Assignment 4

Released: 7 Oct - Due: 14 Oct *TA: Manoj M P*

Please stick to the length-limits.

1. Show that the class of languages accepted by deterministic PDAs is *strictly* contained in the class of CFLs. *(max $\frac{1}{2}$ page)*

2. **Ogden's Lemma** If A is a CFL, then there is a number p such that, if s is any string in A, and at least p characters in s are "marked," then s may be divided into five pieces $s = uvxyz$ satisfying the conditions:

   (a) For each $i \geq 0$, $uv^ixy^iz \in A$,

   (b) v and y together have at least one marked character, and

   (c) vxy has at most p marked characters.

   Use the above form of pumping lemma for CFLs to show that the language $L = \{a^ib^jc^j | i, j \geq 0 \text{ and } i \neq j\}$ is not a CFL. *(max $\frac{1}{2}$ page)*

3. In the following give informal descriptions of PDAs. Make sure that your PDA doesn't end up accepting strings not in the language. *(max $\frac{1}{2}$ page each)*

   * (a) Problem 2.26

   * (b) Problem 2.27