PES UNIVERSITY ONLINE

Automata Formal Languages & Logic

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Unit 3

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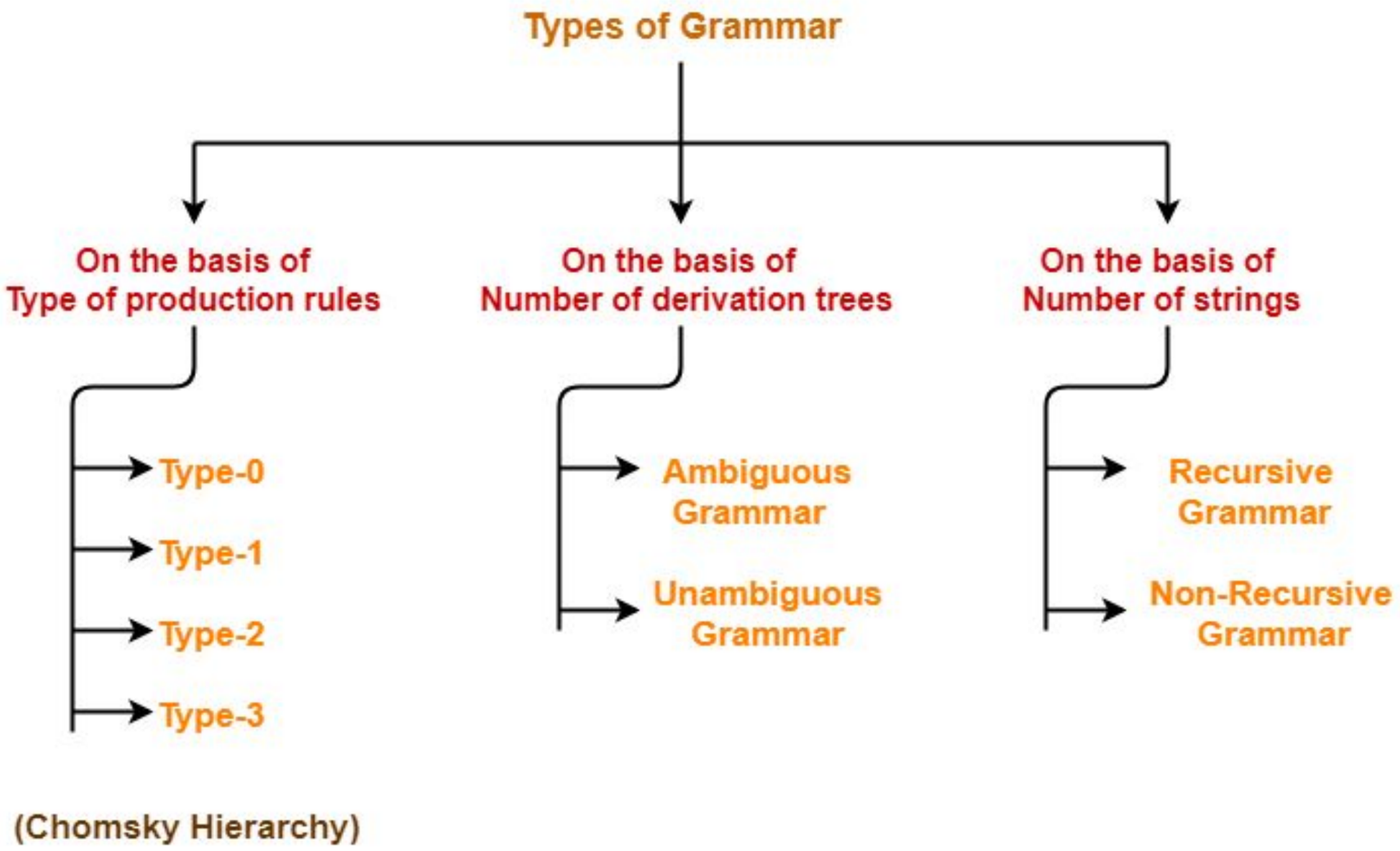
Grammar

