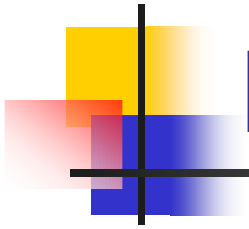
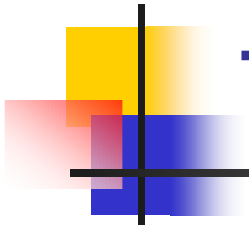
Compound Data



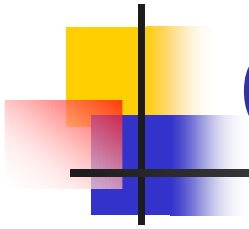
Last Lecture

- Booleans
  - Only two elements
- Symbols
  - Not to be confused with variables
- Strings
- Notions of equality on values



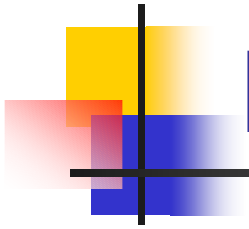
Today's Goals

- Compound data
  - Where/when it's needed
  - How to declare it
  - How to construct (create) it
  - How to deconstruct it (take it apart)
  - How to design functions that process compound data
  - How to define such functions



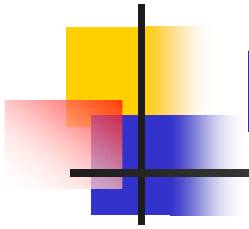
Compound Data

- Again, what can we compute the language constructs we've seen so far?
- What information is associated with
  - A university course,
  - A car, and
  - A house?
- What makes something an atom or compound?



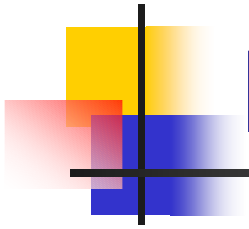
Built-in Example

- Cartesian coordinates
  - Mathematically, a pair (x,y)
  - DrScheme
    - (make-posn 5 6) → (make-posn 5 6)
      - Constructors are like “frozen” functions
    - (define a (make-posn 3 4))
    - (posn-x a) → 3
    - (posn-y a) → 4
- Can we define functions that compute:
  - distance-to-origin, mirror-image, etc?



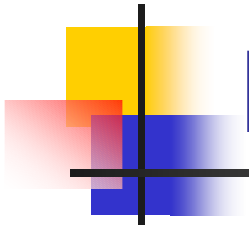
Distance-to-origin

- Contract:
  - distance-to-0: posn -> +ve-number
- Purpose: Takes a position and returns distance from the origin.
- Examples:
  - (distance-to-0 (make-posn 0 10)) → 10
  - (distance-to-0 (make-posn 10 0)) → 10
  - (distance-to-0 (make-posn 3 4)) → 5



Distance-to-origin

- Definition:
  - (define (distance-to-0 p)
    (sqrt (+ (square (posn-x p))
    (square (posn-y p)))))
- This function deconstructs it's input and return a simple value. More often programs will ?.



Rolling Your Own Compounds

- What if we want 3D coordinates?
- First you declare this concept to DrScheme:
  - (define-struct my-posn (x y z))
- Then you can use it:
  - (define b (make-my-posn 3 4 5))
  - (+ (my-posn-x b) (my-posn-y b)) → 7