SICP

- Procedure = processes (to direct)
- using Lisp
→ Techniques for controlling complexity · what CS is about
  - Black Box Abstraction · Module - do not need to know what is inside

$y \to$ ave. $(y, x/y)$ → Fixed Pt. → 36 → sqrt x → 6

Procedure is another procedure

→ 1st topic in course is Black Box Abstraction
  - Primitive objects
    - Procedures + Data
  - Means of combination
  - Means of abstraction
  - Capturing Patterns

→ 2nd Topic

(* x (+ a1 a2))

Est. Conventional Interfaces

- generic operations
- Lg.-scale structure and modularity
- OOP
- operations on aggregates (streams)

3rd Topic

Looking at tech. of building new comp. languages
- process of interpreting Lisp
- metalinguistic Abstraction
  - Eval / Apply

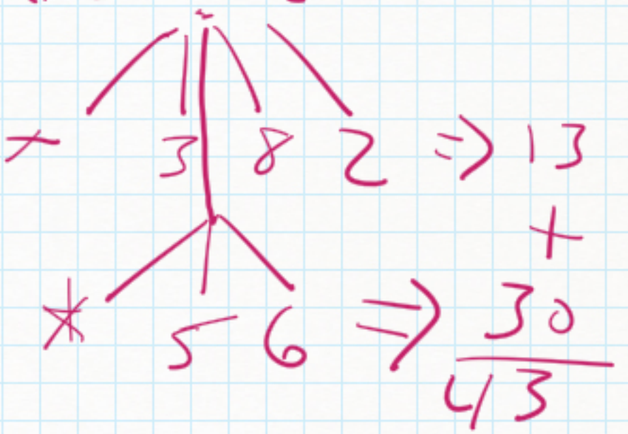
Language
- what are primitive elements?
- means of combination?
- means of abstraction?

primitive data
- 3 17.4 5 + (name for adding)

(+ 3 17.4 5) ⇒ 25.4
- operator
- operands
- combination

(+ 3 (* 5 6) 8 2) ⇒ 43
- Prefix notation (operator left)
- Fully parethesized

Tree



Means of abstraction

(DEFINE A (+ 5 5))

(* A A) ⇒ 625

(DEFINE B (+ A (* 5 A)))

B ⇒ 150

(+ A (/ B 5)) ⇒ 55

Basic Means of Defining Something

to

(DEFINE (SQUARE X) (* X X)) ⇒ Syntactic Sugar

Square Something

= multiply it by itself

SAME

(SQUARE 10) ⇒ 100

(DEFINE SQUARE (LAMDA (X) (* X X)))

of this

make a procedure

(define (average x y)
  (/ (+ x y) 2))

(define (mean-square x y)
  (average (square x)
           (square y)))

← Black Box
Don't need to know if square is built-in or compound

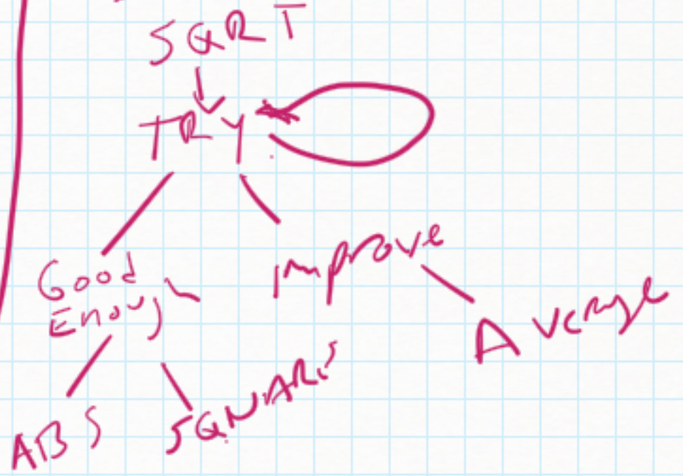
$$abs(x) := \begin{cases} -x & x < 0 \\ 0 & \text{for } x = 0 \\ x & \text{for } x > 0 \end{cases}$$

```
(DEFINE (ABS x)
  (COND ((< x 0) (- x))
        ((= x 0) 0)
        ((> x 0) x)))
```

clause — predicate — action

```
(DEFINE (TRY GUESS X)
  (IF (GOOD-ENOUGH? GUESS X)
      GUESS
      (TRY (IMPROVE GUESS X))))

(DEFINE (SQRT X) (TRY 1 X))
```



(sqrt 2)

(try 1 2)

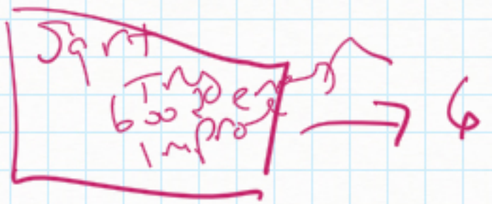
(try (improve 1 2) 2)

(average 1 (/ 2 1))

(try 1.5 2) eaj

1.4142...

Recursive Definition



36 → → 6

Block Structure

conclusion	procedures	DATA
Primitive Elements	+ * < =	27 1.738
Means of combination	( ) composition cond IF	
means of abstraction	DEFINE	