- **V - Variables** — expr, var, S, A, B…, w,x,y
- **T - Terminals** — a, b, c …, 0, 1, … id, num
- **P - Production Rules** — $\alpha = (V \cup T)^*$; $A \rightarrow \alpha$
- **S - Start Symbol** — L(G) = {w | S ⇒ w, where w ∈ Σ^*}



(Chomsky Hierarchy)

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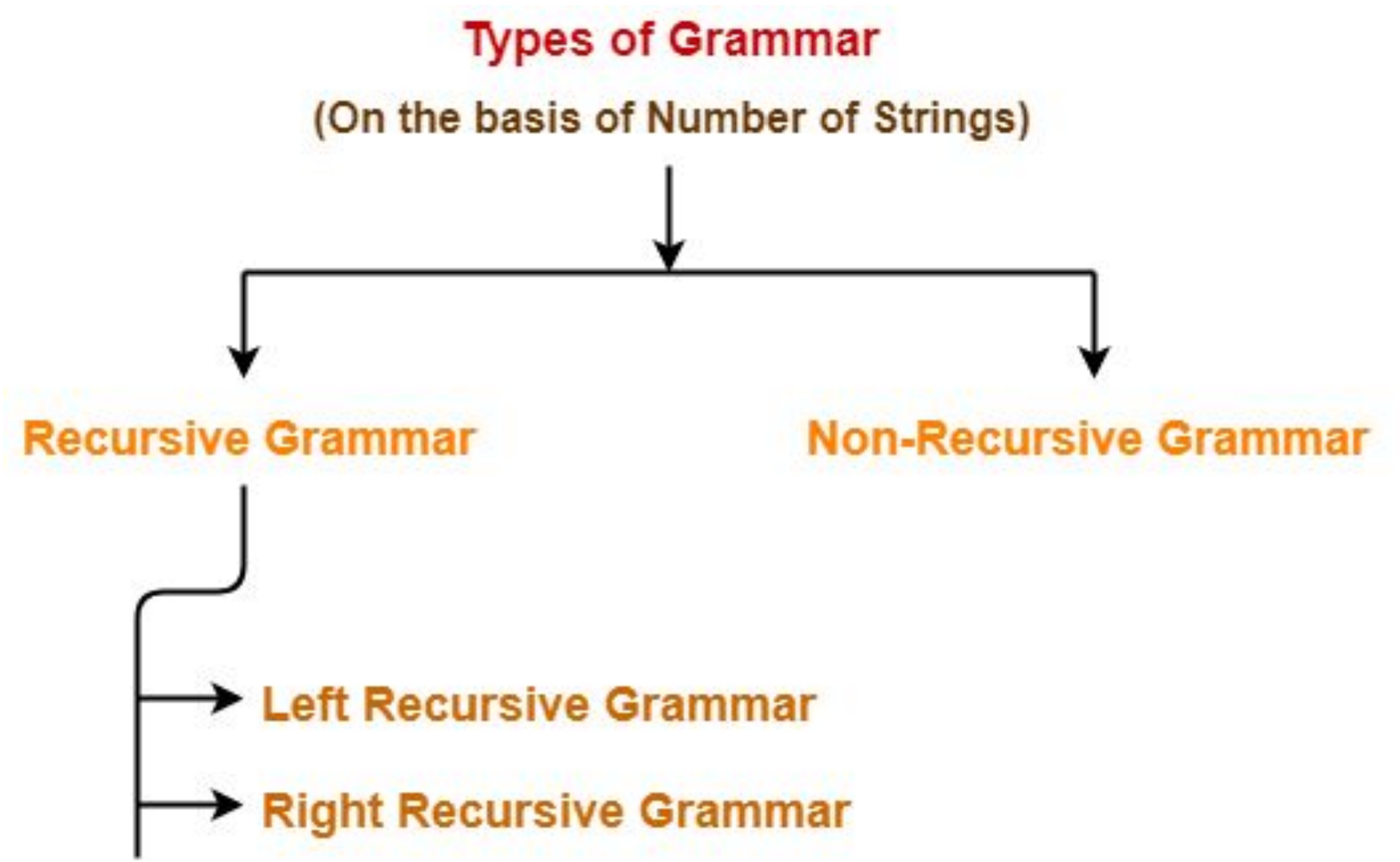

