Homework #6 *due December 13, 2022 before recitation*

Question 1

Consider the CFG $G = (V, \Sigma, R, S)$ *where* $V = \{S,A,B,C,D,E\}$, $\Sigma = \{a,b,c\}$ *and* R *is as given below*

R*:*

$S \rightarrow AE \mid EB \mid C$

$A \rightarrow aA \mid a$

$B \rightarrow Bb \mid b$

$C \rightarrow Cc$

$D \rightarrow aCb \mid a \mid b \mid c$

$E \rightarrow aEb \mid e$

(a) *Remove all the null productions of* G *, if any, and call the result* G_1**.**

(b) *Remove all the unitary productions of* G_1 *, if any , call the result* G_2**.**

(c) *Remove all the non-generative and non-reachable symbols of this grammar, if any, and call the result* G_3**.**

(d) *Compute the Chomsky Normal Form of* G_3 *using your results above.*

(e) *State in the simplest possible way the language generated by* G

Question 2

Consider the alphabet T *of terminals consisting of* 3 *pairs of matching left and right parentheses of three types, namely :* $\{ , \} , [,] , (,)$

(a) *Describe a CFG ,* $G = (V,T ,R ,S)$ *such that* L_G *has the following properties:*

(i) every left parenthesis is balanced by a <u>distinct</u> right parenthesis somewhere on its right side and of its own type; (ii) a priority rule holds : no curly parenthesis - i.e. $\{$ *or* $\}$ *- is contained within a rectangular pair – i.e.* $[\ ]$ *- or a plain pair – i.e.* $(\ )$ *- ; and no rectangular parenthesis is contained within a plain pair; (iii) empty string is not a member of* L_G*.*

(b) *Using your grammar find a parse tree that derives the string:* $\{ (\ ) [\ (\ )\ ] \}\{\}$

Main Text: Exercise 6.4.1 (a),(c) ; 6.4.2