

- (1) $P \rightarrow DS$
- (2) $D \rightarrow DTL; | TL;$
- (3) $T \rightarrow \text{int} | \text{float} | \text{double} | \text{char} | \text{bool}$
- (4) $L \rightarrow \text{id } I, L | \text{id } I$
- (5) $I \rightarrow = \text{id} | = \text{numero} | = \text{caracter} | = \text{true} | = \text{false}$
- (6) $S \rightarrow SZ | Z$
- (7) $Z \rightarrow W | X | Y;$
- (8) $W \rightarrow \text{if}(C) \{S\} | \text{if}(C) \{S\} \text{ else } \{S\}$
- (9) $X \rightarrow \text{while}(C) \{S\}$
- (10) $Y \rightarrow \text{id } OE$
- (11) $O \rightarrow += | -= | *= | /= | \%= | =$
- (12) $C \rightarrow C > C | C < C | C == C | C != C | C >= C | C <= C | E$
- (13) $E \rightarrow E + E | E - E | E * E | E / E | E \% E | (E) | \text{id} |$
 $|\text{numero}| |\text{caracter}| |\text{true}| |\text{false}|$

$P =$ program

$C =$ condición

$D =$ declaraciones

$O =$ opasig

$S =$ sentencias

$E =$ expresión

$T =$ tipo

$L =$ lista-variables

$I =$ init

$Z =$ sentencia

$W =$ sentencia IF

$X =$ sentencia WHILE

$Y =$ sentencia ASIG

Eliminando ambigüedad

| | op | letra |
|---|-------------------|-------|
| - | $=$ $!$ | C |
| + | $<$ $>$ $<=$ $>=$ | Q |

| | op | letra |
|---|--------------|-------|
| - | $+$ $-$ | E |
| + | $*$ $/$ $\%$ | F |
| | $($ $)$ | G |

$$(12) C \rightarrow C == Q \mid C != Q \mid Q$$

$$(14) Q \rightarrow Q > C \mid Q < C \mid Q >= C \mid Q <= C \mid E$$

$$(13) E \rightarrow E + F \mid E - F \mid F$$

$$(15) F \rightarrow F * G \mid F / G \mid F \% G \mid G$$

$$(16) G \rightarrow (E) \mid id \mid numero \mid caracter \mid true \mid false$$

Eliminando recursividad por la izq

$$(1) P \rightarrow DS$$

$$(2) D \rightarrow TL; D'$$

$$(17) D' \rightarrow TL; D' \mid \epsilon$$

$$(3) T \rightarrow int \mid float \mid double \mid char \mid bool$$

$$(4) L \rightarrow id I, L \mid id I$$

$$(5) I \rightarrow = id \mid = numero \mid = caracter \mid = true \mid = false$$

