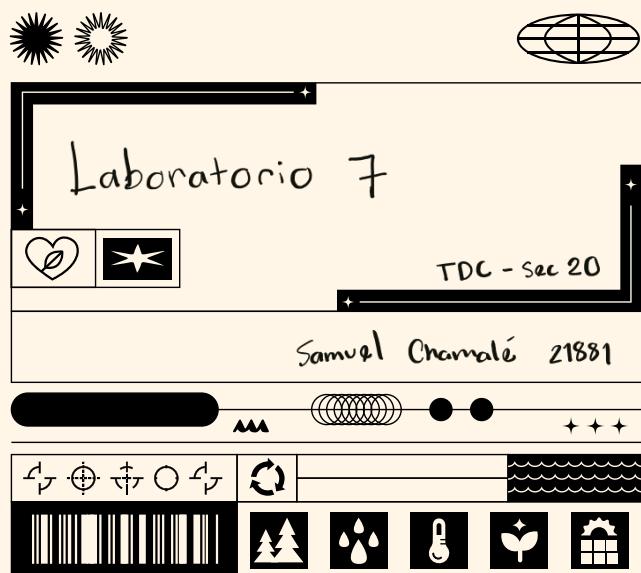
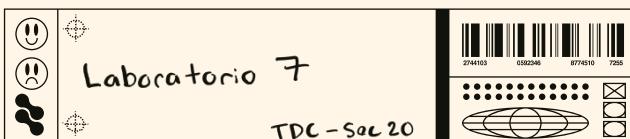


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### Ejercicio No. 1

$$\begin{aligned} 1. \quad S &\rightarrow OA0 \mid 1B1 \mid BB \\ A &\rightarrow C \\ B &\rightarrow S \mid A \\ C &\rightarrow S \mid \epsilon \end{aligned}$$

#### (a) Eliminar producciones $\epsilon$

$\because C \rightarrow \epsilon$ , C es anulable  
&  $A \rightarrow C$ , A es anulable  
&  $B \rightarrow A$ , B es anulable  
&  $S \rightarrow BB$ , S es anulable  $\square$

$$\stackrel{(1)}{\Rightarrow} \text{Reemplazar: } C \rightarrow \epsilon \quad \stackrel{(2)}{\Rightarrow} \text{Reemplazar: } A \rightarrow \epsilon$$

$$\left\{ \begin{array}{l} S \rightarrow OA0 \mid 1B1 \mid BB \\ A \rightarrow C \mid \epsilon \\ B \rightarrow S \mid A \\ C \rightarrow S \end{array} \right. \quad \Rightarrow \quad \left\{ \begin{array}{l} S \rightarrow OA0 \mid 00 \mid 1B1 \mid BB \\ A \rightarrow C \\ B \rightarrow S \mid A \mid \epsilon \\ C \rightarrow S \end{array} \right.$$

$$\stackrel{(3)}{\Rightarrow} \text{Reemplazar: } B \rightarrow \epsilon$$

$$\left\{ \begin{array}{l} S \rightarrow OA0 \mid 00 \mid 1B1 \mid 11 \mid BB \mid B \mid \epsilon \\ A \rightarrow C \\ B \rightarrow S \mid A \\ C \rightarrow S \end{array} \right.$$

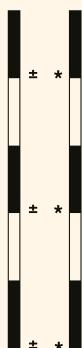
$$\stackrel{(4)}{\Rightarrow} \text{Reemplazar: } S \rightarrow \epsilon$$

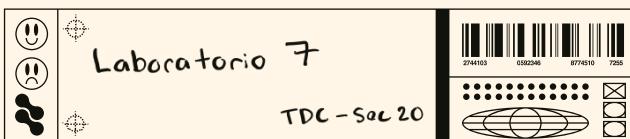
$$\left\{ \begin{array}{l} S \rightarrow OA0 \mid 00 \mid 1B1 \mid 11 \mid BB \mid B \\ A \rightarrow C \\ B \rightarrow S \mid A \\ C \rightarrow S \end{array} \right.$$

#### (b) Eliminar producciones unitarias

Base:  $(S, S), (A, A), (B, B), (C, C)$

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### Inducción:

