

## Gramatica - BNF

PROGRAM → (STATEMENT | FUNCLIST)?  
FUNCLIST → FUNCTIONDEF | FUNCTIONDEF  
FUNCTIONDEF → def ident(PARAMLIST){STATELIST}  
PARAMLIST → (( int | float | string ) ident, PARAMLIST | ( int | float | string ) ident)?

STATEMENT → (VARDECL; |  
    ATTRIBSTAT; |  
    PRINTSTAT; |  
    READSTAT; |  
    RETURNSTAT; |  
    IFSTAT |  
    FORSTAT |  
    {STATELIST} |  
    break ; | ;)

VARDECL → ( int | float | string ) ident ([int constant]) \*  
ATTRIBSTAT → LV ALUE = ( EXPRESSION | ALLOCEXPRESSION | FUNCTIONCALL)  
FUNCTIONCALL → ident(PARAMLIST CALL)  
PARAMLIST CALL → (ident, PARAMLIST CALL | ident)?  
PRINTSTAT → print EXPRESSION  
READSTAT → read LV ALUE  
RETURNSTAT → return

IFSTAT → if( EXPRESSION ) STATEMENT (else STATEMENT)?  
FORSTAT → for(ATTRIBSTAT; EXPRESSION; ATTRIBSTAT) STATEMENT

STATELIST → STATEMENT (STATELIST)?  
ALLOCEXPRESSION → new (int | float | string) ([ NUMEXPRESSION ]) +  
EXPRESSION → NUMEXPRESSION(( < | > | <= | >= | == | != ) NUMEXPRESSION)?  
NUMEXPRESSION → TERM ((+ | -) TERM) \*  
TERM → UNARY EXP R(( \* | / | %) UNARY EXP R) \*  
UNARYEXPR → ((+ | -))? FACTOR  
FACTOR → (int constant | float constant | string constant | null | | LV ALUE |(NUMEXPRESSION))  
LVALUE → ident( [NUMEXPRESSION] ) \*

postfix \* means "repeated 0 or more times"  
postfix + means "repeated 1 or more times"  
postfix ? means "0 or 1 times"

### BNF -> Convencional

PROGRAM  $\rightarrow$  STATEMENT  
PROGRAM  $\rightarrow$  FUNCLIST  
PROGRAM  $\rightarrow \epsilon$

FUNCLIST  $\rightarrow$  FUNCDEF FUNCLIST  
FUNCLIST  $\rightarrow$  FUNCDEF

FUNCDEF  $\rightarrow$  def ident(PARAMLIST){STATELIST}

PARAMLIST  $\rightarrow$  int ident, PARAMLIST  
PARAMLIST  $\rightarrow$  float ident, PARAMLIST  
PARAMLIST  $\rightarrow$  string ident, PARAMLIST  
PARAMLIST  $\rightarrow$  int ident  
PARAMLIST  $\rightarrow$  float ident  
PARAMLIST  $\rightarrow$  string ident  
PARAMLIST  $\rightarrow \epsilon$

STATEMENT  $\rightarrow$  VARDECL;  
STATEMENT  $\rightarrow$  ATRIBSTAT;  
STATEMENT  $\rightarrow$  PRINTSTAT;  
STATEMENT  $\rightarrow$  READSTAT;  
STATEMENT  $\rightarrow$  RETURNSTAT;  
STATEMENT  $\rightarrow$  IFSTAT  
STATEMENT  $\rightarrow$  FORSTAT  
STATEMENT  $\rightarrow$  {STATELIST}  
STATEMENT  $\rightarrow$  break ;  
STATEMENT  $\rightarrow$  ;

[int constant] pode se repetir 0 ou mais vezes ?

