

Universidade Federal de Alagoas  
Instituto de Computação

Compiladores  
Gramática Livre de Contexto e LL(1)

# 1. Gramática Livre de Contexto

**S = FunDecla S | IdDecla S |  $\epsilon$**   
**FunDecla = 'Funcao' TipoFun FunNome Id '(' ConstDc ')' DelimiDecla**  
**FunNome = 'id' | 'PR\_PRINCIPAL'**  
**Param = VarTipo 'id' Param | ',' VarTipo 'id' Param | Es Param | ',' Es Param |  $\epsilon$**   
**AbFecPar = '(' Param ')'**  
**TipoFun = 'Int' | 'Float' | 'Array' | 'Bool' | 'Vazio' | 'Char' | 'Str'**  
**VarTipo = 'Int' | 'Float' | 'Char' | 'Array' | 'Bool' | 'Str'**  
**DelimiDecla = 'Iniciate' Instru 'Halt'**  
**IdDecla = VarTipo 'id' ';' | 'id' |  $\epsilon$**   
**ParamFun = ParamFun ',' Ec | Ec |  $\epsilon$**   
**ConstDc = ConstDc ',' VarTipo Id | VarTipo Id |  $\epsilon$**   
**Id = 'id' '[' Ea ']' | 'id'**  
**IdLL = LId ',' Id '=' Ec | LId ',' Id | Id '=' Ec | Id**  
**VetTipo = '[' Es ']' |  $\epsilon$**   
**Atr = Atr ',' 'id' '=' Ec ';' | Atr ',' 'id' '[' Ea ']' '=' Ec ';' | 'id' '=' Ec | 'id' '[' Ea ']' '=' Ec |  $\epsilon$**   
**Instru = Comando Instru | IdDecla Instru | Id '(' ParamFun ')' ';' Instrucoes**  
**| 'Devolve' Retorno ';' |  $\epsilon$**   
**Comando = 'Se' '(' Eb ')' DelimiDecla | Se '(' Eb ')' DelimiDecla 'SeNao' DelimiDecla**  
**Comando = 'Enquanto' '(' Eb ')' | 'Repita' {Loop} '(' 'RESE\_INT' '=' 'id' ',' 'id' ',' 'id' ')' |**  
**'Entrada' '(' Id ')' | 'Escrever' '(' Id ')' Command '=' FunCham**  
**FunCham = 'id' AbFecPar ';' | 'id' '(' ParamFun ')' ';' |**  
**IdFunCham = Id | 'id' '(' ParamFun ')' | 'id'**  
**Se = 'Se' '(' Eb ')' DelimiDecla | 'Se' '(' Eb ')' DelimiDecla 'SeNao'**  
**SeNao = 'SeNao' 'Initiate' Instru 'Halt' |  $\epsilon$**   
**ImprimirParam = ',' Eb ImprimirParam |  $\epsilon$**   
**EntradaParam = Id | EntradaParam**  
**Enquanto = 'Enquanto' '(' Eb ')' Initiate' Instru 'Halt'**  
**Loop = 'Loop' '(' Inteiro {Int} 'id' '=' Ea ',' Ea ')' 'Initiate' Instru 'Halt'**  
**Retorna = 'Retorna Ec ';' |**  
**Entrada {Ler} = 'Entrada' {Ler} '(' 'id' ')' ';' |**  
**Escrever = 'Escrever' '(' Es ')' ';' |**  
**Ec = Ec 'OP\_CONCAT' Eb Eb**  
**Eb = Eb 'OP\_OU' Tb | Tb**  
**Tb = Tb 'OP\_E' Fb | Fb**  
**Fb = Fb 'OP\_RELA' Ra | 'OP\_NEG' Fb | Ra**  
**Ra = Ra 'OP\_RELA' Ea | Ea**  
**Ea = Ea 'OP\_ADD' Ta | Ea 'OP\_SUB' Ta | Ta**  
**Ta = Ta 'OP\_MULTI' Fa | Ta 'OP\_DIVI' Fa | Fa**

**Fa = ‘( Ec )’ | ‘OP\_SUB’ Fa | IdOuFunCham | ‘CTE\_INT’ | ‘CTE\_FLO’ |**  
**‘CTE\_BOOL’**  
**| ‘CTE\_ARRAY’ | ‘CTE\_CHR’**  
**OP\_REL = ‘==’ | ‘!=’ | ‘OP\_MAIORQ’ | ‘OP\_MENORQ’ | ‘OP\_MAIORI’ |**  
**‘OP\_MENORI’**

