Teoría de la computación
Septiembre , 2025

Lab 7 P2

Problema 2: 50%

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

1.

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

2.

$$S \to aAa \mid bBb \mid \epsilon$$
$$A \to C \mid a$$
$$B \to C \mid b$$
$$C \to CDE \mid \epsilon$$
$$D \to A \mid B \mid ab$$

3.

$$S \to ASA \mid aB$$
$$A \to B \mid S$$
$$B \to b \mid \epsilon$$

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).

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

nulas

2. 1.) C

$A \approx C$

$S \to 0A0 \mid 1B1 \mid BB$

$A \to C \mid \epsilon$

$B \to S \mid A$

$C \to S$

2.) A

$S \to 0A0 \mid 00 \mid 1B1 \mid BB$

$A \to C$

$B \to S \mid A \mid \epsilon$

$C \to S$

3.) B

$S \to 0A0 \mid 00 \mid 1B1 \mid 11 \mid BB \mid B$

$A \to C$

$B \to S \mid A$

$C \to S$

≠

b) unarias

$S \to 0A0 \mid 00 \mid 1B1 \mid 11 \mid BB \mid B$

$A \to C$

$B \to S \mid A$

$C \to S$

1. (S,S) (A,A) (B,B) (C,C)

2.

$\Rightarrow (S,S)$ y $S \to B$ da (S,B)

$\Rightarrow (A,A)$ y $A \to C$ da (A,C)

$\Rightarrow (B,B)$ y $B \to S$ da (B,S)

$\Rightarrow (B,B)$ y $B \to A$ da (B,A)

$\Rightarrow (C,C)$ y $C \to S$ da (C,S)

3.

Pareja	producciones
(S,B)	$S \to 0A0 \mid 00 \mid 1B1 \mid 11 \mid BB$
(A,C)	$A \to 0A0 \mid 00 \mid 1B1 \mid 11 \mid BB$
(B,S)	$B \to 0A0 \mid 00 \mid 1B1 \mid 11 \mid BB$
(B,A)	$B \to$ " "
(C,S)	$C \to$ " "

$S \to 0A0 \mid 00 \mid 1B1 \mid 11 \mid BB$

$A \to 0A0 \mid 00 \mid 1B1 \mid 11 \mid BB$

$B \to 0A0 \mid 00 \mid 1B1 \mid 11 \mid BB$

$C \to 0A0 \mid 00 \mid 1B1 \mid 11 \mid BB$

(c) inútiles

$W_0 = \{00, 11\}$

$W_1 = \{S, A, B, C\}$

$S \to 0A0|100|1B1|11|BB$
$A \to 0A0|100|1B1|11|BB$
$B \to 0A0|100|1B1|11|BB$
$C \to 0A0|100|1B1|11|BB$

$Y_1 = \{S\}$

$Y_2 = \{S, A, B\}$

$Y_3 = \{S, A, B\}$

$S \to 0A0|100|1B1|11|BB$
$A \to 0A0|100|1B1|11|BB$
$B \to 0A0|100|1B1|11|BB$

$\neq$

(d) chomsky

$S \to P\,C_1 \mid PP \mid M\,C_2 \mid MM \mid BB$
$A \to P\,C_1 \mid PP \mid M\,C_2 \mid MM \mid BB$
$B \to P\,C_1 \mid PP \mid M\,C_2 \mid MM \mid BB$
$P \to 0$
$M \to 1$
$C_1 \to AP$
$C_2 \to BM$

