

CS3331 – Assignment 2
due Oct. 21, 2014 (latest to submit: Oct. 24)

1. (30pt) Let $L = \{w \in \{a, b, \cup, \varepsilon, (,), *, +\}^* \mid w \text{ is a syntactically legal regular expression over } \Sigma = \{a, b\}\}$.
 - (a) Give an unambiguous context-free grammar that generates L . The grammar should
 - use the following precedence levels, from highest to lowest: (1) $*$ and $+$ (equal precedence), (2) concatenation, and (3) \cup and
 - left-associate operators of equal precedence.
 - (b) Show the parse tree that your grammar produces for the string $(a \cup b)ba^*$.
2. (40pt) For each of the following languages L , prove whether L is regular, context-free but not regular, or not context-free:
 - (a) $\{xy \mid x, y \in \{a, b\}^* \text{ and } |x| = |y|\}$.
 - (b) $\{a^i b^n \mid i, n > 0 \text{ and } i = n \text{ or } i = 2n\}$.
 - (c) $\{(ab)^n a^n b^n \mid n > 0\}$.
 - (d) $\{ww^R w \mid w \in \{a, b\}^*\}$.
3. (30pt) Show that the following problem is decidable: Given a context-free grammar G , does G generate any even length strings?

Note Submit your solution as a pdf file on `owl.uwo.ca`.