INFO-F-403: Language theory and compiling Rapport projet partie 2 - Grammaire

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1 Transformation de la grammaire donnée

1.1 Opérateurs binaires et unaires

La première étape pour rendre la grammaire LL(1) fut la distinction des deux types d'opérateurs : les opérateurs binaires qui agissent sur deux expressions l'une située à gauche et l'autre à droite de ces opérateurs et les opérateurs unaires qui agissent sur une seule expression située à droite de ces opérateurs. Il faut différencier les deux types d'opérateurs afin de ne pas avoir des expressions du style : *4, *2, 6|,... Les opérateurs unaires sont au nombre de quatre :! (negation), \sim (not bit à bit), + et -. Les opérateurs + et - sont également des opérateurs binaires.

1.2 Priorité et associativité des opérateurs

Lors de cette étape, nous avons modifié la grammaire afin de fixer la priorité et l'associativité des différents opérateurs, ceci afin de rendre la grammaire moins ambigue. Nous avons remarqué que les opérateurs unaires étaient plus prioritaires que les opérateurs binaires et que les opérateurs unaires étaient tous associatifs à droite, tandis que les opérateurs binaires l'étaient tous à gauche. Pour fixer la priorité, nous avons mis les opérateurs les moins prioritaires le plus "haut" possible dans la grammaire et les plus prioritaires le plus "bas" possible.

1.3 Suppression des récursion à gauche

L'étape suivante fut l'étape de suppression des récursions à gauche qui sont incompatibles avec les "top-down parser" car cela fait entrer ce genre de parser dans une boucle ou récursion infinie.

1.4 Left factoring

Cette étape rassemble les règles de production d'une variable qui ont un préfixe commun en une seule règle de production qui contient ce préfixe commun et une nouvelle variable. Cette nouvelle variable possède des règles de production vers les différents suffixes qui étaient présents à l'origine dans les différentes règles de production qui ont été mises en commun. Ceci est nécessaire car le parser qu'on va créer est LL(1), il faut donc qu'il puisse choisir la bonne règle de production en regardant seulement le prochain token qui est en entrée.

1.5 Les variables <Instruction> et <InstructionList>

Dans la grammaire donnée, à chaque fois que la variable <Instruction> se trouvait dans la partie droite d'une règle de production excepté lorque la partie gauche de la règle était <InstructionList>, il y avait une autre règle de production pour cette même partie gauche où <Instruction> était remplacé par <InstructionList>. Par exemple, <If> →<Expression> <Empty> <InstructionList> <IfEnd> et <If> →<Expression> <Empty> <Instruction> <IfEnd>. Ceci permettant de ne pas mettre de END_OF_INSTRUCTION à la fin d'une <Instruction> lorsque le corps d'un block (ici, le corps du "if") ne contenait qu'une seule <Instruction>. Le problème posé par le doublement systématique des règles de production contenant des instructions (une règle pour <Instruction> et une autre pour <InstructionList>) est que ce n'est pas factorisé à gauche et que le first de <InstructionList> peut être

 $<\!$ Instruction>. Afin de résoudre ce problème, nous avons décidé de ne plus utilisé que la variable $<\!$ InstructionList> dans les autres règles de production. Ainsi, on évite le doublement des règles de production. Une $<\!$ InstructionList> est une liste d' $<\!$ Instruction> séparées par des END_OF_INSTRUCTION, avec la dernière $<\!$ Instruction> qui n'est pas nécessairement suivie d'un END_OF_INSTRUCTION. Ceci permet d'avoir un programme du style : if(a>b) ;a=10 end ; Donc seule une $<\!$ InstructionList> permet de produire des $<\!$ Instruction>.