$$(6) S \rightarrow Z S'$$

$$(18) S' \rightarrow Z S' \mid \epsilon$$

$$(17) Z \rightarrow W \mid X \mid Y;$$

$$(8) W \rightarrow if (C) \{ S \} \mid if (C) \{ S \} else \{ S \}$$

$$(9) X \rightarrow while (C) \{ S \}$$

$$(10) Y \rightarrow id OE$$

$$(11) \quad O \rightarrow += | -= | *= | /= | \%. = | =$$

$$(12) \quad C \rightarrow QC'$$

$$(13) \quad C' \rightarrow ==QC' | !=QC' | \varepsilon$$

$$(14) \quad Q \rightarrow EQ'$$

$$(20) \quad Q' \rightarrow >CQ' | <CQ' | >=CQ' | <=CQ' | \varepsilon$$

$$(13) \quad E \rightarrow FE'$$

$$(21) \quad E' \rightarrow +FE' | -FE' | \varepsilon$$

$$(15) \quad F \rightarrow GF'$$

$$(22) \quad F' \rightarrow *GF' | /GF' | \%.GF' | \varepsilon$$

$$(16) \quad G \rightarrow (E) | id | numero | caracter | true | false$$

Factorización

$$(1) \quad P \rightarrow DS$$

$$(2) \quad D \rightarrow TL; D'$$

$$(17) \quad D' \rightarrow TL; D' | \varepsilon$$

$$(3) \quad T \rightarrow int | float | double | char | bool$$

$$(4) \quad L \rightarrow id | L'$$

$$(23) \quad L' \rightarrow , L | \varepsilon$$

$$(5) \quad I \rightarrow = I'$$

$$(24) \quad I' \rightarrow id | numero | caracter | true | false$$

$$(6) \quad S \rightarrow ZS'$$

$$(18) \quad S' \rightarrow ZS' | \varepsilon$$

$$(17) \quad Z \rightarrow W | X | Y;$$

$$(8) \quad W \rightarrow if (C) \{ S \} W'$$

$$(25) \quad W' \rightarrow else \{ S \} | \varepsilon$$

$$(9) \quad X \rightarrow while (C) \{ S \}$$

$$(10) \quad Y \rightarrow id \ O \ E$$

$$(11) \quad O \rightarrow + \mid - \mid * \mid / \mid \% \mid =$$

$$(12) \quad C \rightarrow Q \ C'$$

$$(19) \quad C' \rightarrow == \ Q \ C' \mid != \ Q \ C' \mid \epsilon$$

$$(14) \quad Q \rightarrow E \ Q'$$

$$(20) \quad Q' \rightarrow > \ C \ Q' \mid < \ C \ Q' \mid > = \ C \ Q' \mid < = \ C \ Q' \mid \epsilon$$

$$(13) \quad E \rightarrow F \ E'$$

$$(21) \quad E' \rightarrow + \ F \ E' \mid - \ F \ E' \mid \epsilon$$

$$(15) \quad F \rightarrow G \ F'$$

$$(22) \quad F' \rightarrow * \ G \ F' \mid / \ G \ F' \mid \% \ G \ F' \mid \epsilon$$

$$(16) \quad G \rightarrow (\ E) \mid id \mid numero \mid character \mid true \mid false$$

Notación EBNF

- (1) $P \rightarrow DS$
- (2) $D \rightarrow TL; D'$
- (17) $D' \rightarrow \{TL;\}$
- (3) $T \rightarrow \text{int} \mid \text{float} \mid \text{double} \mid \text{char} \mid \text{bool}$
- (4) $L \rightarrow \text{id} \mid L'$
- (23) $L' \rightarrow [, L]$
- (5) $I \rightarrow = I'$
- (24) $I' \rightarrow \text{id} \mid \text{numero} \mid \text{caracter} \mid \text{true} \mid \text{false}$
- (6) $S \rightarrow z S'$
- (12) $S' \rightarrow \{z\}$
- (17) $z \rightarrow W \mid X \mid Y;$
- (8) $W \rightarrow \text{if}(C) \{S\} W'$
- (25) $W' \rightarrow [\text{else } \{S\}]$
- (9) $X \rightarrow \text{while}(C) \{S\}$
- (10) $Y \rightarrow \text{id } O E$
- (11) $O \rightarrow += \mid -= \mid *= \mid /= \mid \%= \mid =$
- (12) $C \rightarrow Q C'$
- (19) $C' \rightarrow \{= Q\} \mid \{! Q\}$
- (14) $Q \rightarrow E Q'$
- (20) $Q' \rightarrow \{> C\} \mid \{< C\} \mid \{>= C\} \mid \{<= C\}$
- (13) $E \rightarrow F E'$
- (21) $E' \rightarrow \{+ F\} \mid \{- F\}$
- (15) $F \rightarrow G F'$
- (22) $F' \rightarrow \{* G\} \mid \{/ G\} \mid \{\% G\}$
- (16) $G \rightarrow (E) \mid \text{id} \mid \text{numero} \mid \text{caracter} \mid \text{true} \mid \text{false}$

P



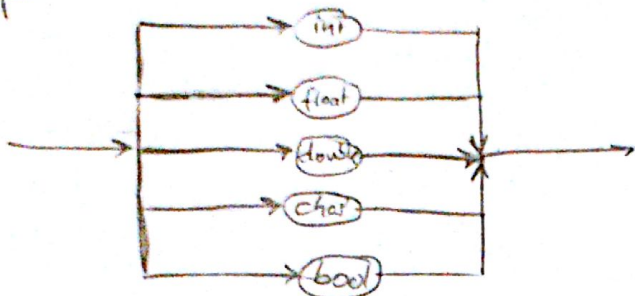
D



D'