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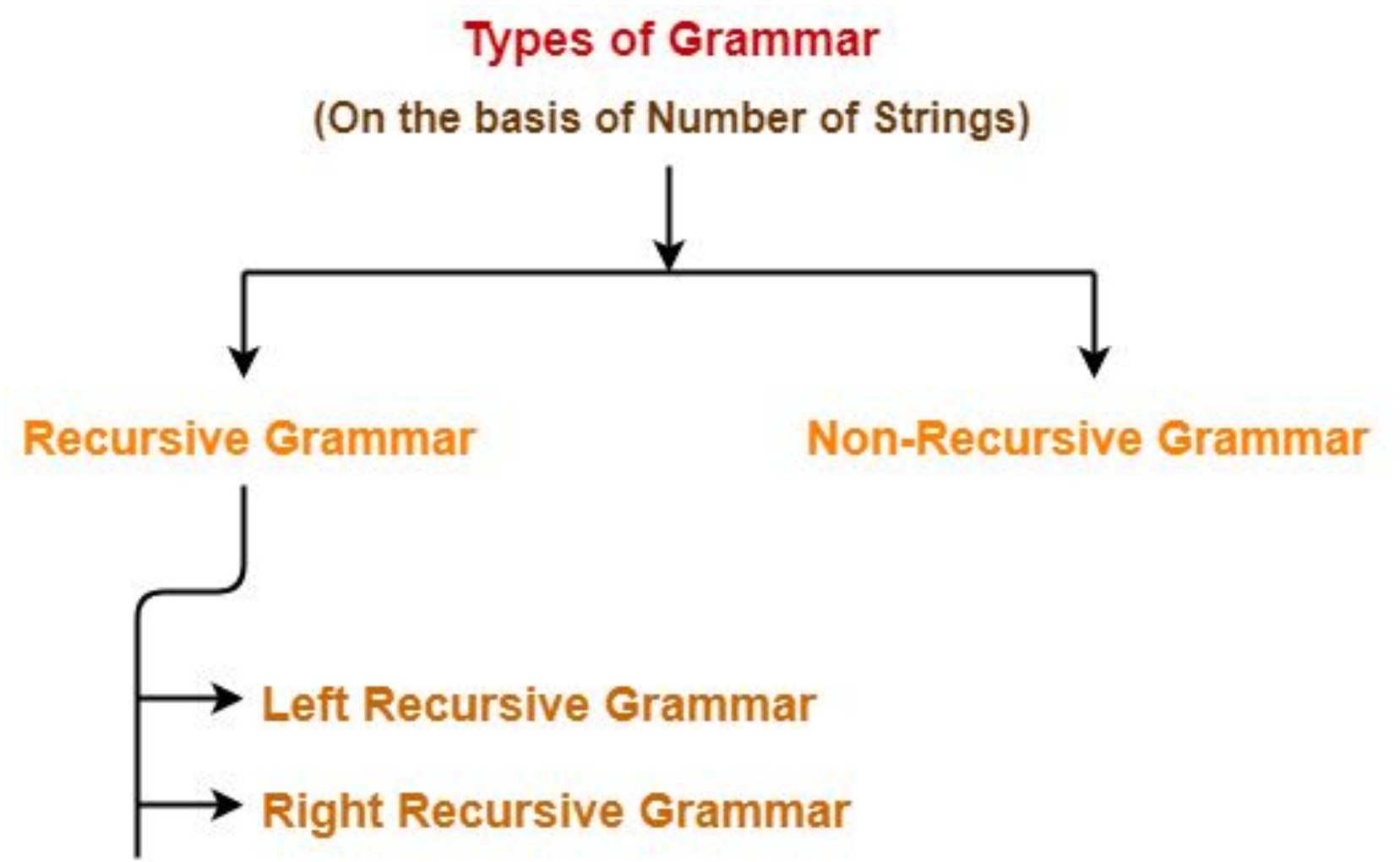

