

HW01 Problem Set

CS-3160

**Assignment**

Sebesta Problems 3.(3,4,7,8,9,10,12,13,14,17)

3. Rewrite the BNF of Example 3.4 to give + precedence over \* and force + to be right associative.
4. Rewrite the BNF of Example 3.4 to add the ++ and -- unary operators of Java.
7. Using the grammar in Example 3.4, show a parse tree and a leftmost derivation for each of the following statements:
  - a.  $A = ( A + B ) * C$
  - b.  $A = B + C + A$
  - c.  $A = A * ( B + C )$
  - d.  $A = B * ( C * ( A + B ) )$
8. Prove that the following grammar is ambiguous:  
 $\langle S \rangle \rightarrow \langle A \rangle$   
 $\langle A \rangle \rightarrow \langle A \rangle + \langle A \rangle \mid \langle \text{id} \rangle$   
 $\langle \text{id} \rangle \rightarrow a \mid b \mid c$
9. Modify the grammar of Example 3.4 to add a unary minus operator that has higher precedence than either + or \*.
10. Describe, in English, the language defined by the following grammar:  
 $\langle S \rangle \rightarrow \langle A \rangle \langle B \rangle \langle C \rangle$   
 $\langle A \rangle \rightarrow a \langle A \rangle \mid a$   
 $\langle B \rangle \rightarrow b \langle B \rangle \mid b$   
 $\langle C \rangle \rightarrow c \langle C \rangle \mid c$

12. Consider the following grammar:

$$\langle S \rangle \rightarrow a \langle S \rangle c \langle B \rangle \mid \langle A \rangle \mid b$$
$$\langle A \rangle \rightarrow c \langle A \rangle \mid c$$
$$\langle B \rangle \rightarrow d \mid \langle A \rangle$$

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

- a. abcd
  - b. acccbd
  - c. acccbcc
  - d. acd
  - e. accc
13. 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, aaaabbbb, and aaaaaaabbabbbb are in the language but a, abb, ba, and aaabb are not.
14. Draw parse trees for the sentences aabb and aaaabbbb, as derived from the grammar of Problem 13.

17. Convert the following EBNF to BNF:

$$S \rightarrow A\{bA\}$$
$$A \rightarrow a[b]A$$

### **Grading Rubric**

The assignment is worth 10 pts (as a whole) and the score will be recorded as a percentage of that amount.

10% Physical Format

50% Answers correct (and supported by work)

40% Effort evidenced by the submitted work