Left Attributed Definitions

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program → **program id (** identifier\_list **);** program1

program1 → declarations program1\_1

program1 → subprogram\_declarations compound\_statement **.**

program1 → compound\_statement **.**

program1\_1 → subprogram\_declarations compound\_statement **.**

program1\_1 → compound\_statement **.**

identifier\_list → **id** identifier\_list1

identifier\_list1 → **, id** identifier\_list1

identifier\_list1→ **epsilon**

declarations → **var id :** type **;** declarations1

declarations1 → **var id :** type **;** declarations1

declarations1 → **epsilon**

type → standard\_type

type → **array [ num .. num ] of** standard\_type

standard\_type → **integer**

standard\_type → **real**

subprogram\_declarations → subprogram\_declaration **;** subprogram\_declarations1

subprogram\_declarations1 → subprogram\_declaration **;** subprogram\_declarations1 subprogram\_declarations1 → **epsilon**

subprogram\_declaration → subprogram\_head subprogram\_declaration1

subprogram\_declaration1 → declarations subprogram\_declaration1\_1

subprogram\_declaration1 → subprogram\_declarations compound\_statement

subprogram\_declaration1 → compound\_statement

subprogram\_declaration1\_1 → subprogram\_declarations compound\_statement subprogram\_declaration1\_1 → compound\_statement

subprogram\_head → **function id** subprogram\_head1

subprogram\_head1 → **(** parameter\_list **)** **:** standard\_type **;** #XXX formal parameters

subprogram\_head1 → **:** standard\_type **;**

parameter\_list → **id** : type parameter\_list1

parameter\_list1 → **; id** **:** type parameter\_list1

parameter\_list1 → **epsilon**

compound\_statement → **begin** compound\_statement1

compound\_statement1 → statement\_list **end**

compound\_statement1 → **end**

statement\_list → statement statement\_list1

statement\_list1 → **;** statement statement\_list1

statement\_list1 → **epsilon**

statement → variable **assignop** expression

{}

statement → compound\_statement

statement → **if** expression **then** statement[1] statement1

{statement.type := if expression.type = BOOL then statement[1].type}

else ERR\* }

statement → **while** expression **do** statement

{statement.type := if expression.type = BOOL then void

else ERR\* }

statement1 → **else** statement

{}

statement1 → **epsilon**

{}

variable → **id** variable1

{variable1.in := getType(id)}

{variable.type := getType(id)}

---begin subset---

variable1 → **[** expression **]** {not done: how to implement this}

{ variable1.type := if expression.type = INT and variable1.in = array(s, t), then t

else ERR\* }

variable1 → **epsilon**

{ variable1.type := void}

expression\_list → expression expression\_list1 {not done: how to implement this}

{expression\_list1.type := if expression\_list1.type = s, then expression.type + expression\_list1.type,

else ERR\*}

expression\_list1 → **,** expression expression\_list1 {not done: how to implement this}

{expression\_list1.type := if expression\_list1.type = s, then expression.type + expression\_list1.type,

else ERR\*}

expression\_list1 → **epsilon** {not done: how to implement this}

{expression\_list1 := newS()} #an empty list for argument types

expression → simple\_expression expression1

{ expression1.in := simple\_expression.type }

{ expression.val := expression1.val }

{ expression.type := simple\_expression.type }

expression1 →**relop** simple\_expression

{ expression1.val := expression1.in **relop** simple\_expression }

{ expression1.type := if expression1.in = simple\_expression.type = (int or real) then BOOL

else ERR\*}

expression1 → **epsilon**

{expression1.type := void}

simple\_expression → term simple\_expression1

{simple\_expression.type := if term.type = simple\_expression1.type or simple\_expression1 := void then term.type

else ERR\*}

simple\_expression → sign term simple\_expression1

{simple\_expression.type := if term.type = simple\_expression.type or simple\_expression1 := void then term.type, else ERR\*}

simple\_expression1 → **addop** term simple\_expression1[1]

{simple\_expression1.type := if term.type = simple\_expression1[1].type or simple\_expression1[1].type = void then term.type

else ERR\* }

simple\_expression1 → **epsilon**

{ simple\_epression1.type := void }

term → factor term1

{term.type := if factor.type = term1.type or term1.type = void then factor.type

else ERR\* }

term1 → **multop** factor term1[1]

{term1.type := if (factor.type = term1[1].type = (int or real)) or term1[1].type = void then factor.type

else ERR\* }

term1 → **epsilon**

{ term1.type := void}

factor → **id** factor1{not done: function calls}

{factor.type := if getType(id) = s → t and factor1.type = s, then t

else if getType(id) = factor1.type, then factor1.type

else ERR\*}

{factor1.in := getType(id)} #need because if type is array, we need to check that id is correct

factor → **num**

{factor.type := num.type}

factor → **(** expression **)**

{factor.type:= expression.type}

factor → **not** factor[1]

{ factor.type := if factor[1].type = BOOL then BOOL

else if factor[1] = ERR or ERR\* then ERR

else ERR\* }

factor1 → **(** expression\_list **)** {not done}

{ factor1.type := if expression\_list.type = s then s,

else ERR\*} #s is a list of the types of all the expressions

factor1 → variable1

{factor1.type := varable1.type} #the type will be array or void

{variable1.in := factor1.in}

sign → **+**

sign → **-**