

G++

G++ is a language being developed for teaching purposes at Gebze Technical University. This language has the following “vision”:

- Lisp like syntax
- Interpreted
- Imperative, non-object oriented
- Static scope, static binding, strongly typed, ...
- A few built-in types to promote exact arithmetic for various domains such as computational geometry

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G++ Interpreter

- Starting G++ without an input file...

```
$ g++
```

```
> _ \\READ-EVAL-PRINT loop starts here...
```

- Starting G++ with an input file...

```
$ g++ myhelloworld.g++
```

```
\\READ-EVAL-PRINT everything in the file...
```

```
> _ \\READ-EVAL-PRINT loop starts here...
```

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G++ – Lexical Syntax

- Keywords: *and, or, not, equal, less, nil, list, append, concat, set, deffun, for, if, exit, load, print, true, false*
- Operators: *+ - / * () ,*
- Comment: Line or part of the line starting with *;;*
- Terminals:
 - *Keywords*
 - *Operators*
 - *Literals: The following are the only predefined types in this language.*
 - *Unsigned integers.*
 - *Unsigned fractions – two unsigned integers separated by the character “.”.*
E.g., 123:12 is the fraction $\frac{123}{12}$
 - *Identifier: Any combination of alphabetical characters, digits and “_” with only leading alphabetical characters.*

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G++ Lexer Tokens

*KW_AND, KW_OR, KW_NOT, KW_EQUAL, KW_LESS, KW_NIL, KW_LIST,
KW_APPEND, KW_CONCAT, KW_SET, KW_DEFFUN, KW_FOR, KW_IF,
KW_EXIT, KW_LOAD, KW_DISP, KW_TRUE, KW_FALSE*

OP_PLUS, OP_MINUS, OP_DIV, OP_MULT, OP_OP, OP_CP, OP_COMMA

COMMENT

VALUEF

IDENTIFIER

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G++ – Concrete Syntax

- Non-terminals:
 - \$START, \$INPUT, \$EXPLIST, \$EXP, \$LIST, \$VALUES, ...

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G++ – Concrete Syntax

- \$START -> \$INPUT
- \$INPUT -> \$EXP | \$EXPLIST

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G++ – Concrete Syntax

- Lists
 - \$LIST -> ' (\$VALUES) | '() | nil
- \$VALUES -> \$VALUES OP_COMMA VALUEF | VALUEF

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G++ – Concrete Syntax

- An expression always returns a fraction
- An expression list returns the value of the last expression
- Expressions:
 - \$EXP -> OP_OP OP_PLUS \$EXP \$EXP OP_CP |
OP_OP OP_MINUS \$EXP \$EXP OP_CP |
OP_OP OP_MULT \$EXP \$EXP OP_CP |
OP_OP OP_DIV \$EXP \$EXP OP_CP |
IDENTIFIER | VALUEF | \$FCALL
 - \$EXPLIST -> OP_OP \$EXPLIST \$EXP OP_CP

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G++ – Syntax

- Assignment:
 - \$EXP -> (set IDENTIFIER \$EXPLIST)
 - Imperative, therefore, \$EXPLIST will be evaluated first...

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G++ – Syntax

- Functions:
 - Definition:
 - EXPI -> (deffun Id IDLIST EXPLISTI)
 - Call:
 - EXPI -> (Id EXPLISTI)
 - Parameter passing by value
 - Returning the value of the last expression
 - *Note that function definition is an expression always returning 0*

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G++ – Syntax

- Control Statements:
 - EXPI -> (if EXPB EXPLISTI)
 - EXPI -> (if EXPB EXPLISTI EXPLISTI)
 - EXPI -> (while (EXPB) EXPLISTI)
 - EXPI -> (for (Id EXPI EXPI) EXPLISTI)

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G++ – Variables

- EXPI -> (defvar Id EXPI) *// declaring a variable*
- EXPI -> (set Id EXPI) *// setting a variable*
 - Scope:
 - Static, lexical scope (shadowing)
 - Binding:
 - Static binding
 - Typing:
 - Strong typing...

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Example Programming in G++

```
$ g++                                ;; helloworld.g++  
> (load "helloworld.g++")          (deffun sumup (x)  
> (sumup 4)                        (if (equal x 0)  
10                                1  
> (exit)                          (+ x (sumup (- x 1)))  
$_                                )  
                                )
```