

# 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

# G++ Interpreter

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

```
$ g++
```

```
> _
```

[\\READ-EVAL-PRINT](#) loop starts here...

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

```
$ g++ myhelloword.g++
```

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

```
> _
```

[\\READ-EVAL-PRINT](#) loop starts here...

# G++ – Lexical Syntax

- Keywords: *and, or, not, eq, gt, nil, set, defvar, deffun, while, if, load, disp, true, false*
- Operators: *+ - / \* ( ) ,*
- Comment: Line or part of the line starting with *;;*
- Terminals:
  - *Keywords*
  - *Operators*
  - *Literals: There is only predefined type in this language.*
    - *Unsigned fractions – two unsigned integers separated by the character “f”. E.g., 123f12 is the fraction  $\frac{123}{12}$*
  - *Identifier: Any combination of alphabetical characters, digits and “\_” with only leading alphabetical characters.*

# G++ Lexer Tokens

*KW\_NIL, DEFF, KW\_WHILE, KW\_IF, KW\_EXIT,  
KW\_LOAD, KW\_DISP, KW\_TRUE, KW\_FALSE*

*OP\_PLUS, OP\_MINUS, OP\_DIV, OP\_MULT, OP, CP, OP\_SET  
OP\_COMMA, OP\_AND, OP\_OR, OP\_NOT, OP\_EQ, OP\_GT*

*COMMENT*

*VALUEF*

*ID*

# G++ – Concrete Syntax

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

# G++ – Concrete Syntax

- $\$START \rightarrow \$INPUT$
- $\$INPUT \rightarrow \$FUNCTION \mid \$EXP \mid \$EXPLIST$

# G++ – Concrete Syntax

- An expression always returns a fraction
- An expression list returns the value of the last expression
- Expressions:
  - $\$EXP \rightarrow OP\_OP \ OP\_PLUS \ \$EXP \ \$EXP \ OP\_CP \mid$   
 $OP\_OP \ OP\_MINUS \ \$EXP \ \$EXP \ OP\_CP \mid$   
 $OP\_OP \ OP\_MULT \ \$EXP \ \$EXP \ OP\_CP \mid$   
 $OP\_OP \ OP\_DIV \ \$EXP \ \$EXP \ OP\_CP \mid$   
 $ID \mid VALUEF \mid \$FCALL \mid \$ASG$
  - $\$EXPLIST \rightarrow OP\_OP \ \$EXPLIST \ \$EXP \ OP\_CP$

# G++ – Syntax

- Assignment:
  - $\$ASG \rightarrow OP\ OP\_SET\ ID\ \$EXP\ CP$
  - Imperative, therefore  $\$EXP$  will be evaluated first...



# G++ – Syntax

- Functions:

- Definition:

\$FUNCTION -> OP DEFF ID OP ( | ID | ID ID | ID ID ID ) CP  
OP \$EXPLIST CP

Extended syntax for  
four alternatives

- Call:

\$FCALL -> OP ID ( | \$EXP | \$EXP \$EXP | \$EXP \$EXP \$EXP ) CP

- Parameter passing by value (only up to 3 parameters allowed)
  - Returning the value of the last expression
  - *Note that function definition is an expression always returning 0f1*

# G++ – Syntax

- Control Statements:

- \$EXP -> (if \$EXPB \$EXPLISTI \$EXPLISTI)
- \$EXP -> (while \$EXPB \$EXPLISTI)

For easy writing, '(', 'if',  
'while' etc. are used  
instead of their  
corresponding tokens

- Binary values and expressions

- \$EXPB -> (eq \$EXP \$EXP) : returns true if equal
- \$EXPB -> (gt \$EXP \$EXP) : returns true if greater
- \$EXPB -> KW\_TRUE | KW\_FALSE
- \$EXPB -> (and \$EXPB \$EXPB)
- \$EXPB -> (or \$EXPB \$EXPB)
- \$EXPB -> (not \$EXPB)

# G++ – Variables

- `$EXP -> OP DEFV ID $EXP CP` *// declaring a variable*
- `$EXP -> OP KW_SET ID $EXP CP` *// setting a variable*
  - Scope:
    - Static, lexical scope (shadowing)
  - Binding:
    - Static binding
  - Typing:
    - Strong typing...

# Example Programming in G++

\$ g++

> (load "helloworld.g++")

> (sumup 4)

10

> (exit)

\$ \_

;; helloworld.g++

(deffun sumup (x)

(if (eq x 1f1) (1)

(+ x (sumup (- x 1f1))))

)