$S \to aAa \mid bBb \mid \epsilon$

$A \to C \mid a$

$B \to C \mid b$

$C \to CDE \mid \epsilon$

$D \to A \mid B \mid ab$

(2) producciones nulas o ε

1.) C

$A \to C \mid a \mid \varepsilon$

$B \to C \mid a \mid \varepsilon$

$C \to CDE$

B

$D \to A \mid B \mid ab \mid \varepsilon$

$S \to aAa \mid bBb \mid bb \mid \varepsilon$

A

$D \to A \mid B \mid ab \mid \varepsilon$

$S \to aAa \mid aa \mid bBb \mid bb \mid \varepsilon$

D

$C \to CDE \mid CE \mid DE \mid E$

$S \to aAa \mid aa \mid bBb \mid bb$

$A \to C \mid a$

$B \to C \mid b$

$C \to CDE \mid DE \mid CE \mid E$

$D \to A \mid B \mid ab$

(b) unários

$S \to aAa \mid aa \mid bBb \mid bb$
$A \to C \mid a$
$B \to C \mid b$
$C \to CDE \mid DE \mid CE \mid E$
$D \to A \mid B \mid ab$

(S,S) (A,A) (B,B) (C,C) (D,D)

$A \to C$ $C \to E$ $D \to A$
$B \to C$ $D \to B$

Pareja	
(A,C)	$A \to CDE \mid DE \mid CE \mid a$
(B,C)	$B \to CDE \mid DE \mid CE \mid b$
(C,E)	$C \to CDE \mid DE \mid CE$
(D,A)	$D \to CDE \mid DE \mid CE \mid a \mid ab$
(D,B)	$D \to b \mid ab \mid CDE \mid DE \mid CE$

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

✗

③ inútiles inalcanzables o no producen

- buscar no producen

$W_0 = \{a, b\}$

$W_1 = \{S, A, B, D\}$

$W_2 = \{S, A, B, D\}$

- buscar inalcanzables..

$Y_1 = \{S\}$

$Y_2 = \{S, A, B\}$

$Y_3 = \{S, A, B\}$

$S \rightarrow aAa \mid aa \mid bBb \mid bb$

$A \rightarrow a$

$B \rightarrow b$

④ CNF chomsky

$S \rightarrow C_1A \mid C_1 \mid C_2B \mid C_2$

$A \rightarrow a$

$B \rightarrow b$

$C_1 \rightarrow AA$

$C_2 \rightarrow BB$

$$S \to ASA \mid aB$$
$$A \to B \mid S$$
$$B \to b \mid \epsilon$$

1. producciones nulas o ϵ

1.) B

$S \to ASA \mid aB \mid a$ ✓

$A \to S \mid B \mid \epsilon$

$B \to b$

2.) A

$S \to ASA \mid \epsilon SA \mid AS\epsilon \mid \epsilon S\epsilon \mid aB \mid a$

$A \to S \mid B$

$B \to b$

2. producciones unarias

(S,S) (A,A) (B,B) X

2.

$\Rightarrow (S,S)$ y $S \to S$ da (S,S)

$\Rightarrow (A,A)$ y $A \to S$ da (A,S)

$\Rightarrow (A,A)$ y $A \to B$ da (A,B) □

3.

Pareja	Producciones
(S,S)	$S \to ASA \mid SA \mid aB \mid a$
(A,S)	$A \to ASA \mid SA \mid aB \mid a$
(A,B)	$A \to b$
(B,B)	$B \to b$

3 inútiles

$S \rightarrow ASA|SA|aB|a$

$A \rightarrow ASA|SA|aB|a|b$

$B \rightarrow b$

$W_0 = \{a, b\}$

$W_1 = \{S, A, B\}$

$W_2 = \{S, A, B\}$

$Y_1 = \{S\}$

$Y_2 = \{S, A, B\}$

$Y_3 = \{S, A, B\}$

$S \rightarrow ASA|SA|aB|a$

$A \rightarrow ASA|SA|aB|a|b$

$B \rightarrow b$

CNF

$S \rightarrow ASA \mid SA \mid FB \mid F$

$A \rightarrow ASA \mid SA \mid FB \mid F \mid B$

$B \rightarrow b$

$F \rightarrow a$

$C_1 = SA$

$S \rightarrow AC_1 \mid C_1 \mid FB \mid F$

$A \rightarrow AC_1 \mid C_1 \mid FB \mid F \mid B$

$B \rightarrow b$

$F \rightarrow a$

$C_1 \rightarrow SA$