2 Grammaire

[1]	<program></program>	\rightarrow	<instructionlist></instructionlist>
[2]	<instruction></instruction>	\rightarrow	<identifierinstruction></identifierinstruction>
[3]		\rightarrow	<constdefinition></constdefinition>
[4]		\rightarrow	<block></block>
[5]		\rightarrow	<loop></loop>
[6]		\rightarrow	<builtinfunctioncall></builtinfunctioncall>
[7]		\rightarrow	<functiondefinition></functiondefinition>
[8]	<InstructionList $>$	\rightarrow	<instruction> <instructionlisttail></instructionlisttail></instruction>
[9]	(Insulationalist)	\rightarrow	<instructionlisttail></instructionlisttail>
[10]	<InstructionListTail $>$	$\stackrel{'}{ ightarrow}$	END OF INSTRUCTION <instructionlist></instructionlist>
[11]		$\stackrel{'}{ ightarrow}$	ϵ
[12]	<IdentifierInstruction $>$	\rightarrow	IDENTIFIER <identifierinstructiontail></identifierinstructiontail>
[13]	<identifierinstructiontail></identifierinstructiontail>	$\stackrel{'}{\rightarrow}$	<assignationtail></assignationtail>
[14]		$\stackrel{'}{ ightarrow}$	TYPE DEFINITION <type></type>
[15]		$\stackrel{'}{\rightarrow}$	<functioncalltail></functioncalltail>
[16]	<AssignationTail $>$	$\stackrel{}{\rightarrow}$	ASSIGNATION < Expression>
	\Assignation fair	\rightarrow	COMMA IDENTIFIER <assignationtail> COMMA</assignationtail>
[17]		\rightarrow	COMMA IDENTIFIER < Assignation fail > COMMA Expression >
[10]	<constdefinition></constdefinition>	,	-
[18]		\rightarrow	CONST IDENTIFIER <assignationtail></assignationtail>
[19]	<block></block>	\rightarrow	LET IDENTIFIER <assignationtail></assignationtail>
[00]	zτ		END_OF_INSTRUCTION <instructionlist> END</instructionlist>
[20]	<loop></loop>	\rightarrow	<if></if>
[21]		\rightarrow	WHILE <expression> END_OF_INSTRUCTION</expression>
[00]			<instructionlist> END</instructionlist>
[22]		\rightarrow	FOR IDENTIFIER ASSIGNATION < Expression >
[0.0]			TERNARY_ELSE <expression> <fortail></fortail></expression>
[23]	<ForTail $>$	\rightarrow	END_OF_INSTRUCTION <instructionlist> END</instructionlist>
[24]		\rightarrow	TERNARY_ELSE < Expression>
F 3	_		END_OF_INSTRUCTION <instructionlist> END</instructionlist>
[25]	<Type $>$	\rightarrow	BOOLEAN_TYPE
[26]		\rightarrow	REAL_TYPE
[27]		\rightarrow	INTEGER_TYPE
[28]	<expression></expression>	\rightarrow	$<\!$
[29]	<TernaryIfExpression $>$	\rightarrow	${ m TERNARY_IF} < { m Expression} >$
			<TernaryElseExpression $>$
[30]		\rightarrow	ϵ
[31]	<TernaryElseExpression $>$	\rightarrow	${\it TERNARY_ELSE} < {\it Expression} >$
[32]	<AtomicExpression $>$	\rightarrow	<AtomicIdentifierExpression $>$
[33]		\rightarrow	INTEGER
[34]		\rightarrow	REAL
[35]		\rightarrow	BOOLEAN
[36]		\rightarrow	<builtinfunctioncall></builtinfunctioncall>
[37]	<AtomicIdentifierExpression $>$	\rightarrow	IDENTIFIER
. ,	•		$<\!$
[38]	<AtomicIdentifierExpressionTail $>$	\rightarrow	<functioncalltail></functioncalltail>
[39]	r	\rightarrow	ϵ
[40]	<unaryexpression></unaryexpression>	\rightarrow	NEGATION <unaryexpression></unaryexpression>
[41]	J F	\rightarrow	<unarybitwisenotexpression></unarybitwisenotexpression>
[]		•	