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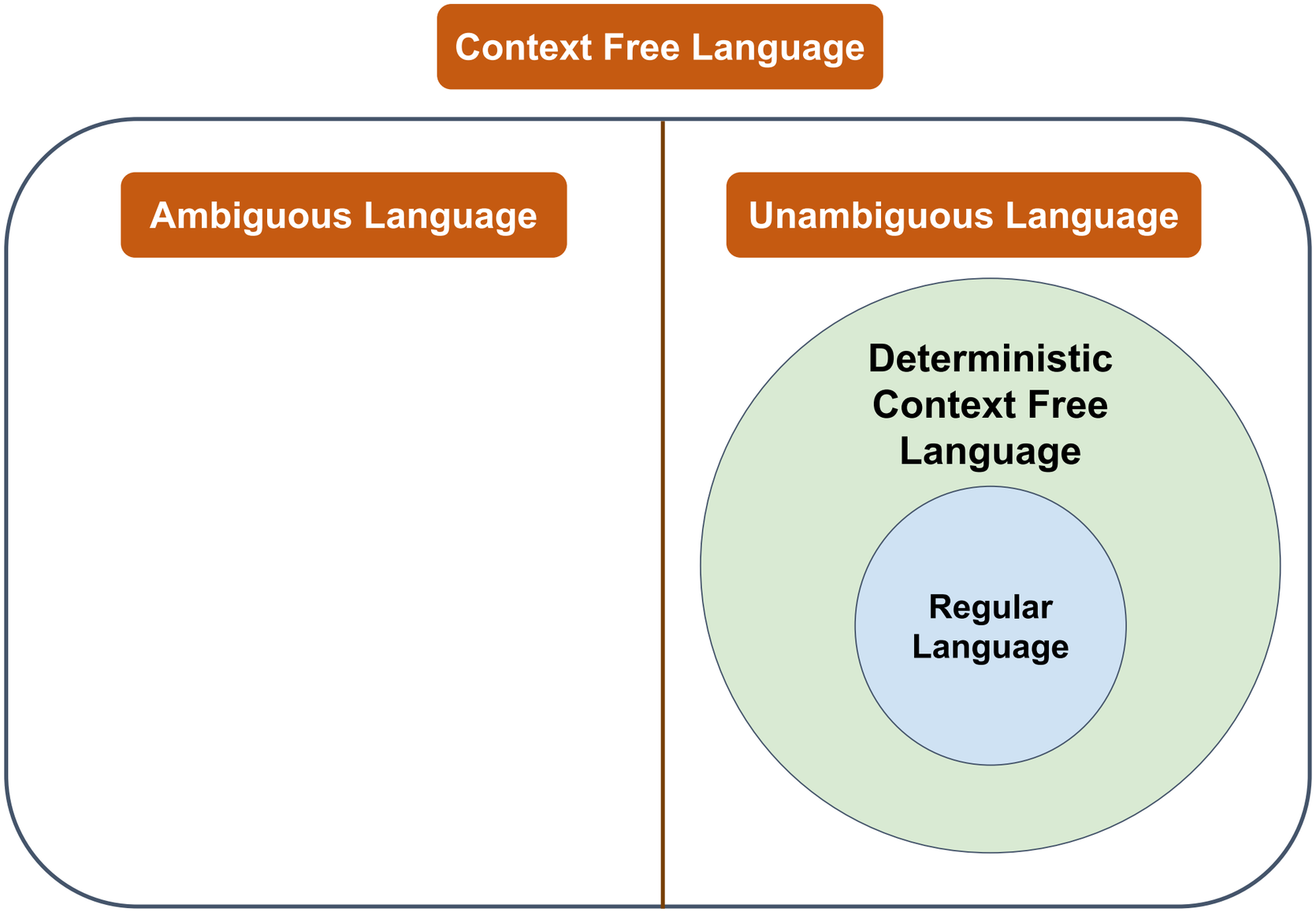
Context Free Language
Ambiguous Language
Unambiguous Language
Deterministic Context Free Language
Regular Language

