⊛ Unrestricted Grammar :-

⇒ A grammar $G(V, \Sigma, S, P)$ is called unrestricted grammar if all productions are of the following form:

$$\alpha \rightarrow \beta$$

where, α must contain at least one non-terminal

$\alpha, \beta \in (V \cup \Sigma)^*$.

Example:- Let us consider a language $L = \{a^n b^n c^n \mid n \geq 0\}$.

Here, language contains the string as $L = \{ \varepsilon, abc, aabbcc, aaabbbccc, \ldots$

Let G be the grammar defined as,

$G = (V, \Sigma, S, P)$

where, $V = \{$

$\Sigma = \{a, b, c\}$

$S \rightarrow \{S\}$

P:

{

$S \rightarrow FS_1 \mid \varepsilon$

$S_1 \rightarrow ABCS_1 \mid ABC$

$CA \rightarrow AC, \; BA \rightarrow AB, \; CB \rightarrow BC$

$FA \to a$, $aA \to aa$, $aB \to ab$, $bB \to bb$, $bC \to bc$, $cC \to cc$

}

Let us take a string(ω) = aaabbbccc

$S \to FS_1$

$S \to FABCS_1$ $\quad \because S_1 \to ABC$

$S \to FABCABCS_1$ $\quad \because S_1 \to ABC$

$S \to FABCABCABC$ $\quad \because S_1 \to ABC$

$S \to FAAABBBCCC$ $\quad \because CA \to AC,\ BA \to AB,\ CB \to BC$

$S \to aAABBBCCC$ $\quad \because FA \to a$

$S \to aaABBBCCC$ $\quad \because aA \to aa$

$S \to aaaBBBCCC$ $\quad \because aA \to aa$

$S \to aaabBBCCC$ $\quad \because aB \to ab$

$S \to aaabbBCCC$ $\quad \because bB \to bb$

$S \to aaabbbCCC$ $\quad \because bB \to bb$

$S \to aaabbbcCC$ $\quad \because bC \to bc$

$S \to aaabbbccC$ $\quad \because cC \to cc$

$S \to aaabbbccc$ $\quad \because cC \to cc$