[42]	$<\!\!\text{UnaryBitwiseNotExpression}\!\!>$	\rightarrow	BITWISE_NOT <unarybitwisenotexpression></unarybitwisenotexpression>
[43]	II M. D. D	\rightarrow	<unaryminusplusexpression></unaryminusplusexpression>
[44]	$<\! {\tt UnaryMinusPlusExpression}\! >$	\rightarrow	MINUS < UnaryMinusPlusExpression>
[45]		\rightarrow	PLUS < UnaryMinusPlusExpression>
[46]		\rightarrow	<Unary $AtomicExpression>$
[47]	<Unary $AtomicExpression>$	\rightarrow	<atomicexpression></atomicexpression>
[48]		\rightarrow	LEFT PARENTHESIS < Expression>
			RIGHT PARENTHESIS
[49]	<binaryexpression></binaryexpression>	\rightarrow	<binarylazyorexpression></binarylazyorexpression>
	J I		<binaryexpression'></binaryexpression'>
[50]	<binaryexpression'></binaryexpression'>	\rightarrow	LAZY_OR <binarylazyorexpression></binarylazyorexpression>
[oo]	\Dinary Expression >	,	<binaryexpression'></binaryexpression'>
[51]		,	€
[51]	<p:< td=""><td>\rightarrow</td><td></td></p:<>	\rightarrow	
[52]	<binarylazyorexpression></binarylazyorexpression>	\rightarrow	<binarylazyandexpression></binarylazyandexpression>
			<binarylazyorexpression'></binarylazyorexpression'>
[53]	$<\!$	\rightarrow	$LAZY_AND < BinaryLazyAndExpression>$
			<BinaryLazyOrExpression' $>$
[54]		\rightarrow	ϵ
[55]	<binarylazyandexpression></binarylazyandexpression>	\rightarrow	<binarynumericexpression></binarynumericexpression>
	• •		<binarylazyandexpression'></binarylazyandexpression'>
[56]	<binarylazyandexpression'></binarylazyandexpression'>	\rightarrow	GREATER_THAN <binarynumericexpression></binarynumericexpression>
[oo]	(Bindiy Bazy i ind Empression)	,	<pre><binarylazyandexpression'></binarylazyandexpression'></pre>
[57]		\rightarrow	LESS THAN <binarynumericexpression></binarynumericexpression>
[97]		\rightarrow	
[=0]			<binarylazyandexpression'></binarylazyandexpression'>
[58]		\rightarrow	GREATER_OR_EQUALS_THAN
			<binarynumericexpression></binarynumericexpression>
			<BinaryLazyAndExpression' $>$
[59]		\rightarrow	LESS_OR_EQUALS_THAN
			<binarynumericexpression></binarynumericexpression>
			<binarylazyandexpression'></binarylazyandexpression'>
[60]		\rightarrow	EQUALITY <binarynumericexpression></binarynumericexpression>
[00]		,	<binarylazyandexpression'></binarylazyandexpression'>
[61]		\rightarrow	INEQUALITY <binarynumericexpression></binarynumericexpression>
[01]		\rightarrow	
[60]			$<\!$
[62]	D	\rightarrow	ε
[63]	<BinaryNumericExpression $>$	\rightarrow	<binarytermexpression></binarytermexpression>
			$<\!$
[64]	<BinaryNumericExpression' $>$	\rightarrow	PLUS <binarytermexpression></binarytermexpression>
			<binarynumericexpression'></binarynumericexpression'>
[65]		\rightarrow	MINUS <binarytermexpression></binarytermexpression>
			<binarynumericexpression'></binarynumericexpression'>
[66]		\rightarrow	BITWISE OR <binarytermexpression></binarytermexpression>
[00]			<binarynumericexpression'></binarynumericexpression'>
[67]		\rightarrow	BITWISE XOR <binarytermexpression></binarytermexpression>
[01]		/	<pre><binarynumericexpression'></binarynumericexpression'></pre>
[60]			-
[68]	D:	\rightarrow	E CLICATE :
[69]	<BinaryTermExpression $>$	\rightarrow	<binaryshiftedexpression></binaryshiftedexpression>
			<binarytermexpression'></binarytermexpression'>
[70]	<BinaryTermExpression' $>$	\rightarrow	ARITHMETIC_SHIFT_LEFT
			<BinaryShiftedExpression $>$
			<binarytermexpression'></binarytermexpression'>
[71]		\rightarrow	ARITHMETIC SHIFT RIGHT
			<binaryshiftedexpression></binaryshiftedexpression>
			<binarytermexpression'></binarytermexpression'>
[72]		\rightarrow	ϵ
[73]	<binaryshiftedexpression></binaryshiftedexpression>	\rightarrow	<binaryfactorexpression></binaryfactorexpression>
[19]	\Dinary5\timecdExpression>	\rightarrow	
			<BinaryShiftedExpression' $>$

