

- a) Elimine las producciones-ε.
- b) Elimine cualquier producción unaria de la gramática resultante.
- c) Elimine cualquier símbolo inútil de la gramática resultante.
  - a. Remueva símbolos que no producen.
  - b. Remueva símbolos no alcanzables.
- d) Coloque la CFG resultante en la Forma Normal de Chomsky (CNF).

Problema 2: 50%

Para las siguientes CFGs realice lo solicitado, mostrando todo el procedimiento.

1.

$$S \rightarrow 0A0 \mid 1B1 \mid BB$$
$$A \rightarrow C$$
$$B \rightarrow S \mid A$$
$$C \rightarrow S \mid \epsilon$$

a)  $C \rightarrow \epsilon$ , C anulable  
 $A \rightarrow C$ , A anulable  
 $B \rightarrow A$ , B anulable  
 $S \rightarrow BB$ , S anulable

→  $S \rightarrow 0A0$ ,  $S \rightarrow 00$ ,  $S \rightarrow 1B1$ ,  $S \rightarrow 11$ ,  $S \rightarrow BB$ ,  $S \rightarrow B$ ,  $S \rightarrow \epsilon$   
 $A \rightarrow C$   
 $B \rightarrow S \mid A$   
 $C \rightarrow S$

∴  $S \rightarrow 0A0 \mid 00 \mid 1B1 \mid 11 \mid BB \mid B \mid \epsilon$

b)  $\left. \begin{matrix} A \rightarrow C \\ B \rightarrow S \\ B \rightarrow A \\ C \rightarrow S \\ S \rightarrow B \end{matrix} \right\}$  Producciones unitarias

→  $A \rightarrow 0A0 \mid 00 \mid 1B1 \mid 11 \mid BB \mid B \mid \epsilon$   
 $S \rightarrow 0A0 \mid 00 \mid 1B1 \mid 11 \mid BB \mid B \mid \epsilon$   
 $B \rightarrow 0A0 \mid 00 \mid 1B1 \mid 11 \mid BB \mid B \mid \epsilon$   
 $C \rightarrow 0A0 \mid 00 \mid 1B1 \mid 11 \mid BB \mid B \mid \epsilon$

- c)
- Todas las producciones tienen 0,1 (terminales)
  - A,B son alcanzables desde S  
C no se usa → C inalcanzable desde S

→  $A \rightarrow 0A0 \mid 00 \mid 1B1 \mid 11 \mid BB \mid B \mid \epsilon$   
 $S \rightarrow 0A0 \mid 00 \mid 1B1 \mid 11 \mid BB \mid B \mid \epsilon$   
 $B \rightarrow 0A0 \mid 00 \mid 1B1 \mid 11 \mid BB \mid B \mid \epsilon$

d)  $\left. \begin{matrix} D \rightarrow 0 \\ E \rightarrow 1 \end{matrix} \right\}$  terminales      →  $S_0 \rightarrow \epsilon \mid DF \mid DD \mid EG \mid EE \mid BB$   
 $\left. \begin{matrix} F \rightarrow AD \\ G \rightarrow BE \end{matrix} \right\}$  auxiliares       $S \rightarrow DF \mid DD \mid EG \mid EE \mid BB$   
 $\phantom{\left. \begin{matrix} F \rightarrow AD \\ G \rightarrow BE \end{matrix} \right\}}$        $A \rightarrow DF \mid DD \mid EG \mid EE \mid BB$   
 $\phantom{\left. \begin{matrix} F \rightarrow AD \\ G \rightarrow BE \end{matrix} \right\}}$        $B \rightarrow DF \mid DD \mid EG \mid EE \mid BB$   
 $\phantom{\left. \begin{matrix} F \rightarrow AD \\ G \rightarrow BE \end{matrix} \right\}}$        $F \rightarrow AD$   
 $\phantom{\left. \begin{matrix} F \rightarrow AD \\ G \rightarrow BE \end{matrix} \right\}}$        $G \rightarrow BE$   
 $\phantom{\left. \begin{matrix} F \rightarrow AD \\ G \rightarrow BE \end{matrix} \right\}}$        $D \rightarrow 0$   
 $\phantom{\left. \begin{matrix} F \rightarrow AD \\ G \rightarrow BE \end{matrix} \right\}}$        $E \rightarrow 1$

