CS21004 - Tutorial 7

11th Mar 2019

Instructions : For the problems with (To submit), please write the answers neatly in loose sheets with your name and roll number. Submit to the TA at the end of the class.

1. Show that following languages are not context-free using pumping lemma
   (a) $L_1 = \{a^n b^j c^k : k > n, k > j\}$
   (b) $L_2 = \{a^n b^j : n \leq j^2\}$ (To submit)
   (c) $L_3 = \{a^n b^j c^k : k = jn\}$ (Home)

2. Covert the following grammars into Chomsky Normal Form.
   (a) $S \rightarrow aXbX$
   $X \rightarrow aY|bY|\epsilon$
   $Y \rightarrow X|c$ (To submit)
   (b) $S \rightarrow AACD$
   $A \rightarrow aAb|\epsilon$
   $C \rightarrow aC|a$
   $D \rightarrow aDa|bDb|\epsilon$
   (Home)

3. Construct the PDA for the following for the language over a, b)
   (a) L1 = $a^i b^j c^k | i, j, k \geq 0$, and i=j or j=k
   (b) L2 = $a^{2m} c^{4n} d^n b^m | m, n \geq 0$
   (c) L3= $x\$y | \exists n : x = binary(n) \wedge y = binary(n+1)$ where binary(n) is the binary encoding of natural number n. For example, this set contains $0\$1, 1101\$1100$ and $001\$101$ but not $1\$1 or 11\$10$. (Home)

4. Give CFG for the following languages.
   (a) Write a rudimentary CFG to parse the roman numerals $1 - 99 (i, ii, iii, iv, v, ..., ix, x, ..., xl, ..., lxxx, ..., xc, ..., xcix)$. Consider the terminals c, l, x, v, i where $c = 100, l = 50, x = 10, v = 5, i = 1$. (Home)
   (b) Construct a context free grammar for generating regular expressions which has the set of terminals T = $a, b, ep, +, *, (,)$ over a, b, with + meaning the RegExp OR operator, and ep meaning the the ϵ symbol. (Home)