Tutorial problems

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Exe : 5.1.1

(a) Design Contex free gramm.

(i) $\{0^n 1^n \mid n \geq 1\}$

$G = (V, T, P, S)$.

$S = S$

$T = \{0, 1\}$.

S = start sym

$P = S \rightarrow 01 \mid 0S1$

(ii) $\{a^i b^j c^k \mid i \neq j \text{ (or) } j \neq k\}$.

$G = (V\ T\ P.\ S)$

$V = \{S, A, B, C, D, E\}$.

$T = \{a, b, c\}$.

S = start sym.

$P = S \rightarrow AB \mid CD$.

$A \rightarrow aA \mid \epsilon$

$D \rightarrow cD \mid \epsilon$.

$B \rightarrow bBc \mid cD \mid E$.

$C \rightarrow aCb \mid aA \mid E$.

$E \rightarrow bE \mid b$

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(iii) The set of all strings with ~~twice~~ as many 0's as 1's

→ $G = (V, T, P, S)$

$V = \{S\}$

$T = \{0, 1\}$

$S = \{S\}$

$P = \{ \quad S \rightarrow S1S0S0S \mid S0S1S0S \mid S0S0S1S \mid \varepsilon \}$

(iv) ~~Set~~ of all strings of a's & b's that are not a's & b's that are not of the form ww (w string repeated)

$G = (V\ T\ P\ S)$

$V = \{S, A, B\}$

$T = \{a, b\}$

S = start symbol

$P = \{$

$S \rightarrow AB \mid BA \mid A \mid B$

$A \rightarrow aAa \mid aAb \mid bAa \mid bAb \mid a$

$B \rightarrow aBa \mid aBb \mid bBa \mid bBb \mid b$

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Ex : 5.1.2 : The foll gram generates the lang of regular Expr. $0^* 1 (0+1)^*$:

$S \rightarrow A1B$ [1]

$A \rightarrow 0A$ [2] $| \; \varepsilon$ [3]

$B \rightarrow 0B$ [4] $| \; 1B$ [5] $| \; \varepsilon$ [6]

Give leftmost & Rightmost derivations of the foll strings

(a) 00101

LMD: $S \Rightarrow A1B \Rightarrow 0A1B \Rightarrow 00A1B \Rightarrow 00\varepsilon 1B \Rightarrow 001B \Rightarrow 0010B \Rightarrow 00101B \Rightarrow 00101\varepsilon \Rightarrow 00101$

RMD : $S \Rightarrow A1B \Rightarrow A10B \Rightarrow A101B \Rightarrow A101\varepsilon \Rightarrow A101 \Rightarrow 0A101 \Rightarrow 00A101 \Rightarrow 00\varepsilon 101 \Rightarrow 00101$

(b) 1001

LMD: $S \Rightarrow A1B \Rightarrow \varepsilon 1B \Rightarrow 1B \Rightarrow 10B \Rightarrow 100B \Rightarrow 1001B \Rightarrow 1001\varepsilon \Rightarrow 1001$

RMD : $S \Rightarrow A1B \Rightarrow A10B \Rightarrow A100B \Rightarrow A1001B \Rightarrow A1001\varepsilon \Rightarrow A1001 \Rightarrow \varepsilon 1001 \Rightarrow 1001$

(c) 00011

→ LMD : $S \Rightarrow A1B \Rightarrow 0A1B \Rightarrow 00A1B \Rightarrow 000A1B$
$\Rightarrow 000\varepsilon 1B \Rightarrow 0001B \Rightarrow 00011B \Rightarrow 00011\varepsilon$
00011

RMS : $S \Rightarrow A1B \Rightarrow A11B \Rightarrow A11\varepsilon \Rightarrow A11 \Rightarrow$
$0A11 \Rightarrow 00A11 \Rightarrow 000A11 \Rightarrow 000\varepsilon 11 \Rightarrow$
00011.

Ex : 5.4.5 :

This que concerns the gram from Ex : 5.1.2, which are produced here.

$S \to A1B$

$A \to 0A \mid \varepsilon$

$B \to 0B \mid 1B \mid \varepsilon$

(a) Show that this gram is unambiguous

For the given lang is unambiguous bcz seq of '00101' can be produced by both left & Right most derivations as shown above Exercise

(b) Find the gram for the same lang that is ambiguous & ~~demon state~~ demonstrate its ambiguity

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⇒ The gram that is ambiguous for this lang : 00101
wing gram
$S \rightarrow A1B$
$A \rightarrow 0A \mid \varepsilon$
$B \rightarrow 1B \mid \varepsilon$

LMD ⇒ $S \Rightarrow A1B \Rightarrow 0A1B \Rightarrow 00A1B \Rightarrow$
$00\varepsilon 1B \Rightarrow 001B \Rightarrow 0011B \Rightarrow 0011\varepsilon$
$\Rightarrow 0011$

RMD ⇒ $S \Rightarrow A1B \Rightarrow A11B \Rightarrow A11\varepsilon \Rightarrow$
$A11 \Rightarrow 0A11 \Rightarrow 00A11 \Rightarrow 00\varepsilon 11$
$\Rightarrow 0011$

Hence is ambiguous.
It is not possible to gen 00101.

Ex : 5.4.7
The foll gram gen prefix expr with operands
x & y & binary operators +, -, & * :
$E \rightarrow +EE \mid *EE \mid -EE \mid x \mid y$

(a) Find the LMD & RMD & a derivation tree for the string $+*-xyxy$

→ LMD : $E \xRightarrow[lm]{} +EE \Rightarrow +*EEE \Rightarrow +*-EEEE$
$\Rightarrow +*-xEEE \Rightarrow +*-xyEE \Rightarrow +*-xyxE$
$\Rightarrow +*xyxy.$

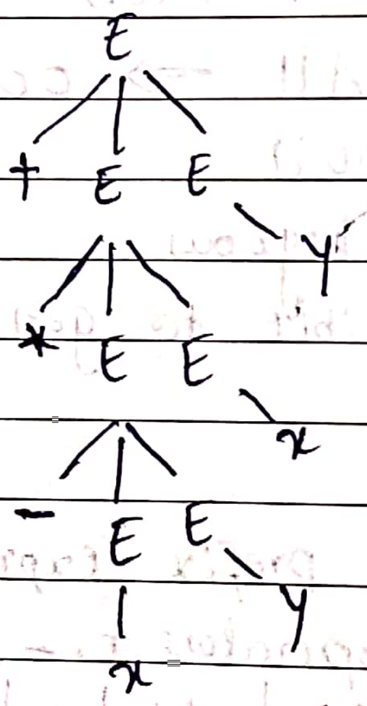
The 2 normal forms are :

1] Chaimksy Normal form (CNF)

2] Greibach Normal form (GNF)

<u>RMD</u> : $E \Rightarrow *EE \Rightarrow *Ey \Rightarrow +*EEy \Rightarrow +*Exy \Rightarrow +*-EExy \Rightarrow +*-Eyxy \Rightarrow +*-xyxy$

<u>Derivation tree</u>



(b) Prove that this gram is unambiguous

$\Rightarrow$ For the given lang is unambiguous bcz seq of '+*-xyxy' can be produced by both left & right most derivations as shown above