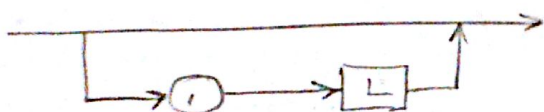
T



L



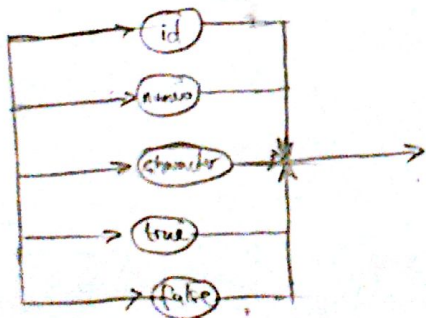
L'



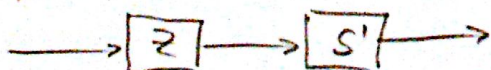
I



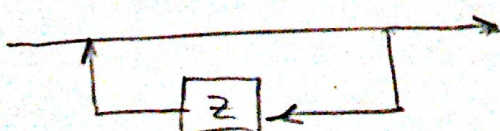
I'



S

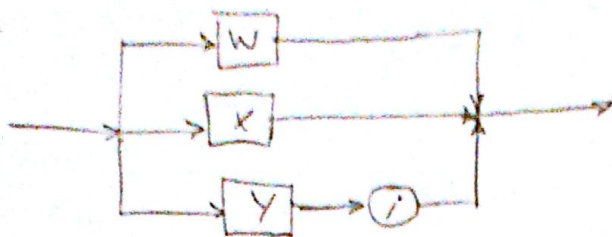


S'



7

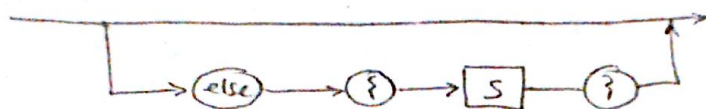
2



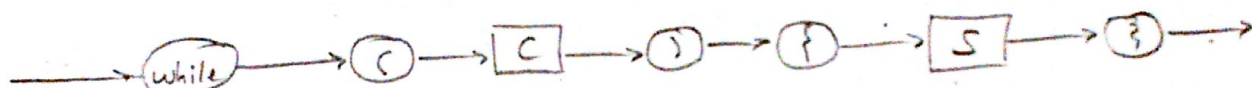
W



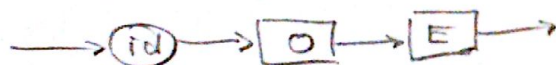
W'



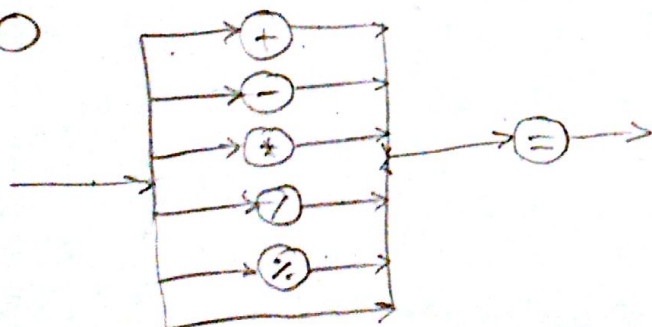
X



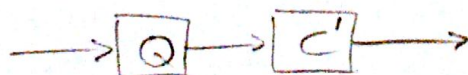
Y



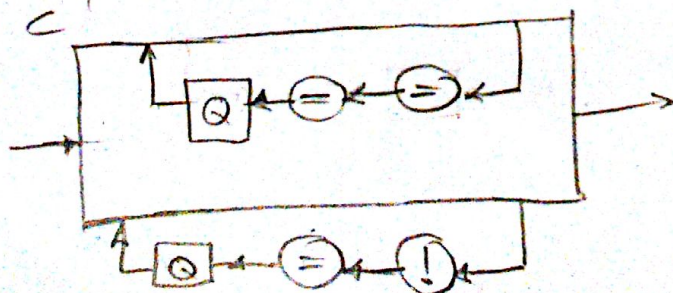
O



C



C'