**S = FunDecla S | IdDecla S | &**  
**FunDecla = ‘Funcao’ TipoFun FunNome Id ‘( ConstDc )’ DelimiDecla**  
**FunNome = ‘id’ | ‘PR\_CENTRAL’**  
**Param = VarTipo ‘id’ Param | ‘,’ VarTipo ‘id’ Param | Es Param | ‘,’ Es Param | &**  
**AbrFecPar = ‘( Param )’**  
**Param = VarTipo ‘id’ Param | ‘,’ VarTipo ‘id’ Param | Es Param | ‘,’ Es Param | &**  
**TipoFun = ‘Int’ | ‘Float’ | ‘Array’ | ‘Bool’ | ‘Vazio’ | ‘Char’ | ‘Str’**  
**VarTipo = ‘Int’ | ‘Float’ | ‘Char’ | ‘Array’ | ‘Bool’ | ‘Str’**  
**DelimiDecla = ‘FunDelimiDecla’ ‘Initiate’ LDc ‘Halt’**  
**IdDecla = VarTipo ‘id’ ‘;’ | ‘id’ | &**  
**ParamFun = Ec ParamFunLL | &**  
**ParamFunLL = ‘,’ Ec ParamFunLL | &**  
**ConstDc = VarTipo ‘id’ VetTipo ConstDc\_LL | &**  
**ConstDc\_LL = ‘,’ VarTipo ‘id’ VetTipo ConstDc\_LL | &**  
**Id = ‘id’ VetTipo**  
**IdLL = Id Atr Id\_LL**  
**Id\_LL = ‘,’ Id Atr IdLL | &**  
**VetTipo = ‘[ Ea ]’ | ε**  
**Atr = ‘,’ Id ‘=’ Ec ‘;’ Atr | &**  
**Instrucoes = Comando Instru | IdDecla Instrucoes | Id ‘( ParamFun )’ ‘;’ Instrucoes**  
**| ‘Retorna’ Retorna ‘;’ | &**  
**Comando = ‘Se’ ‘( Eb )’ DelimiDecla | Se ‘( Eb )’ DelimiDecla ‘SeNao’ DelimiDecla**  
**Comando = ‘Enquanto’ ‘( Eb )’ | ‘Loop’ ‘( RESE\_INT’ ‘=’ ‘id’ ‘,’ ‘id’ ‘,’ ‘id’ )’ |**  
**‘Entrada’ ‘( Id )’ | ‘Imprimir’ ‘( Id )’**  
**Comando = FunCham**  
**FunCham = ‘id’ AbFecPar ‘;’**  
**Se = ‘Se’ ‘( Eb )’ DelimiDecla | ‘Se’ ‘( Eb )’ DelimiDecla ‘SeNao’ DelimiDecla**  
**SeNao = ‘SeNao’ DelimiDecla | &**  
**Enquanto = ‘Enquanto’ ‘( Eb )’ ‘Initiate’ Instru ‘Halt’**  
**Loop = ‘Repita’ ‘( Inteiro ‘id’ ‘=’ Ea ‘,’ Ea )’ ‘Initiate’ Instru ‘Halt’**  
**Retorna = ‘Devolve’ { ‘Retorna’ } Es ‘;’**  
**EntradaParam = ‘id’ VetTipo EntradaParamLL**  
**EntradaParamLL = ‘,’ ‘id’ VetTipo EntradaParamLL | &**  
**ImprimirParam = ‘,’ Ec ImprimirParam | &**  
**Ec = Eb EcLL**  
**EcLL = ‘OP\_CONCAT’ Eb EcLL | &**  
**Eb = Tb EbLL**

**EbLL = ‘OP\_OU’ Tb EbLL | &**  
**Tb = Fb TbLL**  
**TbLL = ‘OP\_E’ Fb TbLL | &**  
**Fb = ‘OP\_NEGA’ Fb | Ra FbLL**  
**FbLL = ‘OP\_MAIORQ’ Ra FbLL | FbLL = ‘OP\_MENORQ’ Ra FbLL | ‘OP\_MAIORI’**  
**Ra**  
**FbLL | ‘OP\_MENORI’ Ra FbLL | &**  
**Ra = Ea RaLL**  
**RaLL = ‘OP\_RELA’ Ea RaLL | &**  
**Ea = Ta EaLL**  
**EaLL = ‘OP\_ADI’ Ta EaLL | ‘OP\_SUB’ Ta EaLL | &**  
**Ta = Pa TaLL**  
**TaLL = ‘OP\_MULTI’ Pa TaLL | ‘OP\_DIVI’ Pa TaLL | &**  
**Pa = Fa PaLL**  
**PaLL = ‘OP\_REST’ Fa PaLL | &**

