

Homework #6 due May 6, 2025 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 distinct 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