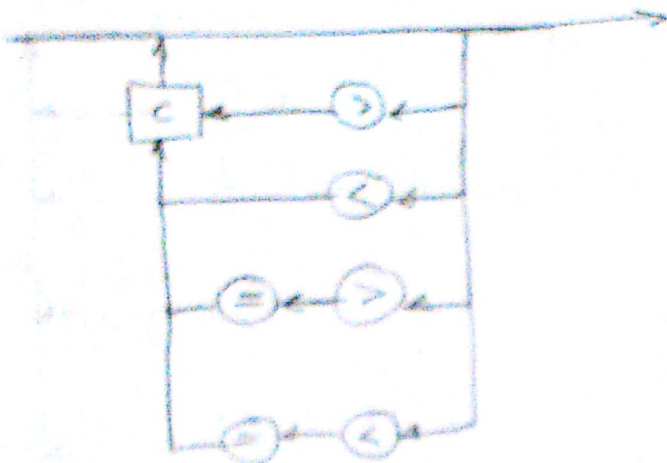


2/

Q



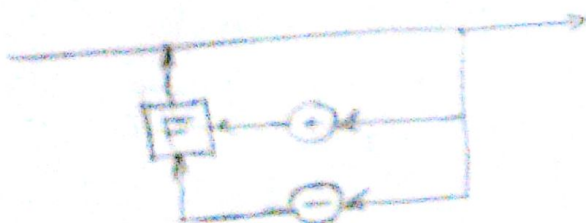
Q'



E



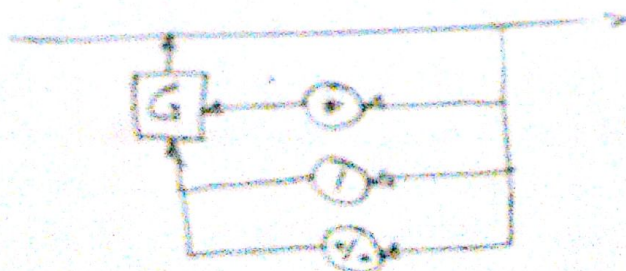
E'

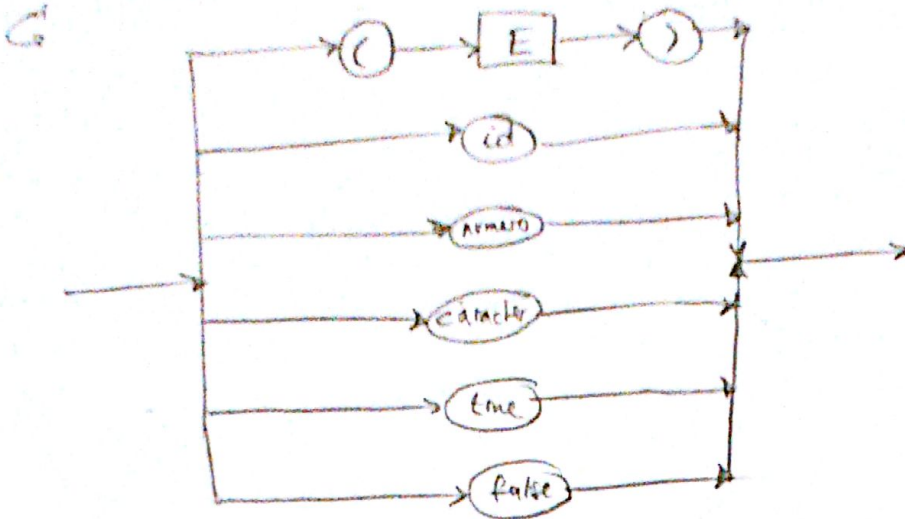


F



F'





$S = P$

$\Sigma = \{ ; \text{ int float double char bool id, = numero character true false if } () \{ \} \text{ else while } += -= *= /= \% = == != > < >= <= } + - * / \% \}$

$T = \{ P D D' T L L' I I' S S' Z W W' X Y O C C' Q Q' E E' F F' G \}$