## 2. Gramática LL(1)

**S = FunDecla S | IdDecla S | &**  
**FunDecla = 'Funcao' TipoFun FunNome Id '(' ConstDc ')' DelimiDecla**  
**FunNome = 'id' | 'PR\_CENTRAL'**  
**Param = VarTipo 'id' Param | ',' VarTipo 'id' Param | Es Param | ',' Es Param | &**  
**AbrFecPar = '(' Param ')'**  
**Param = VarTipo 'id' Param | ',' VarTipo 'id' Param | Es Param | ',' Es Param | &**  
**TipoFun = 'Int' | 'Float' | 'Array' | 'Bool' | 'Vazio' | 'Char' | 'Str'**  
**VarTipo = 'Int' | 'Float' | 'Char' | 'Array' | 'Bool' | 'Str'**  
**DelimiDecla = 'FunDelimiDecla' 'Initiate' LDC 'Halt'**  
**IdDecla = VarTipo 'id' ';' | 'id' | &**  
**ParamFun = Ec ParamFunLL | &**  
**ParamFunLL = ',' Ec ParamFunLL | &**  
**ConstDc = VarTipo 'id' VetTipo ConstDc\_LL | &**  
**ConstDc\_LL = ',' VarTipo 'id' VetTipo ConstDc\_LL | &**  
**Id = 'id' VetTipo**  
**IdLL = Id Atr Id\_LL**  
**Id\_LL = ',' Id Atr IdLL | &**  
**VetTipo = '[' Ea ']' | ε**  
**Atr = ',' Id '=' Ec ';' Atr | &**  
**Instrucoes = Comando Instru | IdDecla Instrucoes | Id '(' ParamFun ')' ';' Instrucoes | 'Retorna' Retorna ';' | &**  
**Comando = 'Se' '(' Eb ')' DelimiDecla | 'Se' '(' Eb ')' DelimiDecla 'SeNao' DelimiDecla**  
**Comando = 'Enquanto' '(' Eb ')' | 'Loop' '(' 'RESE\_INT' '=' 'id' ',' 'id' ',' 'id' ')' | 'Entrada' '(' Id ')' | 'Imprimir' '(' Id ')'**  
**Comando = FunCham**  
**FunCham = 'id' AbFecPar ';' |**  
**Se = 'Se' '(' Eb ')' DelimiDecla | 'Se' '(' Eb ')' DelimiDecla 'SeNao' DelimiDecla**  
**SeNao = 'SeNao' DelimiDecla | &**  
**Enquanto = 'Enquanto' '(' Eb ')' 'Initiate' Instru 'Halt'**  
**Loop = 'Repita' '(' 'Inteiro' 'id' '=' Ea ',' Ea ')' 'Initiate' Instru 'Halt'**  
**Retorna = 'Devolve' {'Retorna'} Es ';' |**  
**EntradaParam = 'id' VetTipo EntradaParamLL**  
**EntradaParamLL = ',' 'id' VetTipo EntradaParamLL | &**  
**ImprimirParam = ',' Ec ImprimirParam | &**  
**Ec = Eb EcLL**  
**EcLL = 'OP\_CONCAT' Eb EcLL | &**  
**Eb = Tb EbLL**  
**EbLL = 'OP\_OU' Tb EbLL | &**  
**Tb = Fb TbLL**  
**TbLL = 'OP\_E' Fb TbLL | &**  
**Fb = 'OP\_NEGA' Fb | Ra FbLL**

**FbLL = ‘OP\_MAIORQ’ Ra FbLL | FbLL = ‘OP\_MENORQ’ Ra FbLL | ‘OP\_MAIORI’  
Ra  
FbLL | ‘OP\_MENORI’ Ra FbLL | &  
Ra = Ea RaLL  
RaLL = ‘OP\_RELA’ Ea RaLL | &  
Ea = Ta EaLL  
EaLL = ‘OP\_ADI’ Ta EaLL | ‘OP\_SUB’ Ta EaLL | &  
Ta = Pa TaLL  
TaLL = ‘OP\_MULTI’ Pa TaLL | ‘OP\_DIVI’ Pa TaLL | &  
Pa = Fa PaLL  
PaLL = ‘OP\_REST’ Fa PaLL | &**