$(S, S) \text{ y } S \rightarrow B \text{ dan } (S, B)$

$(S, B) \text{ y } B \rightarrow S \text{ dan } (S, S)$

$B \rightarrow A \text{ dan } (S, A)$

$(S, A) \text{ y } A \rightarrow C \text{ dan } (S, C)$

$(S, C) \text{ y } C \rightarrow S \text{ dan } (S, S)$

$(A, A) \text{ y } A \rightarrow C \text{ dan } (A, C)$

$(A, C) \text{ y } C \rightarrow S \text{ dan } (A, S)$

$(A, S) \text{ y } S \rightarrow B \text{ dan } (A, B)$

$(A, B) \text{ y } B \rightarrow S \text{ dan } (A, S)$

$B \rightarrow A \text{ dan } (A, A)$

$(B, B) \text{ y } B \rightarrow S \text{ dan } (B, S)$

$B \rightarrow A \text{ dan } (B, A)$

$(B, S) \text{ y } B \rightarrow S \text{ dan } (B, S)$

$B \rightarrow A \text{ dan } (B, A)$

$(B, A) \text{ y } A \rightarrow C \text{ dan } (B, C)$

$(B, C) \text{ y } C \rightarrow S \text{ dan } (B, S)$

$(C, C) \text{ y } C \rightarrow S \text{ dan } (C, S)$

$(C, S) \text{ y } S \rightarrow B \text{ dan } (C, B)$

$(C, B) \text{ y } B \rightarrow S \text{ dan } (C, S)$

$B \rightarrow A \text{ dan } (C, A)$

$(C, A) \text{ y } A \rightarrow C \text{ dan } (C, C)$

### Pareja Producciones

$(S, S) \quad S \rightarrow 0A010011B1|11|BB$

$(S, A) \quad \_\_\_\_$

$(S, B) \quad \_\_\_\_$

$(S, C) \quad \_\_\_\_$

$(A, A) \quad \_\_\_\_$

$(A, B) \quad \_\_\_\_$

$(A, C) \quad \_\_\_\_$

$(A, S) \quad A \rightarrow 0A010011B1|11|BB$

$(B, B) \quad \_\_\_\_$

$(B, C) \quad \_\_\_\_$

$(B, S) \quad B \rightarrow 0A010011B1|11|BB$

$(B, A) \quad \_\_\_\_$

$(C, C) \quad \_\_\_\_$

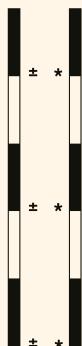
$(C, S) \quad C \rightarrow 0A010011B1|11|BB$

$(C, A) \quad \_\_\_\_$

$(C, B) \quad \_\_\_\_$

$$\therefore \begin{cases} S \rightarrow 0A010011B1|11|BB \\ A \rightarrow 0A010011B1|11|BB \\ B \rightarrow 0A010011B1|11|BB \\ C \rightarrow 0A010011B1|11|BB \end{cases}$$

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↖ \* ⌂ ↑ ↵

### (c) Eliminar símbolos inútiles

$\Rightarrow C$  es inalcanzable

$$\therefore \begin{cases} S \rightarrow 0A0|00|1B1|11|BB \\ A \rightarrow 0A0|00|1B1|11|BB \\ C \rightarrow 0A0|00|1B1|11|BB \end{cases}$$

### (d) Colocar en CNF

$$\Rightarrow S \rightarrow 0A0|00 \quad \& \quad A \rightarrow 0A0|00 \quad \& \quad B \rightarrow 0A0|00$$

$$\therefore D \rightarrow \emptyset$$

$$\Rightarrow S \rightarrow 1B1|11 \quad \& \quad A \rightarrow 1B1|11 \quad \& \quad B \rightarrow 1B1|11$$

$$\therefore E \rightarrow 1$$

$$\therefore \begin{cases} S \rightarrow DAD|DD|EBE|EE|BB \\ A \rightarrow DAD|DD|EBE|EE|BB \\ B \rightarrow DAD|DD|EBE|EE|BB \\ D \rightarrow \emptyset \\ E \rightarrow 1 \end{cases}$$

$$\Rightarrow S \rightarrow DAD \quad \& \quad A \rightarrow DAD \quad \& \quad B \rightarrow DAD$$

$$\therefore F \rightarrow AD \quad \& \quad S \rightarrow DF$$

$$\therefore D \rightarrow \emptyset$$

$$\therefore A \rightarrow DF$$

$$\therefore B \rightarrow DF$$

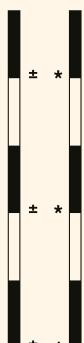
$$\therefore E \rightarrow 1$$

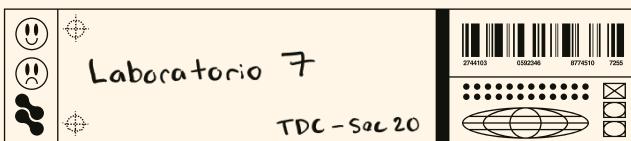
$$\Rightarrow S \rightarrow EBE \quad \& \quad A \rightarrow EBE \quad \& \quad B \rightarrow EBE$$

