Assignment-6

26-8-24

1. optimize the given grammar

$S \rightarrow AB \mid CA$

$B \rightarrow BC \mid AB$

$A \rightarrow a$

$C \rightarrow aB \mid b$

2. convert CFG to CNF $S \rightarrow aAD$

$A \rightarrow aB \mid bAB$

$B \rightarrow a$

$D \rightarrow d$

3. $S \rightarrow ABA$

$A \rightarrow aA \mid \varepsilon$ CFG to CNF

$B \rightarrow bB \mid \varepsilon$

4. Convert CFG $\rightarrow$ GNF

$S \rightarrow AA \mid 0$

$A \rightarrow SS \mid 1$

(1) Given, $S \rightarrow AB \mid CA$

$B \rightarrow BC \mid AB$

$A \rightarrow a$

$C \rightarrow aB \mid b$

i) there is no useless symbol ii) ε elimination

$S \rightarrow AB \mid CA$

$B \rightarrow BC \mid AB$

$A \rightarrow a$

$C \rightarrow aB \mid b$

∴ There is no ε elimitio

iii) unit Production:-

It should contain only one unit production but grammar contain all 2 unit productions.

2. $S \to aAD$

$A \to aB / bAB$

$B \to a$

$D \to d$

i) Check whether the grammar is simplified or not.

∴ grammar is simplified grammar

$S \to aAD$ (Not in CNF format)

by rule,

$P_0 \to a$

$S \to P_0AD$

$P_1 \to AD$

$\boxed{S \to P_0P_1}$ (CNF format)

$B \to a$ (CNF format)

$D \to d$ (CNF format)

∴ $S \to P_0P_1$

$A \to P_0B / P_2P_3$

$B \to a$

$D \to d$

CNF = $NT \to NT.NT$

$NT \to T$

$A \to aB$ (Not in CNF format)

by rule

$A \to P_0B$ (CNF formed)

$A \to bAB$

$P_2 \to b$

$A \to P_2AB$

by rule

$P_3 \to AB$

$\boxed{A \to P_2P_3}$ CNF form

3. Given, $S \to ABA$

$A \to aA / \varepsilon$

$B \to bB / \varepsilon$

i) There is no useless symbol

ii) ε elimination

$A \to aA$

$A \to a\varepsilon$

$A \to a$

$B \to bB$

$B \to b\varepsilon$

$B \to b$

∴ $S \to ABA$

$A \to aA / a$ (∵ $A \to \varepsilon$ is remove)

$B \to bB / b$ $B \to bB / b$ ($B \to \varepsilon$ is removed

$S \rightarrow ABA$

$S \rightarrow AB$ (when $A \rightarrow \varepsilon$)

$S \rightarrow BA$ ($A \rightarrow \varepsilon$)

$S \rightarrow A$ (B & $A \rightarrow \varepsilon$)

$S \rightarrow B$ ($A \rightarrow \varepsilon$ and $A \rightarrow \varepsilon$)

$S \rightarrow \varepsilon$ (both A & $B \rightarrow \varepsilon$)

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

iii) remove unit production.

$S \rightarrow ABA \mid AB \mid BA \mid aA \mid a \mid bB \mid b$

$A \rightarrow aA \mid a$

$B \rightarrow bB \mid b$

$S \rightarrow ABA$ (Not CNF)

$P_0 \rightarrow A$

$S \rightarrow P_0BA$ (Not CNF)

$P_1 \rightarrow BA$

$S \rightarrow P_0P_1$

$S \rightarrow AB$ (CNF)

$S \rightarrow BA$ (CNF format)

$S \rightarrow aA$ (Not in CNF)

$P_2 \rightarrow a$

$S \rightarrow P_2A$

$S \rightarrow P_2P_0$

$S \rightarrow a$ (CNF)

$S \rightarrow bB$ (Not CNF)

$P_3 \rightarrow b$

$S \rightarrow P_3B$

$S \rightarrow b$ (CNF format)

$A \rightarrow aA$ (Not in CNF

$A \rightarrow P_2A$ (CNF)

$A \rightarrow a$ (CNF format

$B \rightarrow bB$ (Not CNF)

$B \rightarrow P_3B$ (CNF)

$B \rightarrow b$ (CNF)

$\therefore S \rightarrow P_0P_1 \mid P_2P_0 \mid a \mid P_3B \mid b \mid AB \mid BA$

$A \rightarrow P_2A \mid a$

1. Q.

$S \to AA \mid 0$
$A \to SS \mid 1$

By lemma 2

$A \to A\alpha \mid \beta$
$Z \to \alpha \mid \alpha Z$
$A \to \beta \mid \beta Z$

start from last

$A \to SS \mid 1$ ($\because S \to AA$)

$A \to AAS \mid 0S \mid 1$
(α = AS, β = 0S | 1)

$Z = AS \mid ASZ$ (Not in GNF)

by lemma 2

$A \to 0S \mid 1 \mid 0SZ \mid 1Z$ $\Rightarrow$ In GNF format

$Z = AS \mid ASZ$ (not in GNF)

$Z \to 0SS \mid 1S \mid 0SSZ \mid 1SZ \mid 0SSZ \mid 1SZ \mid 0SSZZ \mid 1ZSZ$

$\Rightarrow$ in GNF format

$S \to AA \mid 0$

$S \to 0SA \mid 1A \mid 0SZA \mid 1ZA \mid 0$

by lemma 1 :- from new grammer.

Case ii) $S \to 0SA \mid 1A \mid 0SZA \mid 1ZA \mid 0$
$A \to 0S \mid 1 \mid 0SZ \mid 1Z$

$\therefore S \to 0SA \mid 1A \mid 0SZA \mid 1ZA \mid 0$

$A \to 0S \mid 1 \mid 0SZ \mid 1Z$

28/8