

Assignment 1

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Homework for chapter 3(pg.158): Questions 7(d), 8, 9 ,11

Example 3.4:

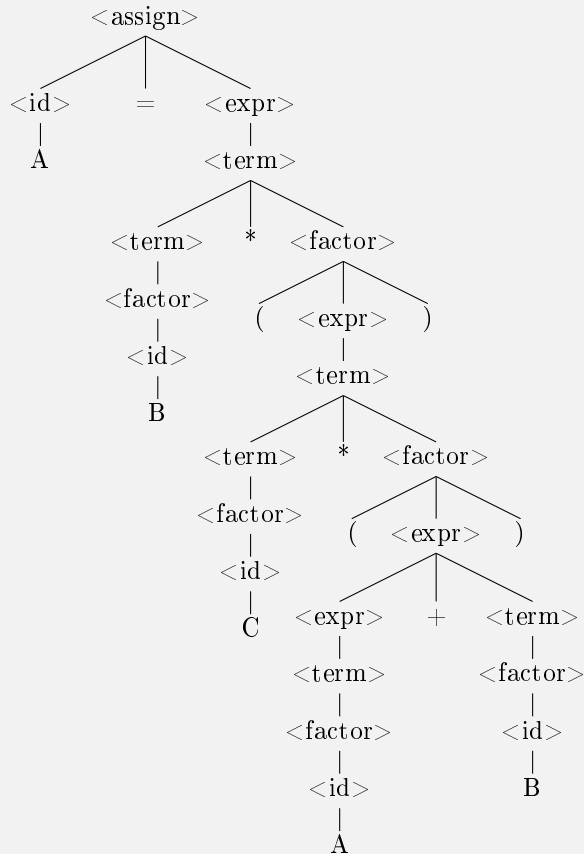
$$\begin{aligned} \langle \text{assign} \rangle &\rightarrow \langle \text{id} \rangle = \langle \text{expr} \rangle \\ \langle \text{id} \rangle &\rightarrow A | B | C \\ \langle \text{expr} \rangle &\rightarrow \langle \text{expr} \rangle + \langle \text{term} \rangle \mid \langle \text{term} \rangle \\ \langle \text{term} \rangle &\rightarrow \langle \text{term} \rangle * \langle \text{factor} \rangle \mid \langle \text{factor} \rangle \\ \langle \text{factor} \rangle &\rightarrow (\langle \text{expr} \rangle) \mid \langle \text{id} \rangle \end{aligned}$$

Problem 7(d):

Using the grammar in Example 3.4, show a parse tree and a leftmost derivation for each of the following statements:

(d): $A = B * (C * (A + B))$

Parse Tree



Left most derivation

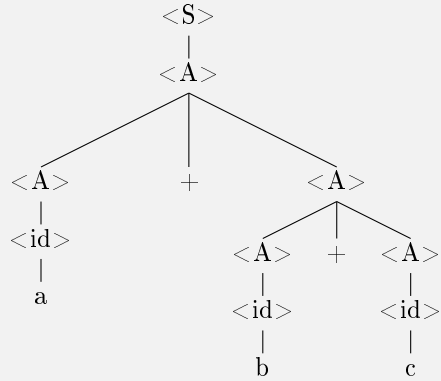
$$\begin{aligned} \langle \text{assign} \rangle &\rightarrow \langle \text{id} \rangle = \langle \text{expr} \rangle \\ &\rightarrow A = \langle \text{expr} \rangle \\ &\rightarrow A = \langle \text{term} \rangle \\ &\rightarrow A = \langle \text{term} \rangle * \langle \text{factor} \rangle \\ &\rightarrow A = \langle \text{factor} \rangle * \langle \text{factor} \rangle \\ &\rightarrow A = \langle \text{id} \rangle * \langle \text{factor} \rangle \\ &\rightarrow A = B * \langle \text{factor} \rangle \\ &\rightarrow A = B * (\langle \text{expr} \rangle) \\ &\rightarrow A = B * (\langle \text{term} \rangle) \\ &\rightarrow A = B * (\langle \text{term} \rangle * \langle \text{factor} \rangle) \\ &\rightarrow A = B * (\langle \text{factor} \rangle * \langle \text{factor} \rangle) \\ &\rightarrow A = B * (\langle \text{id} \rangle * \langle \text{factor} \rangle) \\ &\rightarrow A = B * (\langle \text{id} \rangle * \langle \text{factor} \rangle) \\ &\rightarrow A = B * (C * \langle \text{factor} \rangle) \\ &\rightarrow A = B * (C * (\langle \text{expr} \rangle)) \\ &\rightarrow A = B * (C * (\langle \text{expr} \rangle + \langle \text{term} \rangle)) \\ &\rightarrow A = B * (C * (\langle \text{term} \rangle + \langle \text{term} \rangle)) \\ &\rightarrow A = B * (C * (\langle \text{factor} \rangle + \langle \text{term} \rangle)) \\ &\rightarrow A = B * (C * (\langle \text{id} \rangle + \langle \text{term} \rangle)) \\ &\rightarrow A = B * (C * (A + \langle \text{term} \rangle)) \\ &\rightarrow A = B * (C * (A + \langle \text{factor} \rangle)) \\ &\rightarrow A = B * (C * (A + \langle \text{id} \rangle)) \\ &\rightarrow A = B * (C * (A + B)) \end{aligned}$$

Problem 8:

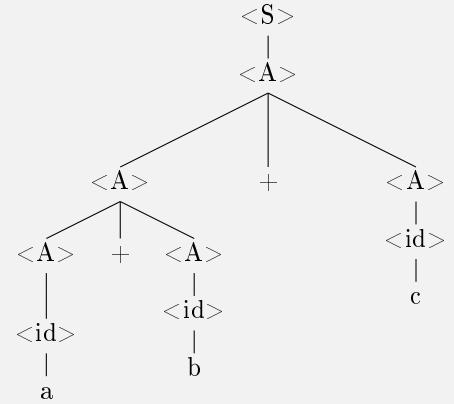
Prove the following grammar is ambiguous:

$$\begin{aligned} \langle S \rangle &\rightarrow \langle A \rangle \\ \langle A \rangle &\rightarrow \langle A \rangle + \langle A \rangle \mid \langle id \rangle \\ \langle id \rangle &\rightarrow a|b|c \end{aligned}$$

Parse Tree 1



Parse Tree 2



2 different trees exists for statements, therefore it is ambiguous.

Problem 9:

Modify the grammar of Example 3.4 to add a unary minus operator that has higher precedence than either + or *.

$$\begin{aligned} \langle assign \rangle &\rightarrow \langle id \rangle = \langle expr \rangle \\ \langle id \rangle &\rightarrow A|B|C \\ \langle expr \rangle &\rightarrow \langle expr \rangle - \langle term \rangle \mid \langle term \rangle \\ \langle term \rangle &\rightarrow \langle term \rangle * \langle factor \rangle \mid \langle factor \rangle \\ \langle factor \rangle &\rightarrow (\langle expr \rangle) \mid \langle id \rangle \end{aligned}$$

Problem 11:

Consider the following grammar:

$$\langle S \rangle \rightarrow \langle A \rangle a \langle B \rangle b$$

$$\langle A \rangle \rightarrow \langle A \rangle b \mid B$$

$$\langle B \rangle \rightarrow a \langle B \rangle \mid a$$

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

a. baab

$$\rightarrow ab$$

$$\rightarrow bab$$

$$\rightarrow baab$$

So, the combination will be generated from the grammar.

b. bbbab

$$\rightarrow ab$$

$$\rightarrow bab$$

$$\rightarrow bbab$$

$$\rightarrow bbbab$$

$$\rightarrow bbbaab$$

Based on the provided grammar, the combination will not be produced

c. bbaaaaaS

d. bbaab