VARDECL  $\rightarrow$  int ident  
VARDECL  $\rightarrow$  int ident [int constant]  
VARDECL  $\rightarrow$  float ident  
VARDECL  $\rightarrow$  float ident [int constant]  
VARDECL  $\rightarrow$  string ident  
VARDECL  $\rightarrow$  string ident [int constant]

ATRIBSTAT  $\rightarrow$  LVALUE = EXPRESSION  
ATRIBSTAT  $\rightarrow$  LVALUE = ALLOC EXPRESSION  
ATRIBSTAT  $\rightarrow$  LVALUE = FUNCCALL

FUNCCALL  $\rightarrow$  ident(PARAMLISTCALL)

PARAMLISTCALL  $\rightarrow$  ident, PARAMLIST CALL  
PARAMLISTCALL  $\rightarrow$  dent  
PARAMLISTCALL  $\rightarrow \varepsilon$

PRINTSTAT  $\rightarrow$  print EXPRESSION  
READSTAT  $\rightarrow$  read LVALUE  
RETURNSTAT  $\rightarrow$  return

IFSTAT  $\rightarrow$  if( EXPRESSION ) STATEMENT else STATEMENT  
IFSTAT  $\rightarrow$  if( EXPRESSION ) STATEMENT

FORSTAT  $\rightarrow$  for(ATTRIBSTAT; EXPRESSION; ATTRIBSTAT) STATEMENT

STATELIST  $\rightarrow$  STATEMENT STATELIST  
STATELIST  $\rightarrow$  STATEMENT

ALLOCEXPRESSION  $\rightarrow$  new int [ NUMEXP RESSION ]  
ALLOCEXPRESSION  $\rightarrow$  new float [ NUMEXP RESSION ]  
ALLOCEXPRESSION  $\rightarrow$  new string ([ NUMEXP RESSION ]  
ALLOCEXPRESSION  $\rightarrow$  new (int | float | string) ([ NUMEXP RESSION ]) +

EXPRESSION  $\rightarrow$  NUMEXPRESSION  
EXPRESSION  $\rightarrow$  NUMEXPRESSION < NUMEXPRESSION  
EXPRESSION  $\rightarrow$  NUMEXPRESSION > NUMEXPRESSION  
EXPRESSION  $\rightarrow$  NUMEXPRESSION <= NUMEXPRESSION  
EXPRESSION  $\rightarrow$  NUMEXPRESSION >= NUMEXPRESSION  
EXPRESSION  $\rightarrow$  NUMEXPRESSION == NUMEXPRESSION  
EXPRESSION  $\rightarrow$  NUMEXPRESSION != NUMEXPRESSION

NUMEXPRESSION  $\rightarrow$  TERM  
NUMEXPRESSION  $\rightarrow$  TERM + TERM  
NUMEXPRESSION  $\rightarrow$  TERM - TERM  
NUMEXPRESSION  $\rightarrow$  TERM ((+ | -) TERM) \*

TERM  $\rightarrow$  UNARYEXPR  
TERM  $\rightarrow$  UNARYEXPR \* UNARYEXPR  
TERM  $\rightarrow$  UNARYEXPR / UNARYEXPR  
TERM  $\rightarrow$  UNARYEXPR % UNARYEXPR  
TERM  $\rightarrow$  UNARYEXPR(( \* | / | %) UNARYEXPR) \*

UNARYEXPR  $\rightarrow$  FACTOR  
UNARYEXPR  $\rightarrow$  + FACTOR  
UNARYEXPR  $\rightarrow$  - FACTOR

FACTOR  $\rightarrow$  int constant  
FACTOR  $\rightarrow$  float constant  
FACTOR  $\rightarrow$  string constant  
FACTOR  $\rightarrow$  null

$\text{FACTOR} \rightarrow \text{LVALUE}$   
 $\text{FACTOR} \rightarrow (\text{NUMEXPRESSION})$

$\text{LVALUE} \rightarrow \text{ident} [\text{NUMEXP RESSION}]$   
 $\text{LVALUE} \rightarrow \text{ident} ( [\text{NUMEXP RESSION}] ) *$   
 $\text{LVALUE} \rightarrow \varepsilon$