[74]	<binaryshiftedexpression'></binaryshiftedexpression'>	\rightarrow	TIMES <binaryfactorexpression></binaryfactorexpression>
[' -]	(Billion)	,	<binaryshiftedexpression'></binaryshiftedexpression'>
[75]		\rightarrow	DIVIDE <binaryfactorexpression></binaryfactorexpression>
[76]			<pre><binaryshiftedexpression'> PEMAINDED < PinaryPost or Europeanian ></binaryshiftedexpression'></pre>
[76]		\rightarrow	REMAINDER <binaryfactorexpression> <binaryshiftedexpression'></binaryshiftedexpression'></binaryfactorexpression>
[77]		\rightarrow	BITWISE AND <binaryfactorexpression></binaryfactorexpression>
. ,			<binaryshiftedexpression'></binaryshiftedexpression'>
[78]		\rightarrow	$INVERSE_DIVIDE < BinaryFactorExpression>$
[=0]			<binaryshiftedexpression'></binaryshiftedexpression'>
[79]	<binaryfactorexpression></binaryfactorexpression>	\rightarrow	€ «UnawyFyrnycogion»
[80]	<binaryfactorexpression></binaryfactorexpression>	\rightarrow	<unaryexpression> <binaryfactorexpression'></binaryfactorexpression'></unaryexpression>
[81]	<binaryfactorexpression'></binaryfactorexpression'>	\rightarrow	POWER <unaryexpression></unaryexpression>
. ,	, I		<binaryfactorexpression'></binaryfactorexpression'>
[82]		\rightarrow	ϵ
[83]	<If $>$	\rightarrow	IF < Expression > END_OF_INSTRUCTION
[0.4]	JCD 1		<instructionlist> <ifend></ifend></instructionlist>
[84]	<IfEnd $>$	\rightarrow	ELSE_IF <expression> END_OF_INSTRUCTION <instructionlist> <ifend></ifend></instructionlist></expression>
[85]		\rightarrow	ELSE <instructionlist> END</instructionlist>
[86]		$\stackrel{'}{ ightarrow}$	END
[87]	$<\!\!\mathrm{BuiltInFunctionCall}\!\!>$	\rightarrow	READ_REAL LEFT_PARENTHESIS
			RIGHT_PARENTHESIS
[88]		\rightarrow	READ_INTEGER LEFT_PARENTHESIS
[00]		,	RIGHT_PARENTHESIS INTEGER_CAST LEFT_PARENTHESIS <expression></expression>
[89]		\rightarrow	RIGHT PARENTHESIS
[90]		\rightarrow	REAL_CAST LEFT_PARENTHESIS <expression></expression>
. ,			RIGHT_PARENTHESIS
[91]		\rightarrow	BOOLEAN_CAST LEFT_PARENTHESIS < Expression>
[00]			RIGHT_PARENTHESIS
[92]		\rightarrow	PRINTLN LEFT_PARENTHESIS <expression></expression>
[93]	<functioncalltail></functioncalltail>	\rightarrow	RIGHT_PARENTHESIS LEFT PARENTHESIS < Parameter>
[99]		,	RIGHT PARENTHESIS
[94]	<parameter></parameter>	\rightarrow	<expression> <parametertail></parametertail></expression>
[95]		\rightarrow	ϵ
[96]	<parametertail></parametertail>	\rightarrow	COMMA < Expression > < Parameter Tail >
[97]	<functiondefinition></functiondefinition>	\rightarrow	ELINOTION IDENTIFIED LEFT. DADENTHESIS
[98]	< FunctionDennition >	\rightarrow	FUNCTION IDENTIFIER LEFT_PARENTHESIS <argument> RIGHT PARENTHESIS</argument>
			<instructionlist> <functiondefinitionend></functiondefinitionend></instructionlist>
[99]	<FunctionDefinitionEnd $>$	\rightarrow	RETURN < Expression > END
[100]		\rightarrow	END
[101]	<Argument $>$	\rightarrow	IDENTIFIER TYPE_DEFINITION < Type>
[100]			<argumenttail></argumenttail>
[102]	/ArgumentToil>	\rightarrow	€ COMMA IDENTIFIER TVPF DEFINITION <type></type>
[103]	<argumenttail></argumenttail>	\rightarrow	COMMA IDENTIFIER TYPE_DEFINITION <type> <argumenttail></argumenttail></type>
[104]		\rightarrow	ϵ
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B Ensembles First et Follow

	FUNCTION, WHILE, READ_REAL EPSILON_VALUE	
	IDENTIFIER, CONST	
<program></program>	BOOLEAN_CAST, PRINTLN	
	END_OF_INSTRUCTION	
	READ_INTEGER, FOR	
	INTEGER_CAST, LET, IF REAL CAST	
	FUNCTION, READ INTEGER	
	FOR, WHILE, READ REAL	
	INTEGER CAST	END, END OF INSTRUCTION
<instruction></instruction>	BOOLEAN CAST, CONST	ELSE IF, ELSE, RETURN
	IDENTIFIER, PRINTLN, LET, IF	
	REAL CAST	
	FUNCTION, WHILE, READ REAL	
	EPSILON VALUE	
	BOOLEAN CAST, IDENTIFIER	
T 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	CONST, PRINTLN	END ELGE LE ELGE DETLIDN
<instructionlist></instructionlist>	END_OF_INSTRUCTION	END, ELSE_IF, ELSE, RETURN
	READ_INTEGER, FOR	
	INTEGER_CAST, LET, IF	
	REAL_CAST	
<instructionlisttail></instructionlisttail>	EPSILON_VALUE	END, ELSE IF, ELSE, RETURN
(11301 40010112130 1411)	END_OF_INSTRUCTION	· — · ·
<identifierinstruction></identifierinstruction>	IDENTIFIER	END, END_OF_INSTRUCTION ELSE_IF, ELSE, RETURN
	ASSIGNATION	END, END OF INSTRUCTION
<IdentifierInstructionTail $>$	TYPE_DEFINITION, COMMA	ELSE IF, ELSE, RETURN
	LEFT_PARENTHESIS	_ · ·
<assignationtail></assignationtail>	ASSIGNATION, COMMA	END, COMMA END OF INSTRUCTION
Assignation ran	ASSIGNATION, COMMA	ELSE IF, ELSE, RETURN
		END, END OF INSTRUCTION
<constdefinition></constdefinition>	CONST	ELSE IF, ELSE, RETURN
		END, END OF INSTRUCTION
<block></block>	LET	ELSE IF, ELSE, RETURN
т.	DOD WHILE IE	END, END OF INSTRUCTION
<loop></loop>	FOR, WHILE, IF	ELSE IF, ELSE, RETURN
<fortail></fortail>	END_OF_INSTRUCTION	END, END_OF_INSTRUCTION
< FOI 1811 >	TERNARY_ELSE	ELSE_IF, ELSE, RETURN
		RIGHT_PARENTHESIS, END
<type></type>	REAL_TYPE, BOOLEAN_TYPE	COMMA
- 1, PC>	INTEGER_TYPE	END_OF_INSTRUCTION
	DEAD DIMEGED TIMEGED	ELSE_IF, ELSE, RETURN
	READ_INTEGER, INTEGER	
	REAL, PLUS, BOOLEAN	RIGHT_PARENTHESIS, END
	NEGATION, MINUS	COMMA
<expression></expression>	BITWISE_NOT, READ_REAL INTEGER CAST	END_OF_INSTRUCTION
	LEFT PARENTHESIS	ELSE_IF, ELSE
	BOOLEAN CAST, IDENTIFIER	TERNARY_ELSE, RETURN
	PRINTLN, REAL CAST	
		RIGHT PARENTHESIS, END
	(DEDNIADA) ID	COMMA
<ternaryifexpression></ternaryifexpression>	TERNARY_IF	END_OF_INSTRUCTION
	EPSILON_VALUE	$\overline{\mathrm{ELSE}}$ _IF, $\overline{\mathrm{ELSE}}$
		TERNARY_ELSE, RETURN

