

## Context Free Grammar

### CFG to CNF

Q.1.  $S \rightarrow aSaA \mid A$   
 $A \rightarrow abA \mid b$

Q.2.  $S \rightarrow aSb \mid aSbb \mid aa \mid a \mid bb \mid b$

Q.3.  $S \rightarrow ab \mid bA$   
 $A \rightarrow a \mid as \mid bAA$   
 $B \rightarrow b \mid bs \mid aBB$

Q.4.  $S \rightarrow \cup S$   
 $S \rightarrow [S \supset S] \quad (\{S\}, \{P, \cup, \cap, \supset, \sqsubset, \sqsupset\}, P, S)$   
 $S \rightarrow P$   
 $S \rightarrow Q$

Q.5.  $S \rightarrow aAbB$   
 $A \rightarrow aA \mid a$   
 $B \rightarrow bB \mid b$

Q.6.  $S \rightarrow ABA$   
 $A \rightarrow aA \mid bA \mid \epsilon$   
 $B \rightarrow bB \mid aA \mid \epsilon$

Q.7.  $S \rightarrow ABC \mid BaB$   
 $A \rightarrow aA \mid bAC \mid aaaa$   
 $B \rightarrow bBb \mid a \mid D$   
 $C \rightarrow CA \mid AC$   
 $D \rightarrow \epsilon$

$$\underline{\underline{Q_6.}} \quad S \rightarrow abSb \mid a \mid \epsilon A b$$

$$A \rightarrow bs \mid a A A b$$

$$\underline{\underline{Q_6.}} \quad S \rightarrow aaas$$

$$\underline{\underline{Q_6.}} \quad S \rightarrow ABA$$

$$A \rightarrow aab$$

$$B \rightarrow AC$$

$$\underline{\underline{Q_6.}} \quad S \rightarrow \textcircled{A} A C D$$

$$A \rightarrow a A b \mid \epsilon$$

$$\textcircled{C} \rightarrow c C \mid a$$

$$A \rightarrow a D a \mid b D b \mid \epsilon$$

$$\underline{\underline{Q_6.}} \quad S \rightarrow ASB \mid \epsilon$$

$$A \rightarrow Aas \mid a$$

$$B \rightarrow sbS \mid A \mid bb$$

$$\underline{\underline{Q_6.}} \quad S \rightarrow aSB \mid \epsilon A$$

$$A \rightarrow Aa \mid \textcircled{S} A \mid a$$

$$\underline{\underline{Q_6.}} \quad A \rightarrow \epsilon B b \mid b B a$$

$$B \rightarrow a B \mid b B \mid \epsilon$$

$$\underline{\underline{Q_6.}} \quad S \rightarrow ABC \mid BaB$$

$$A \rightarrow \epsilon A \mid BaC \mid aaa$$

$$B \rightarrow b B b \mid a \mid D$$

$$C \rightarrow CA \mid AC$$

$$D \rightarrow \epsilon$$

## CFG to CNF

Q<sub>6</sub>  $S \rightarrow ABA$   
 $A \rightarrow aA | \epsilon$   
 $B \rightarrow bB | \epsilon$

Q<sub>6</sub>  $A \rightarrow A1 | 0A | 2$

Q<sub>6</sub>  $A_1 \rightarrow A_2 A_3$   
 $A_2 \rightarrow A_3 A_1 | b$   
 $A_3 \rightarrow A_1 A_2 | b$

Q<sub>6</sub>  $S \rightarrow AB$   
 $A \rightarrow BSB | BB | b$   
 $B \rightarrow a$

Convert CFG to CNF  
then to GNF.

Q<sub>6</sub>  $S \rightarrow 01S | 01$   
 $S \rightarrow 10S | 10$   
 $S \rightarrow 00 | \epsilon$

CFG to CNF then to GNF.

Q<sub>6</sub>  $S \rightarrow AB$   
 $A \rightarrow BSB | \epsilon$   
 $B \rightarrow a$

CFG to CNF then to GNF

Q<sub>6</sub>  $S \rightarrow AA | 0$   
 $A \rightarrow SS | 1$

Q<sub>6</sub>  $S \rightarrow A$   
 $A \rightarrow aba | a$   
 $B \rightarrow bAb | b$

CFG to CNF then to GNF.

$$\underline{\underline{Q:-}} S \rightarrow AA | \cancel{ABA} | BA$$

$$A \rightarrow aA | a$$

$$B \rightarrow bB | b$$

$$\underline{\underline{Q:-}} A \rightarrow AB | a$$

$$B \rightarrow AC | b$$

$$C \rightarrow AA | a$$

CFG to CNF  
then to GNF.

$$\underline{\underline{Q:-}} S \rightarrow XB | \cancel{AA}$$

$$A \rightarrow a | SA$$

$$B \rightarrow b$$

$$X \rightarrow a$$