**Recursao**

**Fatoracao**

## Gramatica final?

PROGRAM  $\rightarrow$  STATEMENT | FUNCLIST |  $\epsilon$   
FUNCLIST  $\rightarrow$  FUNCDEF FUNCLIST1  
FUNCLIST1  $\rightarrow$  FUNCLIST |  $\epsilon$   
FUNCDEF  $\rightarrow$  def ident ( PARAMLIST STATELIST1 ){STATELIST}  
TYPE  $\rightarrow$  int | float | string

PARAMLIST  $\rightarrow$  TYPE ident PARAMLIST1 |  $\epsilon$   
PARAMLIST1  $\rightarrow$  , PARAMLIST |  $\epsilon$

STATEMENT  $\rightarrow$  VARDECL ; |  
                  TRIBSTAT ; |  
                  PRINTSTAT ; |  
                  READSTAT ; |  
                  RETURNSTAT ; |  
                  IFSTAT |  
                  FORSTAT |  
                  {STATELIST} |  
                  break; | ;

VARDECL  $\rightarrow$  TYPE ident ARRAY1  
ARRAY1  $\rightarrow$  [int\_constant] |  $\epsilon$

TRIBSTAT  $\rightarrow$  LVALUE = TRIB  
TRIB  $\rightarrow$  EXPRESSION | FUNCCALL | ALLOCEXPRESSION  
FUNCCALL  $\rightarrow$  ident(PARAMLISTCALL)  
PARAMLISTCALL  $\rightarrow$  ident PARAMLISTCALL1 |  $\epsilon$   
PARAMLISTCALL1  $\rightarrow$  , PARAMLISTCALL |  $\epsilon$   
PRINTSTAT  $\rightarrow$  print EXPRESSION  
READSTAT  $\rightarrow$  read LVALUE

RETURNSTAT  $\rightarrow$  return RETURNSTAT1 LVALUE  
RETURNSTAT1  $\rightarrow$  ident |  $\epsilon$   
LVALUE  $\rightarrow$  ident OPT\_NUMEXPRESSION  
OPT\_NUMEXPRESSION  $\rightarrow$  [NUMEXPRESSION] |  $\epsilon$

IFSTAT  $\rightarrow$  if(EXPRESSION) STATEMENT IFSTAT1  
IFSTAT1  $\rightarrow$  else STATEMENT |  $\epsilon$

FORSTAT  $\rightarrow$  for(TRIBSTAT; EXPRESSION; TRIBSTAT)STATEMENT

STATELIST  $\rightarrow$  STATEMENT STATELIST1  
STATELIST1  $\rightarrow$  STATELIST |  $\epsilon$

ALLOCEXPRESSION  $\rightarrow$  new TYPE [ NUMEXPRESSION ]  
NUMEXPRESSION  $\rightarrow$  TERM NUMEXPRESSION1

NUMEXPRESSION1  $\rightarrow$  OP1 TERM |  $\epsilon$

OP1  $\rightarrow$  + | -

OP2  $\rightarrow$  \* | / | %

TERM  $\rightarrow$  UNARYEXPR TERM1

TERM1  $\rightarrow$  OP2 UNARYEXPR |  $\epsilon$

FACTOR  $\rightarrow$  int\_constant |

float\_constant |

string\_constant |

null |

LVALUE |

(NUMEXPRESSION)

UNARYEXPR  $\rightarrow$  OP\_FACTOR FACTOR

OP\_FACTOR  $\rightarrow$  OP1 |  $\epsilon$

EXPRESSION  $\rightarrow$  NUMEXPRESSION OPT\_EXPRESSION

OPT\_EXPRESSION  $\rightarrow$  OP NUMEXPRESSION |  $\epsilon$

OP  $\rightarrow$  < | > | <= | >= | == | !=