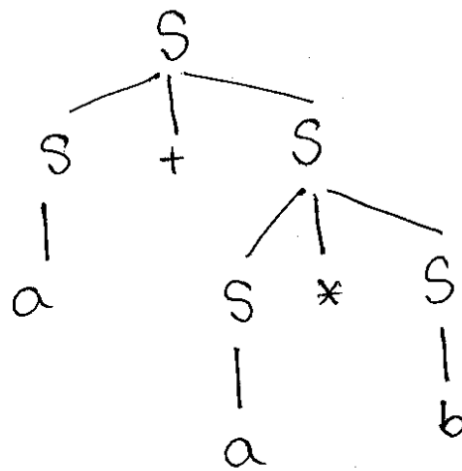
b) Parse tree for the derivation in (a)



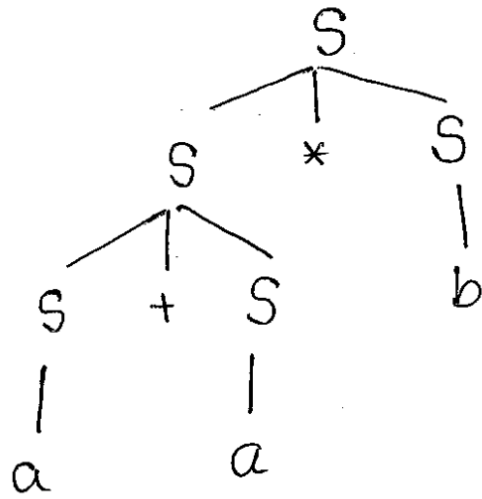
c) Rightmost derivation:

$$\begin{aligned} S &\longrightarrow S + S \\ &\longrightarrow S + S * S \\ &\longrightarrow S + S * b \\ &\longrightarrow S + a * b \\ &\longrightarrow a + a * b \end{aligned}$$

d) Parse tree for the derivation in (c):



e) Another Parse tree to proof the grammar is ambiguous



Derivation, Parse tree, Ambiguity:

③

$$S \longrightarrow B1B$$

$$B \longrightarrow 0B \mid 1B \mid \epsilon$$

Given the context free grammar, answer the following questions:

- a) Give a leftmost derivation for the string 0101
- b) Sketch a parse tree corresponding to the derivation you gave in (a).
- c) Demonstrate one more parse tree (apart from the one you already found in (b)) for the string 0101
- d) Find a string w of length six such that w has exactly one parse tree in the grammar above.

a) leftmost derivation:

$$S \rightarrow B1B$$

$$\rightarrow 0B1B$$

$$\rightarrow 0\epsilon 1B$$

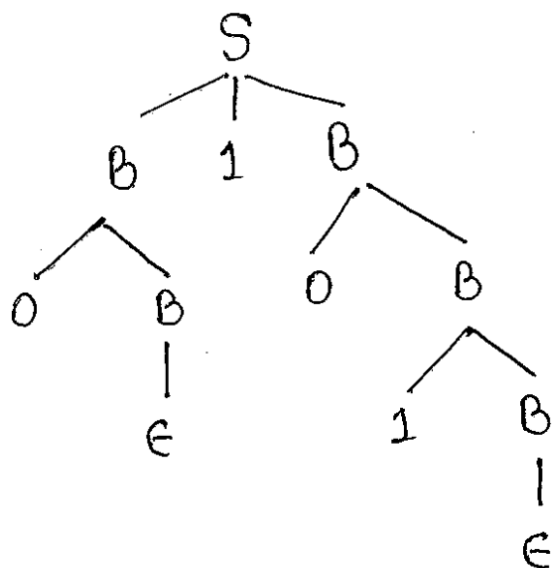
$$\rightarrow 010B$$

$$\rightarrow 0101B$$

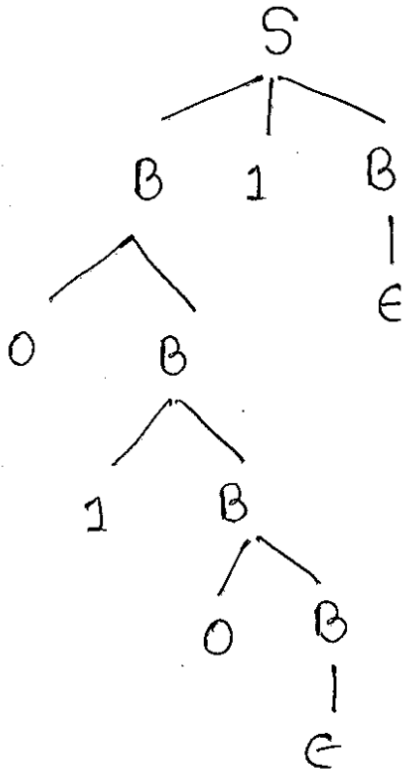
$$\rightarrow 0101\epsilon$$

$$\rightarrow 0101$$

b) Parse tree for the derivation in (a)



c)

d) ~~000000~~

This answer is incorrect. Since, "000000" can not be parsed using the given grammar, means no parse tree exists.

The correct answers are: 100000, 010000, 001000, 000100, 000010, 000001.

[These strings have exactly one parse tree, since they contain One 1 - have only one way to parse them.]