2.

$$\begin{aligned} S &\rightarrow aAa \mid bBb \mid \epsilon \\ A &\rightarrow C \mid a \\ B &\rightarrow C \mid b \\ C &\rightarrow CDE \mid \epsilon \\ D &\rightarrow A \mid B \mid ab \end{aligned}$$

a)  $S \rightarrow \epsilon$ ,  $S$  anulable  
 $C \rightarrow \epsilon$ ,  $C$  anulable  
 $A \rightarrow C$ ,  $A$  anulable  
 $B \rightarrow C$ ,  $B$  anulable  
 $D \rightarrow A \mid B$ ,  $D$  anulable

→  $S \rightarrow aAa \mid bBb \mid aa \mid bb \mid \epsilon$   
 $A \rightarrow C \mid a$   
 $B \rightarrow C \mid b$   
 $C \rightarrow CDE \mid DE \mid CE \mid \epsilon$   
 $D \rightarrow A \mid B \mid ab$

b)  $\left. \begin{aligned} A &\rightarrow C \\ B &\rightarrow C \\ D &\rightarrow A \\ D &\rightarrow B \\ C &\rightarrow E \end{aligned} \right\}$  Producciones unitarias

→  $S \rightarrow aAa \mid bBb \mid aa \mid bb \mid \epsilon$   
 $A \rightarrow CDE \mid DE \mid CE \mid a$   
 $B \rightarrow CDE \mid DE \mid CE \mid b$   
 $C \rightarrow CDE \mid DE \mid CE$

c)

•)  $E$  no genera  
 $C$  no genera → eliminar  
•)  $D$  es inalcanzable desde  $S$  → eliminar

→  $S \rightarrow aAa \mid bBb \mid aa \mid bb \mid \epsilon$   
 $A \rightarrow a$   
 $B \rightarrow b$

d)  $\left. \begin{aligned} F &\rightarrow a \\ G &\rightarrow b \end{aligned} \right\}$  terminales  
 $\left. \begin{aligned} H &\rightarrow AF \\ I &\rightarrow BG \end{aligned} \right\}$  auxiliares  
→  $S_0 \rightarrow \epsilon \mid FH \mid FF \mid GI \mid II$   
 $S \rightarrow FH \mid FF \mid GI \mid II$   
 $A \rightarrow a$   
 $B \rightarrow b$   
 $H \rightarrow AF$   
 $I \rightarrow BG$   
 $F \rightarrow a$   
 $G \rightarrow b$

3.

$$S \rightarrow ASA \mid aB$$

$$A \rightarrow B \mid S$$

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

a)  $A \rightarrow B$ , A anulable  
 $B \rightarrow \epsilon$ , B anulable

→  $S \rightarrow ASA \mid SA \mid AS \mid S \mid aB \mid a$   
 $A \rightarrow B \mid S$   
 $B \rightarrow b$   
 $S \rightarrow S$

b)  $A \rightarrow B$  } Producciones  
 $A \rightarrow S$  } unitarias

→  $S \rightarrow ASA \mid SA \mid AS \mid aB \mid a$   
 $A \rightarrow b \mid ASA \mid SA \mid AS \mid aB \mid a$   
 $B \rightarrow b$

c) Todos generan y son alcanzables desde S

d)  $C \rightarrow a$  } terminales  
 $D \rightarrow b$  }  
 $E \rightarrow SA$  } auxiliares  
 $F \rightarrow AS$  }  
 ⇒  $S \rightarrow AE \mid SA \mid AS \mid CB \mid a$   
 $A \rightarrow b \mid a \mid AE \mid SA \mid AS \mid CB$   
 $B \rightarrow b$   
 $E \rightarrow SA$   
 $F \rightarrow AS$   
 $C \rightarrow a$   
 $D \rightarrow b$