

Homework #1: Chapters 1 and 3

This assignment is due at the beginning of class on **Wednesday, September 10**. Please write or type your answers on your own paper. You will be mostly graded for completeness, but selected problems will be graded for correctness.

1. Many contemporary languages allow two kinds of comments, one in which delimiters are used on both ends (for multiple line comments), and one in which a delimiter marks only the beginning of comment (for one line comments). Discuss the advantages and disadvantages of each of these with respect to the language evaluation criteria presented in Chapter 1.

2. Consider the following grammar:

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

a. Show a leftmost derivation of the following statement

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

b. Show a parse tree of the following statement

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

3. Show that the following grammar is ambiguous:

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

4. Consider the following grammar:

$$\begin{aligned} \langle S \rangle &\rightarrow \langle A \rangle a \langle B \rangle b \\ \langle A \rangle &\rightarrow \langle A \rangle b \mid b \\ \langle B \rangle &\rightarrow a \langle B \rangle \mid a \end{aligned}$$

Which of the following sentences are in the language generated by this grammar? Explain your answer.

- a) baab
- b) bbbab
- c) bbaaaa

5. Write a grammar for the language consisting of strings that have n copies of the letter a followed by the same number of copies of the letter b where $n > 0$. For example, the strings ab, aaabbb, and aaaaaaabbabbbb are in the language but a, abb, ba and aabbb are not.

6. Compute the weakest precondition for each of the following assignment statements and post conditions:

$$\begin{aligned} a &= 2 * (b - 1) - 1 \{a > 0\} \\ x &= 2 * y + x - 1 \{x > 11\} \end{aligned}$$