		DICHT DADENTHECK END
		RIGHT_PARENTHESIS, END COMMA
Tornery Flac Expression >	TERNARY ELSE	END OF INSTRUCTION
<ternaryelseexpression></ternaryelseexpression>	TERNARI _ELSE	ELSE IF, ELSE
		TERNARY ELSE, RETURN
		ARITHMETIC SHIFT RIGHT
		EQUALITY, BITWISE AND
		ARITHMETIC SHIFT LEFT
		TERNARY IF, GREATER THAN
		LESS OR EQUALS THAN
		ELSE, TERNARY ELSE, POWER
	READ_INTEGER, INTEGER	INEQUALITY, BITWISE OR
A. T	REAL, BOOLEAN, READ_REAL	MINUS, RIGHT PARENTHESIS
<atomicexpression></atomicexpression>	INTEGER_CAST	BITWISE XOR, REMAINDER
	BOOLEAN_CAST, IDENTIFIER	COMMA
	PRINTLN, REAL_CAST	END_OF_INSTRUCTION
		RETURN, LESS_THAN
		LAZY_AND, PLUS, LAZY_OR
		INVERSE_DIVIDE, END, TIMES
		ELSE_IF, DIVIDE
		GREATER_OR_EQUALS_THAN
		ARITHMETIC_SHIFT_RIGHT
		EQUALITY, BITWISE_AND
		ARITHMETIC_SHIFT_LEFT
		TERNARY_IF, GREATER_THAN
		LESS_OR_EQUALS_THAN
		ELSE, TERNARY_ELSE, POWER
		INEQUALITY, BITWISE_OR MINUS, RIGHT PARENTHESIS
<atomicidentifierexpression></atomicidentifierexpression>	IDENTIFIER	BITWISE_XOR, REMAINDER
		COMMA
		END OF INSTRUCTION
		RETURN, LESS THAN
		LAZY AND, PLUS, LAZY OR
		INVERSE DIVIDE, END, TIMES
		ELSE IF, DIVIDE
		GREATER_OR_EQUALS_THAN
		ARITHMETIC_SHIFT_RIGHT
		EQUALITY, BITWISE_AND
		ARITHMETIC_SHIFT_LEFT
		TERNARY_IF, GREATER_THAN
		LESS_OR_EQUALS_THAN
		ELSE, TERNARY_ELSE, POWER
	DDGH ON THE	INEQUALITY, BITWISE_OR
<atomicidentifierexpressiontail></atomicidentifierexpressiontail>	EPSILON_VALUE	MINUS, RIGHT_PARENTHESIS
	LEFT_PARENTHESIS	BITWISE_XOR, REMAINDER
		COMMA
		END_OF_INSTRUCTION
		RETURN, LESS_THAN
		LAZY_AND, PLUS, LAZY_OR INVERSE DIVIDE, END, TIMES
		ELSE IF, DIVIDE
		GREATER OR EQUALS THAN
		GREATER_OR_EQUADS_THAN

