

# Nuts and Bolts

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## Low Level

This web page/document includes miscellaneous low-level details (Alastair, Brian, and Sam can safely ignore it) in regards to Cooperscript implementation, some of which are obsolete.

## Public Fields

Public fields are Cooperscript fields (method variables) which are declared in a var block, whereas private (inner) fields are declared in an ivar block. Public fields which include getters and/or setters cannot be modified directly using an assignment statement, except within the class in which they are declared. For a field called myfield, the corresponding getter method is called get-myfield, and the corresponding setter method is called set-myfield. For a boolean field called myfield, the corresponding getter method is called is-myfield. For a boolean field called is-myfield, the corresponding getter method is called get-myfield.

## Cooperscript Parsing

Parser uses following sets of initial chars. (in parentheses or on separate line) to help determine class of tokens encountered.

- Alpha:
  - keyword ( a-z )
  - built-in function ( a-z )
  - system function\* ( \_ )
- Identifiers:
  - local variable ( A-Z, \_ )
  - field ( A-Z, \_ )
  - method ( A-Z, \_ )
  - class ( A-Z, \_ )
- Numeric:
  - 0-9, -
- Punctuation:
  - (, ), {, }, #, ", \$, ;
- Operators:
  - +, -, \*, /, %, &, |, ^, ~, =, !, <, >, :, ?
- Invalid:
  - Literal Chars. ( \, . )
  - Symbols ( [, ], ', ` , @, comma )

Oddball characters:

- ( \ ) backslash found only in string literals
- ( . ) period found only in numeric literals
- ( - ) hyphen found at beginning of numeric literals and 3 operators: negate, subtract, -=
- ( } ) close brace in string literal must be escaped

\* System function names begin and end with 2 consecutive underscores. User-defined identifiers begin with optional single underscore followed by a letter, and may contain letters of both cases. The other 3 types of identifiers (keywords, built-in functions, system functions) contain lower case letters only.

## Lexical Scanner (Summary)

Each bottom-level category followed by (n), where n = count, category omitted if zero.

- ALPHA
  - KEYWORD
  - BLTINFUNC
  - SYSFUNC
  - IDENTIFIER
- NUMERIC
  - BINARY
  - OCTAL
  - HEXADECIMAL
  - DECIMAL
  - LONG
  - FLOAT
- PUNCT
  - OPENPAR
  - CLOSEPAR
  - SEMICOLON
  - CMTLINE
  - CMTBLK
  - STRLIT
  - OPERATOR
- INVALID
  - ERRSYM
  - ERRESC
  - ERRDOT
- Error messages:
  - Line no., description

## Lexical Scanner (Detail)

```
LN # TYP VAL CNV
==== === === ===
      XXX xxx xxx
0001 [ line buf one ]
      KWD str op
      FUN str
      SYS str
      ID str
0002 [ line buf two ]
      BIN str dec
      OCT str dec
      HEX str dec
      DEC dec dec
      LNG dec dec
      FLT str val
0003 [ line buf three ]
      PAR (
      PAR )
      PAR ;
      CMT {
      CMT }
      CMT #
      STR str
      OP str name
      ERR str desc
      [ omit blank lines ]
```

Each 4-digit line no. followed by contents of line in square brackets, followed by tokens, one per line.  
Global boolean: summary/detail

## Code Execution

All Cooperscript source code is in Polish notation, in which operators precede their operands. The following algorithm is used, in which operators are stored in one stack and operands in a separate stack. Executable code consists of tree nodes.

```
rightp = root
while true do
  if rightp = 0 then
    op = pop operator
    if op = root then
      return true
    if op = while/for/loopbody then
      pop rightp from operator stack
      continue
    if op = if then
      pop rightp from operator stack
      pop (
      continue
    if op = block then
      pop (
      pop if from operator stack
      pop (
      pop rightp from operator stack
      continue
  count = 0
  while true do
    pop operand
    if open parenthesis then break
    push operand on operator stack
    increment count
  if op = call then
    rightp = handlecall(count)
    continue
  if op = constructor then
    rightp = handlecons(count)
    continue
  if op = callback then
    rightp = handlecallback(count)
    continue
  pop operand from operator stack
  push operand
  repeat count - 1 times
    pop operand from operator stack
    push operand
    rightpop = pop
    leftpop = pop
    push op(leftpop, rightpop)
    // (: obj attridx) => obj...
  if count = 1 then
    if unary op then
      push op(pop)
    else
      rightpop = pop
```

```

        leftpop = pop
        push op(leftpop, rightpop)
    pop rightp from operator stack
    continue
currnode = getnode(rightp)
if open parenthesis then
    push on operand stack
    push rightp on operator stack
    rightp = currnode.downp
else if operand then
    push on operand stack
    rightp = currnode.rightp
else if operator then
    push on operator stack
    rightp = currnode.rightp
else if funcbody then
    handlebody
    rightp = currnode.rightp
else if endfunc then
    pop downto begin from operator stack
    pop rightp from operator stack
else if while/for then
    rightp = currnode.rightp
    push rightp, while/for on operator stack
else if do then
    flag = pop
    if not flag then
        pop while, rightp from operator stack
        pop rightp from operator stack
        pop (
    else if continue then
        pop downto while from operator stack
        pop rightp from operator stack
    else if break then
        pop downto while from operator stack
        pop rightp, rightp from operator stack
        pop (
    else if breakfor then
        pop downto for from operator stack
        pop rightp, rightp from operator stack
        pop (
        pop (
    else if contfor then
        pop downto loopbody from operator stack
        pop rightp from operator stack
else if then then
    flag = pop
    if flag then
        rightp = currnode.rightp
    else
        pop if from operator stack
        pop (
        pop rightp from operator stack

```

```

else
    return false

pop downto x from operator stack: // handle pop-downto
    pop multiple from operator stack
    if: pop (
    while: pop (

do block while flag: // handle do-while loop
    while true do block if not flag then break

handlecons(count):
    pop classref from operator stack
    gen objref: root 0/1 = instance/class vars
    push objref on operator stack
    return handlecall(count)

handlecall(count):
    pop objref from operator stack
    push objref
    pop codept from operator stack
    return handlecodept(codept, count)

handlecodept(codept, count):
    repeat count - 2 times
        pop val from operator stack
        push val
    push count - 1
    return codept

handlecallback(count):
    pop callback from operator stack
    unpack objref, codept
    push objref
    return handlecodept(codept, count)

handlebody:
    count = pop
    root = new node
    for i = count - 2 downto 0 do
        parm = pop
        add parm to 1st half of tree[i]
    objref = parm
    rightp = currnode.rightp
    loccount = currnode value
    repeat loccount times
        add null node to 2nd half of tree
    rightp = currnode.rightp

```