

# TAREA IV

## GRAMATICALS LIBRES DE CONTEXTO

### Sección 1.2

- (12) Give a simple description of the language generated by the grammar with productions.

$S \rightarrow aA$       ① Generamos algunas cadenas con las producciones  
 $A \rightarrow bS$        $aA \rightarrow abS \rightarrow abaA \rightarrow ababS \rightarrow \lambda$   
 $S \rightarrow \lambda$       ② Nos damos cuenta que se genera patrón  
                         $(ab)^n$

$\rightarrow$  Cadena en forma  $(ab)^n, n \geq 0$

- (13) What language does the grammar with these productions generate?

$S \rightarrow Aa$       ① Desarrollamos cadenas con producciones  
 $A \rightarrow B$        $Aa \rightarrow Ba \rightarrow Aaa \rightarrow Baa \rightarrow Aaaa \rightarrow Baaa \rightarrow Aaaaa$   
 $B \rightarrow Aa$       ② Notamos patrón de generación de a's  
                         $\therefore L = \{ \varnothing \}, n \geq 0$

\* Lenguaje no termina, no hay condición de cierre, el lenguaje es el vacío

- (21) Are the two grammars with respective productions

$S \rightarrow asb | ab | \lambda$  and  $S \rightarrow aAb | ab, A \rightarrow aAb | \lambda$  equivalent?

① Desarrollamos alguna cadena con producciones,

Producción 1

$(ab, \lambda) (asb \rightarrow aasbb \rightarrow aaabb)$   
 $(asb \rightarrow ab)$

→ Producción 2

$$(ab)(aaAb \rightarrow aaAbb \rightarrow aaaAbbb \rightarrow aaabbb)$$
$$(aaAb \rightarrow aaAbb \rightarrow aabb)$$

Notamos que las cadenas generadas son totalmente parecidas, sin embargo en la gramática 1 existe la cadena  $a^k$  y en la gramática 2 no existe: No son equivalentes.

(23) Show that the grammars  $S \rightarrow asblbSa|ss|a$  y  
 $S \rightarrow asblbSa|a$

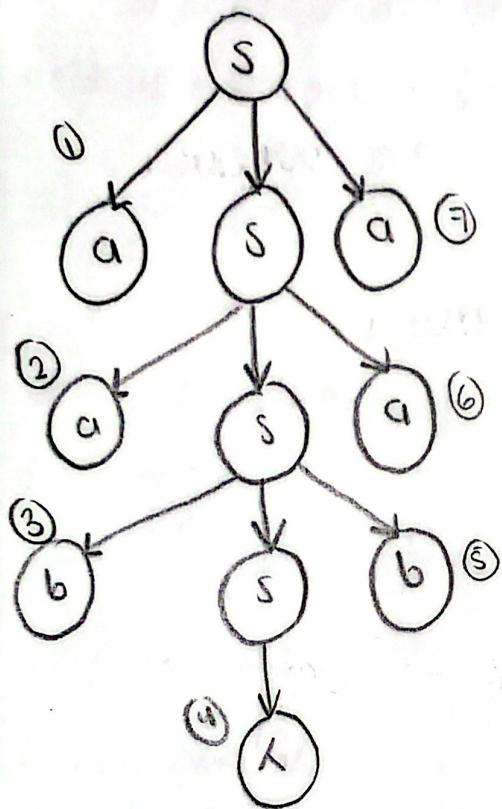
① Generamos cadena con dichas producciones

→  $G_1$   
(a),  $(asb \rightarrow \underline{aab})$ ,  $(bsa \rightarrow \underline{baa})$ ,  $(asb \rightarrow aasbb \rightarrow aabsabb \rightarrow \underline{aababb})$   
 $(ss \rightarrow \underline{aa})$

→  $G_2$   
(a),  $(asb \rightarrow \underline{aab})$ ,  $(bsa \rightarrow \underline{baa})$ ,  $(asb \rightarrow aasbb \rightarrow aabsabb \rightarrow \underline{aababb})$

Notamos que en la gramática 1 podemos generar la cadena  $aa$ , sin embargo en la gramática 2 solo se puede generar la cadena  $a$ : No son equivalentes.