<unaryexpression></unaryexpression>	INTEGER, REAL, BOOLEAN NEGATION, BITWISE_NOT READ_REAL LEFT_PARENTHESIS IDENTIFIER, BOOLEAN_CAST PRINTLN, READ_INTEGER PLUS, MINUS, INTEGER_CAST REAL_CAST	ARITHMETIC_SHIFT_RIGHT EQUALITY, BITWISE_AND ARITHMETIC_SHIFT_LEFT TERNARY_IF, GREATER_THAN LESS_OR_EQUALS_THAN ELSE, TERNARY_ELSE, POWER INEQUALITY, BITWISE_OR MINUS, RIGHT_PARENTHESIS BITWISE_XOR, REMAINDER COMMA END_OF_INSTRUCTION RETURN, LESS_THAN LAZY_AND, PLUS, LAZY_OR INVERSE_DIVIDE, END, TIMES ELSE_IF, DIVIDE GREATER_OR_EQUALS_THAN
$<\!$	READ_INTEGER, INTEGER REAL, PLUS, BOOLEAN, MINUS BITWISE_NOT, READ_REAL INTEGER_CAST LEFT_PARENTHESIS BOOLEAN_CAST, IDENTIFIER PRINTLN, REAL_CAST	ARITHMETIC_SHIFT_RIGHT EQUALITY, BITWISE_AND ARITHMETIC_SHIFT_LEFT TERNARY_IF, GREATER_THAN LESS_OR_EQUALS_THAN ELSE, TERNARY_ELSE, POWER INEQUALITY, BITWISE_OR MINUS, RIGHT_PARENTHESIS BITWISE_XOR, REMAINDER COMMA END_OF_INSTRUCTION RETURN, LESS_THAN LAZY_AND, PLUS, LAZY_OR INVERSE_DIVIDE, END, TIMES ELSE_IF, DIVIDE GREATER OR EQUALS THAN
<unaryminusplusexpression></unaryminusplusexpression>	READ_INTEGER, INTEGER REAL, PLUS, BOOLEAN, MINUS READ_REAL, INTEGER_CAST LEFT_PARENTHESIS BOOLEAN_CAST, IDENTIFIER PRINTLN, REAL_CAST	ARITHMETIC_SHIFT_RIGHT EQUALITY, BITWISE_AND ARITHMETIC_SHIFT_LEFT TERNARY_IF, GREATER_THAN LESS_OR_EQUALS_THAN ELSE, TERNARY_ELSE, POWER INEQUALITY, BITWISE_OR MINUS, RIGHT_PARENTHESIS BITWISE_XOR, REMAINDER COMMA END_OF_INSTRUCTION RETURN, LESS_THAN LAZY_AND, PLUS, LAZY_OR INVERSE_DIVIDE, END, TIMES ELSE_IF, DIVIDE GREATER_OR_EQUALS_THAN

<Unary $f Atomic Expression>$	READ_INTEGER, INTEGER REAL, BOOLEAN, READ_REAL INTEGER_CAST LEFT_PARENTHESIS BOOLEAN_CAST, IDENTIFIER PRINTLN, REAL_CAST	ARITHMETIC_SHIFT_RIGHT EQUALITY, BITWISE_AND ARITHMETIC_SHIFT_LEFT TERNARY_IF, GREATER_THAN LESS_OR_EQUALS_THAN ELSE, TERNARY_ELSE, POWER INEQUALITY, BITWISE_OR MINUS, RIGHT_PARENTHESIS BITWISE_XOR, REMAINDER COMMA END_OF_INSTRUCTION RETURN, LESS_THAN LAZY_AND, PLUS, LAZY_OR INVERSE_DIVIDE, END, TIMES ELSE_IF, DIVIDE GREATER_OR_EQUALS_THAN
<binaryexpression></binaryexpression>	READ_INTEGER, INTEGER REAL, PLUS, BOOLEAN NEGATION, MINUS BITWISE_NOT, READ_REAL INTEGER_CAST BOOLEAN_CAST LEFT_PARENTHESIS IDENTIFIER, PRINTLN REAL_CAST	TERNARY_IF RIGHT_PARENTHESIS, END COMMA END_OF_INSTRUCTION ELSE_IF, ELSE TERNARY_ELSE, RETURN
<binaryexpression'></binaryexpression'>	LAZY_OR, EPSILON_VALUE	TERNARY_IF RIGHT_PARENTHESIS, END COMMA END_OF_INSTRUCTION ELSE_IF, ELSE TERNARY ELSE, RETURN
<binarylazyorexpression></binarylazyorexpression>	READ_INTEGER, INTEGER REAL, PLUS, BOOLEAN NEGATION, MINUS BITWISE_NOT, READ_REAL INTEGER_CAST LEFT_PARENTHESIS BOOLEAN_CAST, IDENTIFIER PRINTLN, REAL_CAST	TERNARY_IF, LAZY_OR RIGHT_PARENTHESIS, END COMMA END_OF_INSTRUCTION ELSE_IF, ELSE TERNARY_ELSE, RETURN
<binarylazyorexpression'></binarylazyorexpression'>	LAZY_AND, EPSILON_VALUE	TERNARY_IF, LAZY_OR RIGHT_PARENTHESIS, END COMMA END_OF_INSTRUCTION ELSE_IF, ELSE TERNARY_ELSE, RETURN
$<\!$	READ_INTEGER, INTEGER REAL, PLUS, BOOLEAN NEGATION, MINUS BITWISE_NOT, READ_REAL INTEGER_CAST BOOLEAN_CAST LEFT_PARENTHESIS IDENTIFIER, PRINTLN REAL_CAST	LAZY_AND, TERNARY_IF LAZY_OR RIGHT_PARENTHESIS, END COMMA END_OF_INSTRUCTION ELSE_IF, ELSE TERNARY_ELSE, RETURN

