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| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | **program** | **id** | **(** | **)** | **,** | **;** | **:** | **var** | **array** | **num . . num** | **[** | **]** | **of** | **integer** | **real** | **function** | **procedure** | **begin** | **end** | **assignop** | **if** | **then** | **else** | **while** | **do** | **relop** | **addop** | **mulop** | **num** | **not** | **+** | **-** | **$** |
| PROGRAM | PROGRAM -> **program id** ( IDENTIFIER\_LIST ) ; DECLARATIONS SUBPROGRAM\_DECLARATIONS COMPOUND\_STATEMENT |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| IDENTIFIER\_LIST |  | IDENTIFIER\_LIST -> **id** IDENTIFIER\_LIST’ |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| IDENTIFIER\_LIST’ |  |  |  | IDENTIFIER\_LIST’ -> Î | IDENTIFIER\_LIST’ -> , **id** IDENTIFIER\_LIST’ |  | IDENTIFIER\_LIST’ -> Î |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| DECLARATIONS |  |  |  |  |  |  |  | DECLARATIONS -> DECLARATIONS’ |  |  |  |  |  |  |  | DECLARATIONS -> Î | DECLARATIONS -> Î | DECLARATIONS -> Î |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| DECLARATIONS’ |  |  |  |  |  |  |  | DECLARATIONS’ -> **var** IDENTIFIER\_LIST : TYPE ; DECLARATIONS’ |  |  |  |  |  |  |  | DECLARATIONS’ -> Î | DECLARATIONS’ -> Î | DECLARATIONS’ -> Î |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| TYPE |  |  |  |  |  |  |  |  | TYPE ->  **array [ num . . num ] of** STANDARD\_TYPE |  |  |  |  | TYPE -> STANDARD\_TYPE | TYPE -> STANDARD\_TYPE |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| STANDARD\_TYPE |  |  |  |  |  |  |  |  |  |  |  |  |  | STANDARD\_TYPE -> **integer** | STANDARD\_TYPE -> **real** |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| SUBPROGRAM\_DECLARATIONS |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | SUBPROGRAM\_DECLARATIONS -> SUBPROGRAM\_DECLARATIONS’ | SUBPROGRAM\_DECLARATIONS -> SUBPROGRAM\_DECLARATIONS’ | SUBPROGRAM\_DECLARATIONS -> Î |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| SUBPROGRAM\_DECLARATIONS’ |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | SUBPROGRAM\_DECLARATIONS’ -> SUBPROGRAM\_DECLARATION ; SUBPROGRAM\_DECLARATIONS’ | SUBPROGRAM\_DECLARATIONS’ -> SUBPROGRAM\_DECLARATION ; SUBPROGRAM\_DECLARATIONS’ | SUBPROGRAM\_DECLARATIONS’ -> Î |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| SUBPROGRAM\_DECLARATION |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | SUBPROGRAM\_DECLARATION -> SUBPROGRAM\_HEAD DECLARATIONS COMPOUND\_STATEMENT | SUBPROGRAM\_DECLARATION -> SUBPROGRAM\_HEAD DECLARATIONS COMPOUND\_STATEMENT |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| SUBPROGRAM\_HEAD |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | SUBPROGRAM\_HEAD -> **function id** ARGUMENTS : STANDARD\_TYPE | SUBPROGRAM\_HEAD ->  **procedure id** ARGUMENTS ; |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| ARGUMENTS |  |  | ARGUMENTS -> ( PARAMETER\_LIST ) |  |  | ARGUMENTS -> Î | ARGUMENTS -> Î |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| PARAMETER\_LIST |  | PARAMETER\_LIST -> IDENTIFIER\_LIST : TYPE PARAMETER\_LIST’ |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| PARAMETER\_LIST’ |  |  |  | PARAMETER\_LIST’ -> Î |  | PARAMETER\_LIST’ -> ; IDENTIFIER\_LIST : TYPE PARAMETER\_LIST’ |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| COMPOUND\_STATEMENT |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | COMPOUND\_STATEMENT -> **begin** OPTIONAL\_STATEMENTS **end** |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| OPTIONAL\_STATEMENTS |  | OPTIONAL\_STATEMENTS -> STATEMENT\_LIST |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | OPTIONAL\_STATEMENTS -> STATEMENT\_LIST | OPTIONAL\_STATEMENTS -> Î |  | OPTIONAL\_STATEMENTS -> STATEMENT\_LIST |  |  | OPTIONAL\_STATEMENTS -> STATEMENT\_LIST |  |  |  |  |  |  |  |  |  |
| STATEMENT\_LIST |  | STATEMENT\_LIST -> STATEMENT STATEMENT\_LIST’ |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | STATEMENT\_LIST -> STATEMENT STATEMENT\_LIST’ |  |  | STATEMENT\_LIST -> STATEMENT STATEMENT\_LIST’ |  |  | STATEMENT\_LIST -> STATEMENT STATEMENT\_LIST’ |  |  |  |  |  |  |  |  |  |
| STATEMENT\_LIST’ |  |  |  |  |  | STATEMENT\_LIST’ -> ; STATEMENT STATEMENT\_LIST’ |  |  |  |  |  |  |  |  |  |  |  |  | STATEMENT\_LIST’ -> Î |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| STATEMENT |  | STATEMENT -> VARIABLE **assignop** EXPRESSION |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | STATEMENT -> PROCEDURE\_STATEMENT |  |  | STATEMENT -> **if** EXPRESSION **then** STATEMENT **else** |  |  | STATEMENT -> **while** EXPRESSION **do** STATEMENT |  |  |  |  |  |  |  |  |  |
| VARIABLE |  | VARIABLE -> **id** VARIABLE’ |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| VARIABLE’ |  |  |  |  |  |  |  |  |  |  | VARIABLE’ -> [ EXPRESSION ] |  |  |  |  |  |  |  |  | VARIABLE’ -> Î |  |  |  |  |  |  |  |  |  |  |  |  |  |
| PROCEDURE\_STATEMENT |  | PROCEDURE\_STATEMENT -> **id** PROCEDURE\_STATEMENT’ |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| PROCEDURE\_STATEMENT’ |  |  | PROCEDURE\_STATEMENT’ -> ( EXPRESSION\_LIST ) |  |  | PROCEDURE\_STATEMENT’ -> Î |  |  |  |  |  |  |  |  |  |  |  |  | PROCEDURE\_STATEMENT’ -> Î |  |  |  | PROCEDURE\_STATEMENT’ -> Î |  |  |  |  |  |  |  |  |  |  |
| EXPRESSION\_LIST |  | EXPRESSION\_LIST -> EXPRESSION EXPRESSION\_LIST’ | EXPRESSION\_LIST -> EXPRESSION EXPRESSION\_LIST’ | EXPRESSION\_LIST -> Î |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | EXPRESSION\_LIST -> EXPRESSION EXPRESSION\_LIST’ | EXPRESSION\_LIST -> EXPRESSION EXPRESSION\_LIST’ | EXPRESSION\_LIST -> EXPRESSION EXPRESSION\_LIST’ | EXPRESSION\_LIST -> EXPRESSION EXPRESSION\_LIST’ | EXPRESSION\_LIST -> EXPRESSION EXPRESSION\_LIST’ | EXPRESSION\_LIST -> EXPRESSION EXPRESSION\_LIST’ |  |
| EXPRESSION\_LIST’ |  |  |  | EXPRESSION\_LIST’ -> Î | EXPRESSION\_LIST’ -> , EXPRESSION EXPRESSION\_LIST’ |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| EXPRESSION |  | EXPRESSION -> SIMPLE\_EXPRESSION EXPRESSION’ | EXPRESSION -> SIMPLE\_EXPRESSION EXPRESSION’ | EXPRESSION -> Î | EXPRESSION -> Î | EXPRESSION -> Î |  |  |  |  |  | EXPRESSION -> Î |  |  |  |  |  |  | EXPRESSION -> Î |  |  | EXPRESSION -> Î | EXPRESSION -> Î |  | EXPRESSION -> Î |  | EXPRESSION -> SIMPLE\_EXPRESSION EXPRESSION’ | EXPRESSION -> SIMPLE\_EXPRESSION EXPRESSION’ | EXPRESSION -> SIMPLE\_EXPRESSION EXPRESSION’ | EXPRESSION -> SIMPLE\_EXPRESSION EXPRESSION’ | EXPRESSION -> SIMPLE\_EXPRESSION EXPRESSION’ | EXPRESSION -> SIMPLE\_EXPRESSION EXPRESSION’ |  |