② Draw the derivation tree corresponding to the derivation in Example 5.1



③ Give a derivation tree for  $w = abbaabbaba$  for the grammar in example 5.2. Use the derivation tree to find a leftmost derivation

### Productions (E)

$$S \rightarrow abB$$

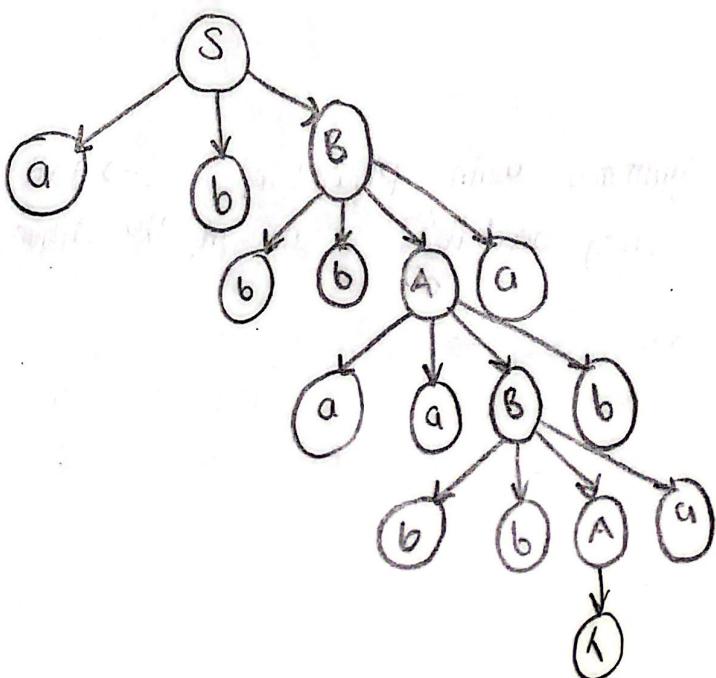
$$A \rightarrow aaBb$$

$$B \rightarrow bbAa$$

$$A \rightarrow \lambda$$

### Derivación

$abB \rightarrow abbbAa \rightarrow abbaabbaba \rightarrow abbaabbAaba \rightarrow abbaabbaba$



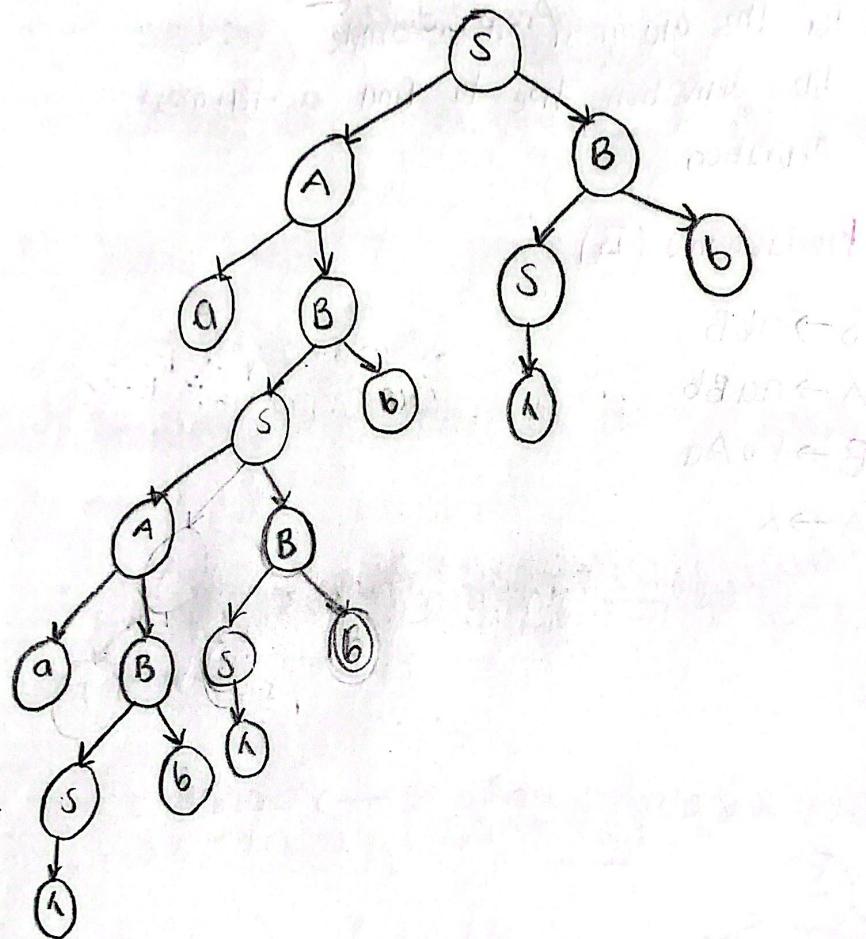
19) Show a derivation tree for the string aabbabb with the grammar

