ASSIGNMENT-6

Q1) Convert the grammar into CNF

$S \to ABa$

$A \to aab$

$B \to Ac$

Sol:- $S_0 \to S$

$S \to ABa$

$A \to aab$

$B \to Ac$

Then, $S_0 \to ABa$

$S \to ABa$

$A \to aab$

$B \to Ac$

Now, I would re-write it as below:-

$R \to AB$

$R_1 \to a$

$R_2 \to b$

$R_3 \to c$

On using the new notations:-

$S_0 \to RR_1$ [Since, $R \to AB$]

$S \to RR_1$ [Since, $R \to AB$ and $R_1 \to a$]

$A \to R_1R_1R_2$ [Since, $R_1 \to a$, $R_2 \to b$]

$B \to AR_3$ [Since, $R_3 \to c$]

In the above steps,

We can rewrite(assign) R_1R_1 to R_4 which changes the grammar to:

∴ $S_0 \to RR_1$ [Final Grammar]

$S \to RR_1$

$A \to R_4R_2$

$B \to AR_3$

$R \to AB$

$R_1 \to a$

$R_2 \to b$

$R_3 \to c$

$R_4 \to R_1R_1$

Q2) Convert the grammar into CNF

$S \rightarrow ABC$

$C \rightarrow BaB/c$

$B \rightarrow b/bb$

$A \rightarrow a$

Sol:-

$S_0 \rightarrow S$

$S \rightarrow ABC$

$C \rightarrow BaB/c$

$B \rightarrow b/bb$

$A \rightarrow a$

Then,

$S_0 \rightarrow ABC$

$S \rightarrow ABC$

$C \rightarrow BaB/c$

$B \rightarrow b/bb$

$A \rightarrow a$

Now, on using new notations by re-writing:-

$U \rightarrow AB$

This gives :-

$S_0 \rightarrow UC$

$S \rightarrow UC$

$C \rightarrow BAB/c$ [As, given $A \rightarrow a$]

$B \rightarrow b/BB$ [As, given $B \rightarrow b$]

$A \rightarrow a$

$U \rightarrow AB$

Scanned by CamScanner

$\therefore$ The final grammar in CNF form is :-

$S_0 \rightarrow UC$

$S \rightarrow UC$

$C \rightarrow BU / c$

$B \rightarrow b / BB$

$A \rightarrow a$

$U \rightarrow AB$

Q3) $G = (V, T, S, P)$ is a CNF Grammar without any of ϵ-productions (or) unit productions.

UNIT PRODUCTION :- $A \to B$ where $A, B \in V$

K :- Maximum number of symbols on the right of any production in P

Prove that there is an equivalent CNF grammar with no more than $(K-1)|P| + |T|$ productions.

Sol:- $G = (V, T, S, P)$

Now :- $|T|$ represents the total number of terminals.
$|P|$ represents the total number of productions.
Total number of rules with terminal :- Atmost $|T|$

Given, K :- Maximum number of symbols on the right of productions

On using the terminal rules on any given production, the production is the STRING OF ALL NON-TERMINAL SYMBOLS.

$\therefore$ To convert into CNF, the string of length K is split into $(K-1)$ ways.

∴ Total numbers of possible productions =

$(K-1)|P|$ for NON-TERMINALS.

The production can be NO MORE THAN $(K-1)|P| + |T|$ for both terminals and non-terminals.