① $L = \{ a^i b^j c^k \mid i = j \ o \ j \leq k \}$

$S \to XC \mid AY$

$X \to aXb \mid \lambda$

$C \to Cc \mid \lambda$

$A \to Aa \mid \lambda$

$Y \to bYc \mid C$

FN. Chomsky:

$A \to BC$

$A \to a$

a) Eliminar producciones con la cadena vacía

b) Eliminar producciones unitarias

c) Cambio de variables

a) $S \to XC \mid AY \mid C \mid X \mid Y \mid A$

$X \to aXb \mid ab$

$C \to Cc \mid c$

$A \to Aa \mid a$

$Y \to bYc \mid bc \mid C$

b) $S \to XC \mid AY \mid Cc \mid c \mid aXb \mid ab \mid bYc \mid bc \mid Aa \mid a$

$X \to aXb \mid ab$

$C \to Cc \mid c$

$A \to Aa \mid a$

$Y \to bYc \mid bc \mid Cc \mid c$

c) $S \to XC \mid AY \mid CC_1 \mid c \mid A_1X_1 \mid A_1B_1 \mid B_1Y_1 \mid B_1C_1 \mid AA_1 \mid a$

$X \to A_1X_1 \mid A_1B_1$

$C \to CC_1 \mid c$

$A \to AA_1 \mid a$

$Y \to B_1Y_1 \mid B_1C_1 \mid CC_1 \mid c$

$A_1 \to a$

$B_1 \to b$

$C_1 \to c$

$X_1 \to XB_1$

$Y_1 \to YC_1$

$A_1 = a$

$B_1 = b$

$C_1 = c$

$X_1 = Xb$

$Y_1 = Yc$

(2) $L = \{ a^i b^j a^k \mid j = i+k \; ; \; i,j,k \geq 0 \}$

$S \to XY$

$X \to aXb \mid \lambda$

$Y \to bYa \mid \lambda$

a) $S \to XY \mid X \mid Y$

$X \to aXb \mid ab$

$Y \to bYa \mid ba$

b) $S \to XY \mid aXb \mid ab \mid bYa \mid ba$

$X \to aXb \mid ab$

$Y \to bYa \mid ba$

c) $S \to XY \mid X_1 B_1 \mid A_1 B_1 \mid Y_1 A_1 \mid B_1 A_1$

$X \to X_1 B_1 \mid A_1 B_1$

$Y \to Y_1 A_1 \mid B_1 A_1$

$A_1 \to a$

$B_1 \to b$

$X_1 \to aX$

$Y_1 \to bY$

③ $L = \{ w \in (a+b)^* \mid N(a) \neq N(b) \}$

↳ Conjunto de todas las cadenas formadas por a y b incluyendo cadena vacía

$N(a) \neq N(b) \begin{cases} N(a) > N(b) \\ N(a) < N(b) \end{cases}$

$S \to B\,a\,B \mid A\,b\,A$

$B \to aB\,bB \mid bB\,aB \mid \lambda$

$A \to aA\,bA \mid bA\,aA \mid \lambda$

a) $S \to BaB \mid aB \mid Ba \mid a \mid AbA \mid bA \mid Ab \mid b$

$B \to aBbB \mid abB \mid aBb \mid ab \mid bBaB \mid baB \mid bBa \mid ba$

$A \to aAbA \mid abA \mid aAb \mid ab \mid bAaA \mid baA \mid bAa \mid ba$

b)

c) $S \to BX_2 \mid A_1B \mid BA_1 \mid a \mid AY_1 \mid B_1A \mid AB_1 \mid b$

$B \to X_2Y_2 \mid A_1Y_2 \mid X_2B_1 \mid A_1B_1 \mid Y_2X_2 \mid B_1X_2 \mid Y_2A_1 \mid B_1A_1$

$A \to X_1Y_1 \mid A_1Y_1 \mid X_1B_1 \mid A_1B_1 \mid Y_1X_1 \mid B_1X_1 \mid Y_1A_1 \mid B_1A_1$

$A_1 \to a$

$B_1 \to b$

$X_1 \to aA$

$X_2 \to aB$

$Y_1 \to bA$

$Y_2 \to bB$

(4) $L = \{ a^i b^j c^k \mid k \neq i+j \}$

$k \neq i+j$ { $k > i+j$; $k < i+j$

$S \to aSc \mid Y \mid AX$

$Y \to bYc \mid Yc \mid c$

$A \to aA \mid Ab \mid a$

$X \to bXc \mid \lambda$

(5) $L = \{ a^i b^j c^k d^m \mid i > m \ \text{y} \ j > k \}$

$S \to AX$

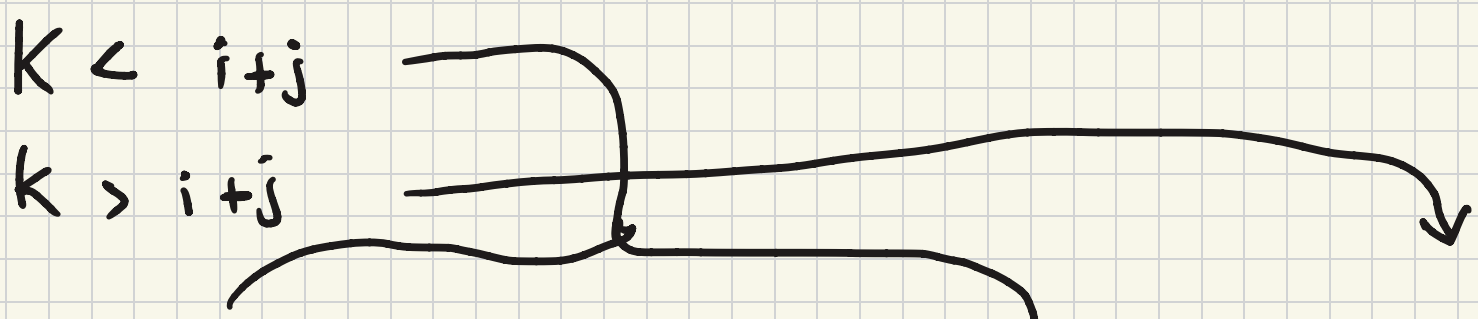
$A \to aA \mid a$

$X \to aXd \mid BY$

$B \to bB \mid b$

$Y \to bYc \mid \lambda$

(6) $L = \{ a^i (b+c)^k a^j \mid k \neq i+j \; ; \; i,j,k \geq 0 \}$



$S \to aAXYA \mid AXYAa \mid XVY$

$A \to aA \mid \lambda$

$X \to aXb \mid aXc \mid \lambda$

$Y \to bYa \mid cYa \mid \lambda$

$V \to bV \mid Vc \mid b \mid c$

(7) $L = \{ a^i b^j c^k a^m b^p \mid i = j+k \text{ y } m = p \; ; \; i,j,k,m,p \geq 0 \}$

$S \to XY$

$X \to aXc \mid Z$

$Z \to aZb \mid \lambda$

$Y \to aYb \mid \lambda$

(8) $L = \{a^i b^j c^k d^m \mid i+k = j+m,\ a, b, i+j+k=m;$

$i, j, k, m \geq 0\}$

$S \to aSd \mid XYZ \mid W$

$W \to aWd \mid V$

$V \to bVd \mid U$

$U \to cUd \mid \lambda$

$i+j+k=m$

$X \to aXb \mid \lambda$

$Y \to bYc \mid \lambda$

$Z \to cZd \mid \lambda$

$i+k=j+m$