$<\!$	EQUALITY, INEQUALITY GREATER_THAN EPSILON_VALUE LESS_OR_EQUALS_THAN GREATER_OR_EQUALS_THAN LESS_THAN	LAZY_AND, TERNARY_IF LAZY_OR RIGHT_PARENTHESIS, END COMMA END_OF_INSTRUCTION ELSE_IF, ELSE TERNARY_ELSE, RETURN
<binarynumericexpression></binarynumericexpression>	READ_INTEGER, INTEGER REAL, PLUS, BOOLEAN NEGATION, MINUS BITWISE_NOT, READ_REAL INTEGER_CAST LEFT_PARENTHESIS BOOLEAN_CAST, IDENTIFIER PRINTLN, REAL_CAST	EQUALITY, TERNARY_IF GREATER_THAN RIGHT_PARENTHESIS, COMMA END_OF_INSTRUCTION LESS_OR_EQUALS_THAN ELSE, TERNARY_ELSE, RETURN LESS_THAN, LAZY_AND INEQUALITY, LAZY_OR, END ELSE_IF GREATER_OR_EQUALS_THAN
<binarynumericexpression'></binarynumericexpression'>	BITWISE_OR, PLUS, MINUS BITWISE_XOR EPSILON_VALUE	EQUALITY, TERNARY_IF GREATER_THAN RIGHT_PARENTHESIS, COMMA END_OF_INSTRUCTION LESS_OR_EQUALS_THAN ELSE, TERNARY_ELSE, RETURN LESS_THAN, LAZY_AND INEQUALITY, LAZY_OR, END ELSE_IF GREATER_OR_EQUALS_THAN
<binarytermexpression></binarytermexpression>	READ_INTEGER, INTEGER REAL, PLUS, BOOLEAN NEGATION, MINUS BITWISE_NOT, READ_REAL INTEGER_CAST BOOLEAN_CAST LEFT_PARENTHESIS IDENTIFIER, PRINTLN REAL_CAST	EQUALITY, TERNARY_IF RIGHT_PARENTHESIS GREATER_THAN BITWISE_XOR, COMMA END_OF_INSTRUCTION LESS_OR_EQUALS_THAN ELSE, TERNARY_ELSE, RETURN LESS_THAN, LAZY_AND INEQUALITY, BITWISE_OR PLUS, LAZY_OR, MINUS, END ELSE_IF GREATER_OR_EQUALS_THAN
<binarytermexpression'></binarytermexpression'>	ARITHMETIC_SHIFT_RIGHT ARITHMETIC_SHIFT_LEFT EPSILON_VALUE	EQUALITY, TERNARY_IF RIGHT_PARENTHESIS GREATER_THAN BITWISE_XOR, COMMA END_OF_INSTRUCTION LESS_OR_EQUALS_THAN ELSE, TERNARY_ELSE, RETURN LESS_THAN, LAZY_AND INEQUALITY, BITWISE_OR PLUS, LAZY_OR, MINUS, END ELSE_IF GREATER_OR_EQUALS_THAN

		ARITHMETIC SHIFT RIGHT
<binaryshiftedexpression></binaryshiftedexpression>	READ_INTEGER, INTEGER REAL, PLUS, BOOLEAN NEGATION, MINUS BITWISE_NOT, READ_REAL INTEGER_CAST LEFT_PARENTHESIS BOOLEAN_CAST, IDENTIFIER PRINTLN, REAL_CAST	EQUALITY, TERNARY_IF ARITHMETIC_SHIFT_LEFT RIGHT_PARENTHESIS GREATER_THAN BITWISE_XOR, COMMA END_OF_INSTRUCTION LESS_OR_EQUALS_THAN ELSE, TERNARY_ELSE, RETURN LESS_THAN, LAZY_AND INEQUALITY, PLUS BITWISE_OR, LAZY_OR, MINUS END, ELSE_IF GREATER_OR_EQUALS_THAN
$<\!$	BITWISE_AND INVERSE_DIVIDE REMAINDER, TIMES EPSILON_VALUE, DIVIDE	ARITHMETIC_SHIFT_RIGHT EQUALITY, TERNARY_IF ARITHMETIC_SHIFT_LEFT RIGHT_PARENTHESIS GREATER_THAN BITWISE_XOR, COMMA END_OF_INSTRUCTION LESS_OR_EQUALS_THAN ELSE, TERNARY_ELSE, RETURN LESS_THAN, LAZY_AND INEQUALITY, PLUS BITWISE_OR, LAZY_OR, MINUS END, ELSE_IF GREATER_OR_EQUALS_THAN
<binaryfactorexpression></binaryfactorexpression>	READ_INTEGER, INTEGER REAL, PLUS, BOOLEAN NEGATION, MINUS BITWISE_NOT, READ_REAL INTEGER_CAST BOOLEAN_CAST LEFT_PARENTHESIS IDENTIFIER, PRINTLN REAL_CAST	ARITHMETIC_SHIFT_RIGHT EQUALITY, BITWISE_AND ARITHMETIC_SHIFT_LEFT TERNARY_IF, GREATER_THAN LESS_OR_EQUALS_THAN ELSE, TERNARY_ELSE INEQUALITY, BITWISE_OR MINUS, RIGHT_PARENTHESIS BITWISE_XOR, REMAINDER COMMA END_OF_INSTRUCTION RETURN, LESS_THAN LAZY_AND, PLUS, LAZY_OR INVERSE_DIVIDE, END, TIMES ELSE_IF, DIVIDE GREATER_OR_EQUALS_THAN

