



Programs and Design Recipes



Last Lecture

- Why we chose DrScheme
- Mathematical numbers
- Numbers on the machine
- Our first program
- Step by step evaluation
- Things we can and can't do with what we know of DrScheme



Today's Goals

- Programs can go wrong in different ways:
 - Syntactically
 - At runtime
- Ingredients of a design recipe
 - Components
 - Order



Let's Take a Closer Look at Programs

- A syntactically correct program can be
 - An atom, like a number 17, "rabbit", of a variable *radius*, or
 - A compound program,
 - starting with `(`
 - followed by operator (variable name)
 - then one (for now) or more programs
 - and, finally, ending with `)`
- Syntax errors: 3) , (3 + 4) , [+ 3 1],)+(...



Runtime Errors

- Happen when operators are “surprised”
- Consider the following examples:
 - `(/ 1 0)`
 - `(sqrt 1 2 3 4)`
 - `(rabbit 17)`
- Try things like that in DrScheme, and make a mental note of the error messages you get back.



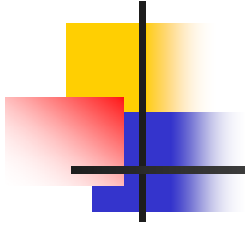
Our First Design Recipe

```
;; Contract: area-of-ring : number number -> number
;; Purpose: to compute the area of a ring whose radius is
;; outer and whose hole has a radius of inner
;; Example: (area-of-ring 5 3) should produce 50.24
;; Definition: [refines the header]
(define (area-of-ring outer inner)
  (- (area-of-disk outer)
     (area-of-disk inner)))
;; Tests:
(area-of-ring 5 3)
;; expected value
50.24
```



Contract (a), Purpose (b), and Examples (c)

- area-of-rectangle:
 - a) Area-of-rectangle: p-real p-real -> p-real
 - b) To compute area of a rectangle
 - c) Use several!
 - a) (= (area-of-rectangle 2 3) 6)
 - b) (= (area-of-rectangle 3 2) 6)
 - c) (= (area-of-rectangle 3 3) 9)
 - d) (= (area-of-rectangle 2 5) 10) ...



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- **Always** write examples before definition!
 - Compare this to the scientific method
 - If you don't, you become a "Hacker"
 - Not good 😊
 - To get full credit for assignments, always follow recipe carefully, and submit all parts of recipe.