Example 1:

Construct linear grammar for the even palindromes. $L=\{ww^R, w \in \{a,b\}^*\}$

Solution :

$S \rightarrow aSa|bSb|\lambda$

Example 2:

Construct linear grammar for the even palindromes. $L=\{wCw^R, w \in \{a,b\}^*\}$

Solution :

$S \rightarrow aSa|bSb|C$

Example 3:

Construct linear grammar for $L=\{ww^R, w \in \{ab\}^* \mid (ba)^*\}$

Solution :

$S \rightarrow abSba \mid baSab \mid \lambda$

Example 4:
Construct linear grammar for $L=\{a^n w w^R b^n \mid w \in \{a,b\}^*\}$

Solution :

$S \rightarrow aSb \mid A$

$A \rightarrow aAa \mid bAb \mid \lambda$

Example 5:
Construct linear grammar for $L=\{a^n b^{n+1} , n>=0\}$

Solution :

$S \rightarrow aSb \mid b$

Example 6:
Construct linear grammar for $L=\{a^{n+2}b^n, n>=1\}$

Solution :

$S \rightarrow aSb \mid aaab$

Example 7:
Construct linear grammar for $L=\{a^n b^{2n}, n>=0\}$

Solution :

$S \rightarrow aSbb \mid \lambda$

Example 8:
Construct linear grammar for $L=\{a^n b^{n-3}, n>=3\}$

Solution :

$S \rightarrow aSb \mid aaa$

Example 9:
Construct linear grammar for $L=\{a^n b^m, n>m\}$

Solution :

$S \rightarrow aSb \mid aS \mid a$

Example 10:
Construct linear grammar for $L=\{a^n b^m, n \neq m\}$

Solution :

$S \rightarrow A \mid B$

$A \rightarrow aAb \mid aA \mid a$

$B \rightarrow aBb \mid bB \mid b$

Example 11:
Construct linear grammar for $L=\{a^n b^m, n=2+(m \bmod 3)\}$

Solution :

$S \rightarrow aaA \mid aaabA \mid aaaabbA$

$A \rightarrow bbbA \mid \lambda$

Example 12:
Construct linear grammar for $L=\{a^n b^m, n \neq 2m\}$

Solution :

$S \rightarrow aaSb|A|B|aC$

$A \rightarrow aA|a$

$B \rightarrow Bb|b$

$C \rightarrow Cb|\lambda$

Example 13:
Construct linear grammar for $L=\{a^{n+2}b^m, m>n, n>=0\}$

Solution :

$S \rightarrow aSb|aab|Sb$

Example 14:
Construct linear grammar for $L=\{a^n b^m c^m d^n, n,m>=1\}$

Solution :

$S \rightarrow aSd|aAd$

$A \rightarrow bAc|bc$

Example 15:

Construct linear grammar for $L=\{a^n b^m c^k, k=n+m, n,m,k>=0\}$

Solution :

$S \rightarrow aSc|A$

$A \rightarrow bAc|\lambda$

Example 16:
Construct linear grammar for $L=\{a^n b^m c^k, m=2n, k=2, n>=0\}$

Solution :

$S \rightarrow AB$

$A \rightarrow aAbb \mid \lambda$

$B \rightarrow cc$

Example 17:
Construct linear grammar for $L=\{a^n b^m c^k, m,n>=0 , k=n+2m\}$

Solution :

$S \rightarrow aSc|A$

$A \rightarrow bAcc|\lambda$

Example 18:

Construct linear grammar for L={|w|mod 3 ≠ |w| mod 2,w∈{a}*}

Solution :

$S \rightarrow aaaaaaS \mid aa \mid aaa \mid aaaa \mid aaaaa$

THANK YOU

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