

CS 5000: Theory of Computation

Assignment 8: Breaking Out of Context Freedom

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Learning Objectives

1. Context-Free Grammars & Non-Context-Free Grammars
2. Pumping Lemma for Context-Free Languages

Problem 1 (1 point)

Consider the following grammar G :

$S \rightarrow aSBC$

$S \rightarrow aBC$

$CB \rightarrow BC$

$aB \rightarrow ab$

$bB \rightarrow bb$

$bC \rightarrow bc$

$cC \rightarrow cc$

What is the $L(G)$? Does your finding contradict Slide 27 in Lecture 18? Briefly (1 or 2 sentences) explain why or why not.

Problem 2 (3 points)

Consider the following languages. For each language, show if it is or is not CF.

a) $L_1 = \{a^n b^m c^n d^m \mid m > 0, n > 0\}$

b) $L_2 = \{a^n c^{2n} d^{3n} \mid n > 0\}$

c) $L_3 = \{a^n b^n c^m d^m \mid m > 0, n > 0\} \cup \{a^n b^m c^m d^n \mid m > 0, n > 0\}$

Problem 3 (1 point)

$L = L_1 \cdot L_2 \cdot \dots \cdot L_n, n > 1$, where L_j is CF if j is even and L_j is regular if j is odd.

Is L context-free or not?