

Forma normal de Chomsky

$$\begin{aligned} a) S &\rightarrow TTU \\ T &\rightarrow OT|TO| \# \\ U &\rightarrow OUOO| \# \end{aligned}$$

1 - S_0

2 - ϵ

3 - Unitária

4 - $A \rightarrow u_1 u_2 u_3 \dots$

$$\begin{aligned} I) S_0 &\rightarrow S \\ S &\rightarrow TTU \\ T &\rightarrow OT|TO| \# \\ U &\rightarrow OUOO \end{aligned}$$

$$\begin{aligned} II) S_0 &\rightarrow TT|OUOO| \# \\ S &\rightarrow TT|OUOO| \# \\ T &\rightarrow OT|TO| \# \\ U &\rightarrow OUOO| \# \end{aligned}$$

$$\begin{aligned} V) S_0 &\rightarrow TT|ZZZZ| \# \\ S &\rightarrow TT|ZZZZ| \# \\ T &\rightarrow ZT|TZ| \# \\ Z &\rightarrow O \\ Z_2 &\rightarrow UZ \end{aligned}$$

$$\begin{aligned} III) S_0 &\rightarrow TT|OUOO| \# \\ S &\rightarrow TT|OUOO| \# \\ T &\rightarrow OT|TO| \# \\ U &\rightarrow OUOO| \# \\ Z &\rightarrow O \end{aligned}$$

$$\begin{aligned} Z_3 &\rightarrow ZZZ \\ U &\rightarrow ZZZZ| \# \end{aligned}$$

$$\begin{aligned} VI) S_0 &\rightarrow TT|ZZZ| \# \\ S &\rightarrow TT|ZZZ| \# \\ T &\rightarrow ZT|TZ| \# \\ Z &\rightarrow O \end{aligned}$$

$$\begin{aligned} IV) S_0 &\rightarrow TT|ZUZZ| \# \\ S &\rightarrow TT|ZUZZ| \# \\ T &\rightarrow ZT|TZ| \# \\ Z &\rightarrow O \\ Z_2 &\rightarrow UZ \\ U &\rightarrow ZUZZ| \# \end{aligned}$$

$$\begin{aligned} Z_2 &\rightarrow UZ \\ Z_3 &\rightarrow ZZZ \\ U &\rightarrow ZZZ| \# \end{aligned}$$

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D S T Q O S S
D L M M J V S

$$b) S \rightarrow aSb / bY / Ya$$

$$Y \rightarrow bY / aY / \epsilon$$

$$I) S_0 \rightarrow S$$

$$S \rightarrow aSb / bY / Ya / a / b$$

$$Y \rightarrow bY / aY / a / b$$

$$II) S_0 \rightarrow aSb / bY / Ya / a / b$$

$$S \rightarrow aSb / bY / Ya / a / b$$

$$Y \rightarrow bY / aY / a / b$$

$$III) S_0 \rightarrow ASB / BY / YA / a / b$$

$$S \rightarrow ASB / BY / YA / a / b$$

$$Y \rightarrow BY / AY / a / b$$

$$A \rightarrow a$$

$$B \rightarrow b$$

$$IV) S_0 \rightarrow AS_2 / BY / YA / a / b$$

$$S \rightarrow AS_2 / BY / YA / a / b$$

$$Y \rightarrow BY / AY / a / b$$

$$A \rightarrow a$$

$$B \rightarrow b$$

$$S_2 \rightarrow SB$$

$$\begin{aligned} \text{c) } E &\rightarrow E + T \mid T \\ T &\rightarrow T \times F \mid F \\ F &\rightarrow (E) \mid a \end{aligned}$$

$$\begin{aligned} \text{i) } S_0 &\rightarrow (E) \\ E &\rightarrow E + T \mid (T) \\ T &\rightarrow T \times F \mid (F) \\ F &\rightarrow (E) \mid a \end{aligned}$$

$$\begin{aligned} \text{ii) } S_0 &\rightarrow E + T \mid T \times F \mid (E) \mid a \\ E &\rightarrow E + T \mid T \times F \mid (E) \mid a \\ T &\rightarrow T \times F \mid (E) \mid a \\ F &\rightarrow (E) \mid a \end{aligned}$$

$$M \rightarrow +$$

$$V \rightarrow x$$

$$P_1 \rightarrow ($$

$$P_2 \rightarrow)$$

$$\begin{aligned} \text{iii) } S_0 &\rightarrow E M T \mid T V F \mid P_1 E P_2 \mid a \\ E &\rightarrow E M T \mid T V F \mid P_1 E P_2 \mid a \\ T &\rightarrow T V F \mid P_1 E P_2 \mid a \\ F &\rightarrow P_1 E P_2 \mid a \end{aligned}$$

$$M \rightarrow +$$

$$V \rightarrow x$$

$$P_1 \rightarrow ($$

$$P_2 \rightarrow)$$

$$E_2 \rightarrow M T$$

$$T_2 \rightarrow V F$$

$$P_3 \rightarrow E P_2$$

$$\text{iv) } S_0 \rightarrow E E_2 \mid T T_2 \mid P_1 P_3 \mid a$$

$$E \rightarrow E E_2 \mid T T_2 \mid P_1 P_3 \mid a$$

$$T \rightarrow T T_2 \mid P_1 P_3 \mid a$$

$$M \rightarrow +$$

$$V \rightarrow x$$

$$P_1 \rightarrow ($$

$$P_2 \rightarrow)$$

$$E_2 \rightarrow M T$$

$$T_2 \rightarrow V F$$

$$P_3 \rightarrow E P_2$$