$$S \rightarrow AB \quad | \quad \lambda, \quad \text{Derivación}$$

$$A \rightarrow aB$$

$$B \rightarrow sB$$

$$\begin{aligned} AB &\rightarrow A\bar{s}b \rightarrow a\bar{B}s\bar{b} \rightarrow a\bar{s}\bar{b}\delta\bar{b} \rightarrow a\bar{A}B\bar{b}s\bar{b} \rightarrow a\bar{a}B\bar{B}b\bar{s}\bar{b} \\ &\rightarrow a\bar{a}s\bar{b}B\bar{B}s\bar{b} \rightarrow a\bar{a}s\bar{b}s\bar{b}b\bar{s}\bar{b} \rightarrow a\bar{a}b\bar{s}b\bar{b}s\bar{b} \rightarrow a\bar{a}b\bar{b}b\bar{b}s\bar{b} \rightarrow a\bar{a}b\bar{b}b\bar{b}b\bar{b} \end{aligned}$$

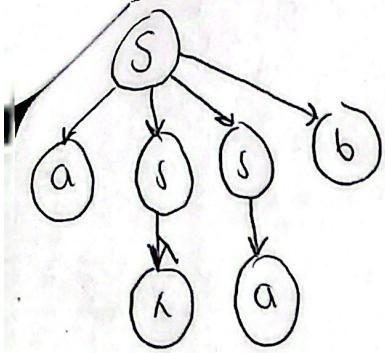


20) Consider the grammar with production,  $S \rightarrow aAB, A \rightarrow bBb \mid \lambda, B \rightarrow Aa$   
Show that the string aabbabbba is not in the language generated by this grammar

$$aAB \rightarrow aaAa \rightarrow aabBba \rightarrow aab\underset{\lambda}{A}bba \rightarrow aabbBbabba \rightarrow aabbAababba \rightarrow aabbabbabba$$

Nos damos cuenta que aquí rompe la forma en que termina aba ≠ bba

Consider the derivation tree below. Find a grammar  $G$  for which this is the derivation tree of the string  $aab$ . Then find two more sentences of  $L(G)$ . Find a sentence in  $L(G)$  that has a derivation tree of height five or longer.