$$\therefore G \rightarrow BE \quad \& \quad S \rightarrow EG$$

$$\therefore A \rightarrow EG$$

$$\therefore B \rightarrow EG$$

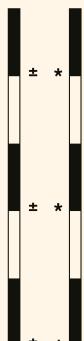


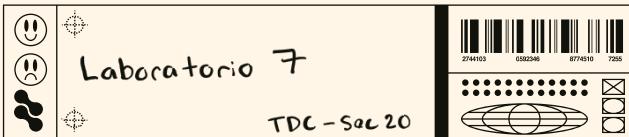


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∴  $S \rightarrow DF|DD|EG|EE|BB$   
 $A \rightarrow DF|DD|EG|EE|BB$   
 $B \rightarrow DF|DD|EG|EE|BB$   
 $D \rightarrow \emptyset$   
 $E \rightarrow 1$   
 $F \rightarrow AD$   
 $G \rightarrow BE$

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L\*U↑ 26/09/2023

2.  $S \rightarrow aAa \mid bBb \mid \epsilon$   
 $A \rightarrow C \mid a$   
 $B \rightarrow C \mid b$   
 $C \rightarrow CDE \mid \epsilon$   
 $D \rightarrow A \mid B \mid ab$

a) Eliminar producciones -  $\epsilon$

$\therefore C \rightarrow \epsilon$ , C es anulable  
&  $A \rightarrow C$ , A es anulable  
&  $B \rightarrow C$ , B es anulable  
&  $D \rightarrow B$ , D es anulable  
&  $S \rightarrow \epsilon$ , S es anulable  $\square$

①  $\Rightarrow$  Reemplazar:  $C \rightarrow \epsilon$

$$\left\{ \begin{array}{l} S \rightarrow aAa \mid bBb \mid \epsilon \\ A \rightarrow C \mid a \\ B \rightarrow C \mid b \\ C \rightarrow CDE \mid DE \\ D \rightarrow A \mid B \mid ab \end{array} \right.$$

②  $\Rightarrow$  Reemplazar:  $A \rightarrow \epsilon$

$$\left\{ \begin{array}{l} S \rightarrow aAa \mid aal \mid bBb \mid bbl \mid \epsilon \\ A \rightarrow C \mid a \\ B \rightarrow C \mid b \\ C \rightarrow CDE \mid DE \\ D \rightarrow A \mid B \mid ab \end{array} \right.$$

③  $\Rightarrow$  Reemplazar:  $B \rightarrow \epsilon$

$$\left\{ \begin{array}{l} S \rightarrow aAa \mid aal \mid bBb \mid bbl \mid \epsilon \\ A \rightarrow C \mid a \\ B \rightarrow C \mid b \\ C \rightarrow CDE \mid DE \\ D \rightarrow A \mid B \mid ab \end{array} \right.$$

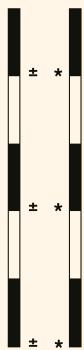
④  $\Rightarrow$  Reemplazar:  $D \rightarrow \epsilon$

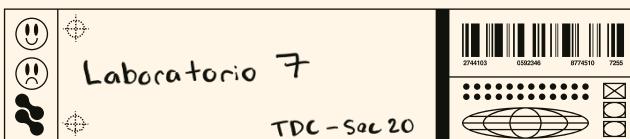
$$\left\{ \begin{array}{l} S \rightarrow aAa \mid aal \mid bBb \mid bbl \mid \epsilon \\ A \rightarrow C \mid a \\ B \rightarrow C \mid b \\ C \rightarrow CDE \mid CE \mid DE \mid E \\ D \rightarrow A \mid B \mid ab \end{array} \right.$$

⑤  $\Rightarrow$  Reemplazar:  $S \rightarrow \epsilon$

$$\therefore \left\{ \begin{array}{l} S \rightarrow aAa \mid aal \mid bBb \mid bbl \\ A \rightarrow C \mid a \\ B \rightarrow C \mid b \\ C \rightarrow CDE \mid CE \mid DE \mid E \\ D \rightarrow A \mid B \mid ab \end{array} \right.$$

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b) Eliminar producciones unarias

Base:  $(S, S), (A, A), (B, B), (C, C), (D, D), (E, E)$

Inducción:

$(S, S) \text{ y } \underline{\quad}$

$(C, C) \text{ y } C \rightarrow E \text{ dan } (C, E)$

$(C, E) \text{ y } \underline{\quad}$

$(A, A) \text{ y } A \rightarrow C \text{ dan } (A, C)$

$(D, D) \text{ y } D \rightarrow A \text{ dan } (D, A)$

$(A, C) \text{ y } C \rightarrow E \text{ dan } (A, E)$

$D \rightarrow B \text{ dan } (D, B)$

$(A, E) \text{ y } \underline{\quad}$

$(D, A) \text{ y } A \rightarrow C \text{ dan } (D, C)$

$(B, B) \text{ y } B \rightarrow C \text{ dan } (B, C)$

$(D, C) \text{ y } C \rightarrow E \text{ dan } (D, E)$

$(B, C) \text{ y } C \rightarrow E \text{ dan } (B, E)$

$(D, E) \text{ y } \underline{\quad}$

$(B, E) \text{ y } \underline{\quad}$

$(D, B) \text{ y } B \rightarrow C \text{ dan } (D, C)$

Pareja | Producciones

$(S, S) \quad S \rightarrow aAa|aa|abBb|bb$

$\therefore S \rightarrow aAa|aa|abBb|bb$

$(A, A) \quad A \rightarrow a$

$A \rightarrow CDE|CE|DE|a$

$(A, C) \quad A \rightarrow CDE|CE|DE$

$B \rightarrow CDE|CE|DE|b$

$(A, E) \quad \underline{\quad}$

$C \rightarrow CDE|CE|DE$

$(B, B) \quad B \rightarrow b$

$D \rightarrow CDE|CE|DE|a|b|ab$

$(B, C) \quad B \rightarrow CDE|CE|DE$

$(B, E) \quad \underline{\quad}$

$(C, C) \quad C \rightarrow CDE|CE|DE$

$(C, E) \quad \underline{\quad}$

$(D, D) \quad D \rightarrow ab$

$(D, A) \quad D \rightarrow a$

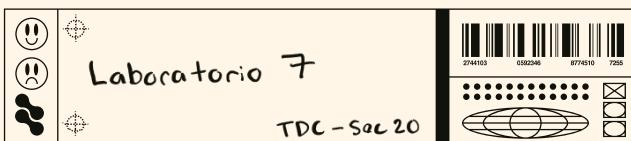
$(D, B) \quad D \rightarrow b$

$(D, C) \quad D \rightarrow CDE|CE|DE$

$(D, E) \quad \underline{\quad}$

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(c) Eliminar símbolos inútiles

$\Rightarrow E$  no produce

$$\therefore \begin{cases} S \rightarrow aAa | aa | bBb | bb \\ A \rightarrow a \\ B \rightarrow b \\ C \rightarrow \text{—} \\ D \rightarrow a | b | ab \end{cases}$$

$\Rightarrow C$  &  $D$  son inalcanzables

$$\therefore \begin{cases} S \rightarrow aAa | aa | bBb | bb \\ A \rightarrow a \\ B \rightarrow b \end{cases}$$

(d) Colocar en CNF

$$\Rightarrow S \rightarrow aAa | aa$$

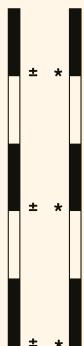
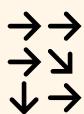
$$\therefore F \rightarrow a$$

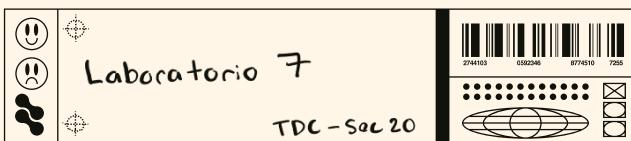
$$\Rightarrow S \rightarrow bBb | bb$$

$$\therefore G \rightarrow b$$

$$\therefore \begin{cases} S \rightarrow FAF | FF | GBG | GG \\ A \rightarrow a \\ B \rightarrow b \end{cases}$$

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$\Rightarrow S \rightarrow FAF$

$\therefore \exists H \rightarrow AF$  &  $\therefore S \rightarrow FH$

$\Rightarrow S \rightarrow GBG$

$\therefore \exists I \rightarrow BG$  &  $\therefore S \rightarrow GI$

$\therefore S \rightarrow FH \mid FF \mid GI \mid GG$

$A \rightarrow a$

$B \rightarrow b$

$F \rightarrow a$

$G \rightarrow b$

$H \rightarrow AF$

$I \rightarrow BG$

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