$<\!$	POWER, EPSILON_VALUE	ARITHMETIC_SHIFT_RIGHT EQUALITY, BITWISE_AND ARITHMETIC_SHIFT_LEFT TERNARY_IF, GREATER_THAN LESS_OR_EQUALS_THAN ELSE, TERNARY_ELSE INEQUALITY, BITWISE_OR MINUS, RIGHT_PARENTHESIS BITWISE_XOR, REMAINDER COMMA END_OF_INSTRUCTION RETURN, LESS_THAN LAZY_AND, PLUS, LAZY_OR INVERSE_DIVIDE, END, TIMES ELSE_IF, DIVIDE GREATER_OR_EQUALS_THAN
<if></if>	IF	END, END_OF_INSTRUCTION ELSE IF, ELSE, RETURN
<ifend></ifend>	END, ELSE_IF, ELSE	END, END_OF_INSTRUCTION ELSE_IF, ELSE, RETURN
$<\!$	READ_INTEGER, READ_REAL INTEGER_CAST BOOLEAN_CAST, PRINTLN REAL_CAST	ARITHMETIC_SHIFT_RIGHT EQUALITY, BITWISE_AND TERNARY_IF ARITHMETIC_SHIFT_LEFT GREATER_THAN LESS_OR_EQUALS_THAN TERNARY_ELSE, ELSE, POWER INEQUALITY, BITWISE_OR MINUS, RIGHT_PARENTHESIS REMAINDER, BITWISE_XOR COMMA END_OF_INSTRUCTION RETURN, LESS_THAN LAZY_AND, PLUS, LAZY_OR INVERSE_DIVIDE, TIMES, END ELSE_IF, DIVIDE GREATER_OR_EQUALS_THAN
<functioncalltail></functioncalltail>	LEFT_PARENTHESIS	ARITHMETIC_SHIFT_RIGHT EQUALITY, BITWISE_AND TERNARY_IF ARITHMETIC_SHIFT_LEFT GREATER_THAN LESS_OR_EQUALS_THAN TERNARY_ELSE, ELSE, POWER INEQUALITY, BITWISE_OR MINUS, RIGHT_PARENTHESIS REMAINDER, BITWISE_XOR COMMA END_OF_INSTRUCTION RETURN, LESS_THAN LAZY_AND, PLUS, LAZY_OR INVERSE_DIVIDE, TIMES, END ELSE_IF, DIVIDE GREATER_OR_EQUALS_THAN

<parameter></parameter>	INTEGER, REAL, BOOLEAN NEGATION, BITWISE_NOT READ_REAL, EPSILON_VALUE BOOLEAN_CAST, IDENTIFIER LEFT_PARENTHESIS PRINTLN, READ_INTEGER PLUS, MINUS, INTEGER_CAST REAL_CAST	RIGHT_PARENTHESIS
<parametertail></parametertail>	COMMA, EPSILON_VALUE	RIGHT_PARENTHESIS
<functiondefinition></functiondefinition>	FUNCTION	END, END_OF_INSTRUCTION ELSE_IF, ELSE, RETURN
<functiondefinitionend></functiondefinitionend>	END, RETURN	END, END_OF_INSTRUCTION ELSE_IF, ELSE, RETURN
<argument></argument>	EPSILON_VALUE IDENTIFIER	RIGHT_PARENTHESIS
<argumenttail></argumenttail>	COMMA, EPSILON_VALUE	RIGHT_PARENTHESIS

4 Action Table

Les lignes de l'"action table" représente les variables et les colonnes, les terminaux. Une cellule de cette table contient le numéro d'une règle de production correspondant au numéro repris dans la section grammaire.

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