

Computation Theory (COMP 170), Fall 2020
Assignment 05

Answer each problem below to the best of your ability. Submit all parts by 9:00 AM on Monday, October 26. List your collaborators. Late homework is accepted within 24 hours for half credit. After 24 hours no credit is given. The first late assignment (up to 24 hours) per student incurs no penalty. **Make sure that your submission follows the formatting guidelines given at the end of this document.**

Reading: Sipser Chapter 2.2, 2.3, 3

[1] (6 pts.) **Context Free Pumping Lemma**

Consider the following two languages:

$$A_S = \{a^n b^m c^r \mid n + m = r\}$$

$$A_P = \{a^n b^m c^r \mid n \times m = r\}$$

We've seen that A_S is context free by constructing a *CFG* that generates it. Prove that, unlike A_S , A_P is not context free.

[2] (6 pts.) **CFG's from Regular Expressions**

In class, we saw we could start with an arbitrary DFA M , and use that to create a CFG G that generates the same language as that recognized by M (i.e. $L(G) = L(M)$). For this problem, your goal is to show how to inductively create a CFG that simulates an arbitrary regular expression. Given an arbitrary regular expression R , formally specify how to create a CFG G such that $L(G) = L(R)$. No proof needed, but make sure your construction is precise.

[3] (8 pts.) **Pushdown Automata**

Let A denote the language of even-length strings over $\Sigma = \{a, b\}$ that are *not* palindromes. Specify a PDA that recognizes A , using a transition diagram to describe δ . Explain informally how your machine works, but no proof is required.