Assignment: Left Recursion & Left Factoring

1) Program → program id (identifier_list) ; declarations subprogram declarations compound_statement .

Nothing to Remove

2) Identifier_list → id | identifier_list , id

Removing Left Recursion

identifier_list → id identifier_list'

identifier_list' → , id identifier_list' | ε

3) declarations → declarations var identifier_list : type ;

Removing Left Recursion

declarations → declarations'

declarations' → var identifier_list : type ; declarations' | ε

4) type → standard_type | array [num .... num] of standard_type

5) standard_type → integer | real

6) subprogram_declarations → subprogram_declarations subprogram_declaration ; | ε

Removing Left Recursion

subprogram_declarations → subprogram_declarations' | ε

subprogram_declarations' → subprogram_declaration ; subprogram_declarations' | ε

7) subprogram_declaration → subprogram_head declarations compound_statement

~~8) subprogram_head → function id arguments : standard_type ; | procedure id arguments ;~~

8) arguments → (parameter_list) | ε

9) parameter_list → identifier_list : type | parameter_list ; identifierlist : type

Removing Left Recursion

Parameter_list → identifier_list : parameter_list'

Parameter_list' → ; identifier_list : type parameter_list' | ε

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10) subprogram_head → function id arguments : standard_type; |
procedure id arguments;

~~Removing left factoring~~ Nothing to Remove.

~~subprogram_head → id arguments subprogram_head'~~
~~subprogram_head' → function procedure : ; standard_type ;~~

11) compound_statement → begin optional_statement end

12) optional_statement → statement_list | ε

13) statement_list → statement | statement_list ; statement

Removing Left Recursion

statement_list → statement statement_list'
statement_list' → ; statement statement_list' | ε

14) statement → variable assignop expression | procedure_statement
| compound_statement | if expression then
statement else statement | while expression
do statement.

15) variable → id | id [expression]

Removing left Factoring

variable → id variable'
variable' → [expression] | ε

16) expression_list → expression | expression_list, expression

Removing Left Recursion

expression_list → expression expression_list'
expression_list' → , expression expression_list' | ε

17) Expression → simple_expression | simple_expression relop simple_expression

Removing Left Factoring

expression → simple_expression expression'
expression' → relop simple_expression | ε

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18) simple-expression → term | sign term | simple_expression addop term

Removing Left Recursion

simple_expression → term | sign term simple-expression'

simple-expression' → addop term simple_expression' | ε

19) term → factor | term mulop factor

Removing Left Recursion

term → factor term'

term' → mulop factor term' | ε

20) factor → id | id (expression_list) | num | (expression) | not factor

Removing left recursion factoring

factor → id factor' | num | (expression) | not factor

factor' → (expression_list) | ε

21) sign → + | −

Nothing to Remove

22) Procedure-statement → id | id (expression_list)

Removing Left Factoring

Procedure-statement → id Procedure-statement'

Procedure-statement' → (expression_list) | ε

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