| EXPRESSION’ |  |  |  | EXPRESSION’ -> Î | EXPRESSION’ -> Î | EXPRESSION’ -> Î |  |  |  |  |  | EXPRESSION’ -> Î |  |  |  |  |  |  | EXPRESSION’ -> Î |  |  | EXPRESSION’ -> Î | EXPRESSION’ -> Î |  | EXPRESSION’ -> Î | EXPRESSION’ -> **relop** SIMPLE\_EXPRESSION |  |  |  |  |  |  |  |
| SIMPLE\_EXPRESSION |  | SIMPLE\_EXPRESSION -> TERM SIMPLE\_EXPRESSION’ | SIMPLE\_EXPRESSION -> TERM SIMPLE\_EXPRESSION’ | SIMPLE\_EXPRESSION -> TERM SIMPLE\_EXPRESSION’ | SIMPLE\_EXPRESSION -> TERM SIMPLE\_EXPRESSION’ | SIMPLE\_EXPRESSION -> TERM SIMPLE\_EXPRESSION’ |  |  |  |  |  | SIMPLE\_EXPRESSION -> TERM SIMPLE\_EXPRESSION’ |  |  |  |  |  |  | SIMPLE\_EXPRESSION -> TERM SIMPLE\_EXPRESSION’ |  |  | SIMPLE\_EXPRESSION -> TERM SIMPLE\_EXPRESSION’ | SIMPLE\_EXPRESSION -> TERM SIMPLE\_EXPRESSION’ |  | SIMPLE\_EXPRESSION -> TERM SIMPLE\_EXPRESSION’ | SIMPLE\_EXPRESSION -> TERM SIMPLE\_EXPRESSION’ | SIMPLE\_EXPRESSION -> TERM SIMPLE\_EXPRESSION’ | SIMPLE\_EXPRESSION -> TERM SIMPLE\_EXPRESSION’ | SIMPLE\_EXPRESSION -> TERM SIMPLE\_EXPRESSION’ | SIMPLE\_EXPRESSION -> TERM SIMPLE\_EXPRESSION’ | SIMPLE\_EXPRESSION -> SIGN TERM SIMPLE\_EXPRESSION’ | SIMPLE\_EXPRESSION -> SIGN TERM SIMPLE\_EXPRESSION’ |  |
| SIMPLE\_EXPRESSION’ |  |  |  | SIMPLE\_EXPRESSION’ -> Î | SIMPLE\_EXPRESSION’ -> Î | SIMPLE\_EXPRESSION’ -> Î |  |  |  |  |  | SIMPLE\_EXPRESSION’ -> Î |  |  |  |  |  |  | SIMPLE\_EXPRESSION’ -> Î |  |  | SIMPLE\_EXPRESSION’ -> Î | SIMPLE\_EXPRESSION’ -> Î |  | SIMPLE\_EXPRESSION’ -> Î | SIMPLE\_EXPRESSION’ -> Î | SIMPLE\_EXPRESSION’ -> **addop** TERM SIMPLE\_EXPRESSION’ |  |  |  |  |  |  |
| TERM |  | TERM -> FACTOR TERM’ | TERM -> FACTOR TERM’ | TERM -> Î | TERM -> Î | TERM -> Î |  |  |  |  |  | TERM -> Î |  |  |  |  |  |  | TERM -> Î |  |  | TERM -> Î | TERM -> Î |  | TERM -> Î | TERM -> Î | TERM -> Î | TERM -> FACTOR TERM’ | TERM -> FACTOR TERM’ | TERM -> FACTOR TERM’ |  |  |  |
| TERM’ |  |  |  | TERM’ -> Î | TERM’ -> Î | TERM’ -> Î |  |  |  |  |  | TERM’ -> Î |  |  |  |  |  |  | TERM’ -> Î |  |  | TERM’ -> Î | TERM’ -> Î |  | TERM’ -> Î | TERM’ -> Î | TERM’ -> Î | TERM’ -> **mulop** FACTOR TERM’ |  |  |  |  |  |
| FACTOR |  | FACTOR -> **id** FACTOR’ | FACTOR -> ( EXPRESSION ) | FACTOR -> FACTOR’ | FACTOR -> FACTOR’ | FACTOR -> FACTOR’ |  |  |  |  |  | FACTOR -> FACTOR’ |  |  |  |  |  |  | FACTOR -> FACTOR’ |  |  | FACTOR -> FACTOR’ | FACTOR -> FACTOR’ |  | FACTOR -> FACTOR’ | FACTOR -> FACTOR’ | FACTOR -> FACTOR’ | FACTOR -> FACTOR’ | FACTOR -> **num** | FACTOR -> **not** |  |  |  |
| FACTOR’ |  |  | FACTOR’ -> ( EXPRESSION\_LIST ) | FACTOR’ -> Î | FACTOR’ -> Î | FACTOR’ -> Î |  |  |  |  |  | FACTOR’ -> Î |  |  |  |  |  |  | FACTOR’ -> Î |  |  | FACTOR’ -> Î | FACTOR’ -> Î |  | FACTOR’ -> Î | FACTOR’ -> Î | FACTOR’ -> Î | FACTOR’ -> Î |  |  |  |  |  |
| SIGN |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | SIGN -> **+** | SIGN -> **-** |  |