Introduction to Lush

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http://lush.sourceforge.net

Language Design

- Simple syntax
- Interpreted (typeless)
- Can be compiled (typed)
- C/C++ inline
- Powerful built-in data structure
- Online help

Functions

- The essential two things:
  - Define a function
  - Apply the function
- Compare with C

```
? (de square (x)
        (* x x))

 ? (square 4)
  = 16
```

```
double square (double x) {
        return x*x;
}

square(4);
```

Operators

- Prefix, no infix
  - ? (+ 3 4) ;; 3+4
  - ? (* 3 4) ;; 3*4
  - ? (> (- 2 4) 1) ;; (2 – 4) > 1
  - ? (- 4) ;; -4
- No precedence
- Really just built-in functions

Variables and Assignment

- Global variables: setq
  - ? (setq x 5) ;; x = 5
  - ? (* x x)
- Local variables: let, let*

```
? (de harmonic (n)
        (let* ((z 0) (i 0))
            (while (< i n)
                (incr i)
                (incr z (/ i)))))
```

Control Flow

- Selection if,when, cond, selectq
  - no else!
  - ? (if (> x 0) ;; a sign function
    +1
    -1)
- Repetition for, while, repeat
  - ? (for (i 2 5)
    (print i (sqrt i)))

```
2    1.4142
3    1.7321
4    2
5    2.2361
= 2.2361
```

Basic Types

- Literals have types!
  - numbers ? (setq x -3.4e6)
  - strings ? (setq x “foo”)
  - boolean ? (setq x t)
    ? (setq x ()) ;; (if x 1 2)
  - lists ? (setq x '(1 2 3))
  - symbols ? (setq x 'foo)

Arrays

- 0 to 8 dimensions
  - ? (setq x (matrix 10 8 4)) ;; double x[10][8][4];
- Get value
  - ? (x 0 0 0) ;; x[0][0][0]
- Set value
  - ? (x 0 0 0 45.6) ;; x[0][0][0] = 45.6;

Scalar

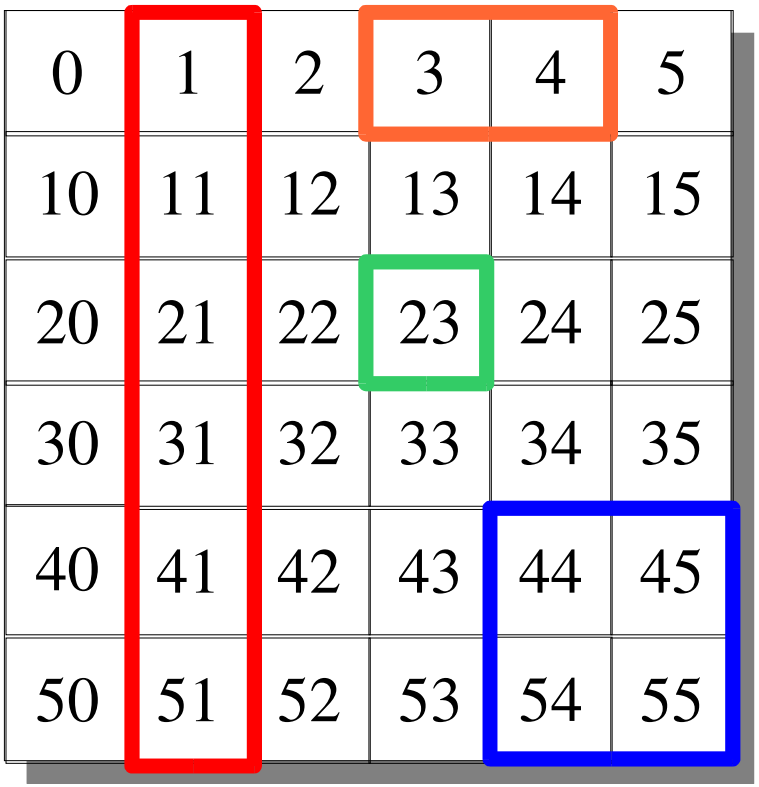
- Is 0 dimensional array
- Is NOT number!
  - Number to scalar:
    - ? (setq x ((matrix) 10))
  - Scalar to number:
    - ? (x)
- Very useful

Scalar

- As results
  - ? (idx-dot [1 2 3] [1 2 3]) ;; W'X
    = [@ 14]

- As operands ;; (y-sgn(W'X))X
  - ? (idx-dotm0 [1 2 3] ((matrix) 10))
    = [10 20 30]
  - ? (setq p [1 2 3])
  - ? (idx-dotm0acc [1 2 3] ((matrix) 10) p) ;;what's p?

Narrow and Select



0	1	2	3	4	5
10	11	12	13	14	15
20	21	22	23	24	25
30	31	32	33	34	35
40	41	42	43	44	45
50	51	52	53	54	55

? (select x 1 1) 1D

? (narrow (narrow x 0 2 4) 1 2 4) 2D

? (narrow (select x 0 0) 0 2 3) 1D

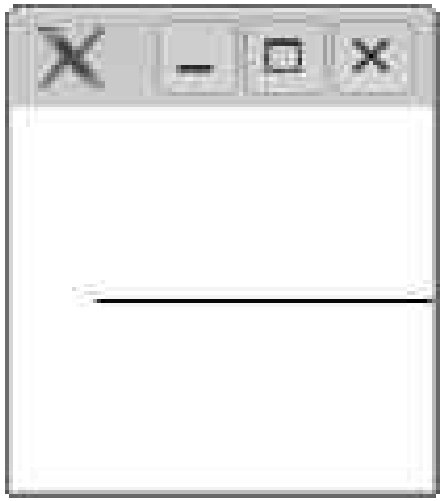
? (select (select x 1 3) 0 2) scalar!

Array Iterator

- Works like foreach
  - ? (setq x [1 2 3])
  - ? (idx-bloop ((v x))
    (v (* (v) 10)))
    = [10 20 30]
- Iterators can be nested
  - inner most: manipulate scalar

GUI, Plotting

- Open a window
  - ? (new-window 10 10 100 100)
  - <x> <y> <w> <h>
- Draw a line
  - ? (draw-line 20 50 100 50)
  - <x1> <y1> <x2> <y2>
  - figure out the origin, x-axis, y-axis!



Searchable Online Help