①  $L(G)$  con producciones,

$$S \rightarrow aSSb$$

$$S \rightarrow \lambda | a$$

② Possible sentences of  $L(G)$

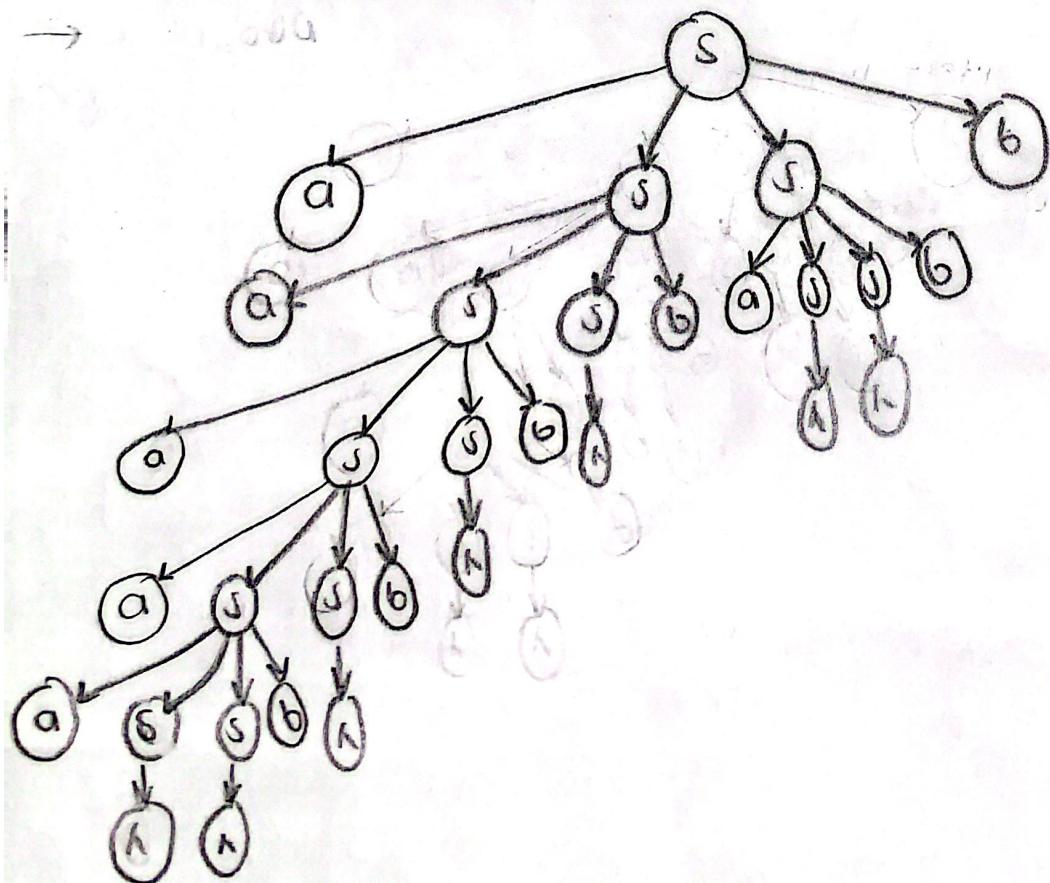
a)  $\lambda$

b)  $a$

c)  $aSSb \rightarrow aaaSbsb \rightarrow aaSSbssb \rightarrow aaahhbhb \rightarrow aabb$

③ Árbol de  $S$  o más niveles

$S \rightarrow aSSb \rightarrow aaaSbsb \rightarrow aaassbsbsb \rightarrow aaassbsbsbsb \rightarrow$   
 $\rightarrow aaassbsbsbsassbb \rightarrow aaaaassbsbsbsbsassbb \rightarrow aaaaabbabbabb$   
 $\rightarrow$   
 $\rightarrow$



⑦ Find context-free grammar for the following languages (with  $n \geq 0, m \geq 0$ )

$$(a) L = \{a^n b^m : n \leq m+3\}$$

$$S \rightarrow \lambda \mid asb \mid A$$

$$A \rightarrow aB \mid aaB \mid aaaB \mid B$$

$$B \rightarrow \lambda \mid abb \mid Bb$$

$\lambda, a, aa, aaa, ab, aab, aaab,$   
 $aaaab, bb, abb, aabb, aaabb,$   
 $aaaabb, aaaaabb, bbb,$

$$S \rightarrow SBB \rightarrow aabb \rightarrow abbb \rightarrow aabb \rightarrow abbb \rightarrow aabb \rightarrow abbb$$

$$(b) L = \{a^n b^m : n \neq m-1\}$$

$$\rightarrow S \rightarrow asb \mid AaB \mid \lambda$$

$$A \rightarrow Aa \mid \lambda$$

$$B \rightarrow Ab \mid Bbb$$

- Cadenas más al's que b's

- Cadenas más b que al's pero

minimo 2 b mas numero de al's

aabbabb

$$(13) \text{ Let } L = \{a^n b^n : n \geq 0\}$$

(a) Show that  $L^2$  is context free

$$S \rightarrow aLbL \mid \lambda$$

$$L \Rightarrow aLb \mid \lambda$$

$$L^1 = \{\lambda, ab, aabb, aaabb, \dots\}$$

$$L^2 = \{\lambda\lambda, \lambda ab, \lambda aabb, \dots\}$$

$$ab\lambda, abab, abaabb, abaaabb, \\ aabb\lambda, aabbab, aabbbaab, \dots\}$$

$$L^2 = \{\lambda\lambda, \lambda ab, \lambda aabb, \dots\}$$

c) Show that  $L^*$  are context free

$$S \rightarrow asbS \mid \lambda$$

todos los

→ Concatenación de cadenas dentro de

$L = \{a^n b^n : n \geq 0\}$  con todos los cadenas del  
el lenguaje