

CSCI 447 – Fall 2002

Context-Free Grammars

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Due Date: Monday, Nov 4, 2002

1. Given the grammar $A \rightarrow AA \mid (A) \mid \epsilon$
 - a. Describe the language it generates.
 - b. Show that this grammar is ambiguous.
 - c. Write an unambiguous grammar that generates the same language
2. The following grammar generates all regular expressions over the alphabet of letters

rex \rightarrow $rex \mid rex$
 \rightarrow $rex \mid rex$
 \rightarrow $rex \mid *$
 \rightarrow $(\mid rex \mid)$
 \rightarrow **letter**

- a. Show that this grammar is ambiguous
 - b. Rewrite the above grammar to establish correct precedence of operators. Parentheses are given highest precedence, then Kleene closure (*), then concatenation (no operator symbol), then alternation (|).
 - c. What associativity does your answer in (b) give to operators and why?
3. Write a grammar for Boolean expressions that include the constants **true** and **false**, identifiers, the operators **and**, **or**, **not**, and parentheses. Be sure to give **or** a lower precedence than **and** and **and** a lower precedence than **not** and to allow repeated **not**'s. The associativity of **or** and **and** is left-to-right, while the associativity of **not** is right-to-left. Be sure that your grammar is not ambiguous.
 4. The following grammar has been proposed to remedy the **else** ambiguity in **if** statements:

$stmt$ \rightarrow $matched \mid unmatched$
 $matched$ \rightarrow **if** $expr$ **then** $matched$ **else** $stmt$
 $matched$ \rightarrow $other-stmt$
 $unmatched$ \rightarrow **if** $expr$ **then** $stmt$

Show that this grammar is still ambiguous

5. a. Write a regular expression that generates the same language of the grammar:

$A \rightarrow aA \mid B \mid \epsilon$
 $B \rightarrow bB \mid A$

- b. Write a regular grammar for: $(a \mid c \mid ba \mid bc)^*(b \mid \epsilon)$.