

Homework 5

*Assigned: 27 April**Due: 3 May, 9:00pm PDT*

Note Submission deadline is now 9:00pm.

Problem 1

Let alphabet $\Sigma = \{ a, b, c \}$, and let:

$$L_{add} = \{ a^i b^j c^k \mid k = i + j \}$$

Show a PDA for this language. There are no other conditions for correctness other than what you see here, except, of course our general guidance in this class that your answer should be clear and avoid too much unnecessary complexity. Remember to include a brief description of how your PDA is designed to correctly recognize the language.

Problem 2

Let $\Sigma = \{ a, b, c \}$. Show using the Pumping Lemma for the Family of CFLs (and possibly other results) that the following language over Σ is not context free:

$$L_2 = \{ a^i b^j c^k \mid k = i + j \text{ and } i > j \}$$

Remember that your proof will be graded based on the four elements of a good proof using the CFL pumping lemma: appropriate choice of your string s ; effective use of the constraints on the 5 substrings $uvxyz$ from the lemma; showing that you have considered every possible case for $s = uvxyz$; and clear, sound logic in each case.

Problem 3

Let A and B be two languages over the same alphabet, Σ . Assume that neither language contains ϵ . Then let the **perfect shuffle** of A and B be the language $\{ \omega \mid \omega = a_1 b_1 \dots a_k b_k \text{ where } a_1 \dots a_k \in A \text{ and } b_1 \dots b_k \in B \text{ each } a_i, b_i \in \Sigma \}$.

Show that the class of finite state (aka regular) languages is closed under perfect shuffle by showing how to construct a DFA for the perfect shuffle of two given FSLs. You must use precise mathematical notation to express your construction. Drawing a picture of a transition diagram leaves too much to the imagination to be precise, and that will not be accepted as an answer.

You do *not* have to formally prove that your constructed finite automaton is correct. However, as always in this class, your response must include a brief explanation of how your answer correctly represents the solution.