

Context-Free Grammars (CFGs) - Syntactic Theory Exercises
(06.11.2008)

Due on Monday 10.11.2008, 17:00

November 6, 2008

1. Consider the following grammar with start symbol S:

$S \rightarrow AA$
 $A \rightarrow AAA$
 $A \rightarrow a$
 $A \rightarrow bA$
 $A \rightarrow Ab$

- (a) What strings can be produced by derivations of four or fewer steps?
(b) Give at least four distinct derivations for the string babbab.

2. Consider the following grammar with start symbol S:

$S \rightarrow aB$
 $S \rightarrow bA$
 $A \rightarrow a$
 $A \rightarrow aS$
 $A \rightarrow BAA$
 $B \rightarrow b$
 $B \rightarrow bS$
 $B \rightarrow ABB$

- (a) Show that the string ababba belongs to this language.
(b) Prove that all strings in the language have equal numbers of a's and b's.

3. Consider the following grammar with start symbol S:

$S \rightarrow PVP$
 $P \rightarrow N$
 $P \rightarrow AP$
 $N \rightarrow \text{cheese}$
 $N \rightarrow \text{Jim}$

V → ate
A → green
A → big

(a) Give a parse tree for the sentence "big Jim ate green cheese".

Total points: 60. Pass: 30 points.