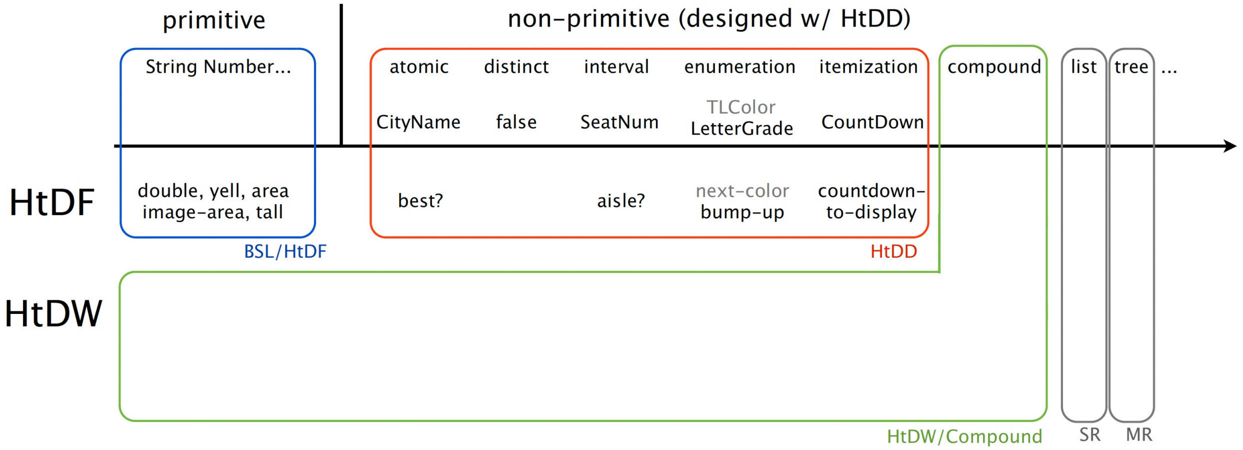
form of data



primitive

non-primitive (designed w/ HtDD)

String Number...

atomic distinct interval enumeration itemization

compound

list tree ...

CityName false SeatNum TLColor LetterGrade CountDown

HtDF

double, yell, area image-area, tall

best? aisle? next-color bump-up countdown-to-display

BSL/HtDF

HtDD

HtDW

HtDW/Compound

SR MR

lecture 05 – 2 main topics

- revising an existing program
  - in this case a world program
  - you will see this in problem sets 4 and 5, can also show up in exam problems
  - and is nearly all of the work developers do
  - as always, we will work systematically, re-running the recipes as needed
- compound data
  - “2 or more items of information that naturally belong together”

- also, variations on enumeration templating
  - large enumerations
  - enumerations where an additional parameter is complex

SPD Checklists

See full recipe page for details

```
(require spd/tags)
(require 2htdp/image)
(require 2htdp/universe)

;; My world program  (make this more specific)
(@htdw WS)
;; =================
;; Constants:


;; =================
;; Data definitions:

(@htdd WS)
;; WS is ... (give WS a better name)



;; =================
;; Functions:

(@htdf main)
(@signature WS -> WS)
;; start the world with (main ...)
;;
(@template-origin htdw-main)
(define (main ws)
  (big-bang ws         ;WS
    (on-tick   tock)   ;WS -> WS
    (to-draw   render) ;WS -> Image
    (on-mouse  ...)    ;WS Integer Integer MouseEvent -> WS
    (on-key    ...)))  ;WS KeyEvent -> WS

(@htdf tock)
(@signature WS -> WS)
;; produce the next ...
;; !!!
(define (tock ws) ws)

(@htdf render)
(@signature WS -> Image)
;; render ...
;; !!!
(define (render ws) empty-image)
```

HtDW

1. Domain analysis (use a piece of paper!)
    1. Sketch program scenarios
    2. Identify constant information
    3. Identify changing information
    4. Identify big-bang options
2. Build the actual program
    1. Constants (based on 1.2 above)
    2. Data definitions (based on 1.3 above)
    3. Functions
        1. main first (based on 1.4 and 2.2 above)
        2. wish list entries for big-bang handlers
    4. Work through wish list until done

```
on-tick
to-draw
on-key
on-mouse
```

HtDD

First identify form of information, then write:

1. A possible structure definition (not until compound data)
2. A type comment that defines type name and describes how to form data
3. An interpretation to describe correspondence between information and data.
4. One or more examples of the data.
5. A template for a 1 argument function operating on data of this type.

HtDF

1. Signature, purpose and stub.
2. Define examples, wrap each in check-expect.
3. Template and inventory.
4. Code the function body.
5. Test and debug until correct

Test guidelines

1. at least 2
2. different argument/field values
3. code coverage
4. points of variation in behavior
5. 2 long / 2 deep

Choosing form of data definition

When the form of the information to be represented...	Use a data definition of this kind
is atomic	simple atomic data (String, Number...)
is numbers within a certain range	number type and CONSTRAINT
consists of a fixed number of distinct items	enumeration (one-of several strings)
is comprised of 2 or more subclasses, at least one of which is not a distinct item	itemization (one-of several subclasses)
consists of items that naturally belong together	compound data
is arbitrary sized	well formed self-referential data definition (or mutually referential)
is naturally composed of different parts	reference to another defined type

Metadata tags

```
@assignment
@cwl

@problem

@htdw
@htdd
@htdf

@signature
@dd-template-rules
@template-origin
@template
```

Data Driven Template Rules

Form of data	cond question (if any)	Body or cond answer

atomic non-distinct	type predicate
	`(string? x) (number? x)`
	`etc.`
		`(... x)`

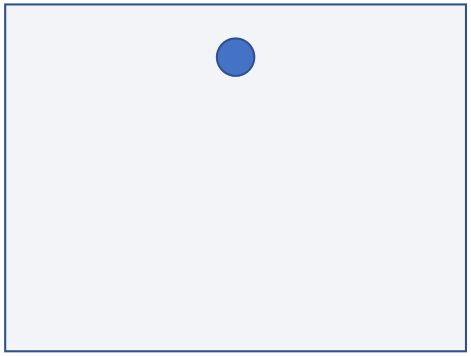
atomic distinct	`equality predicate`
	`(string=? x “red”)`
	`etc. possible w/ guard`
		`(...)`

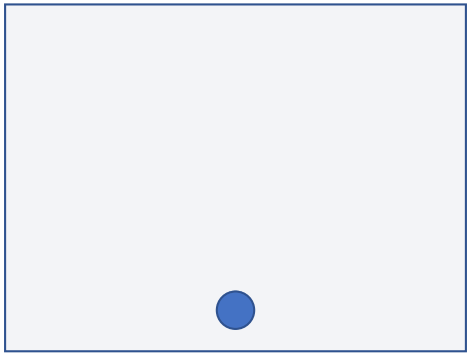
one of		cond w/ one Q&A pair per subclass be sure to guard in mixed data itemizations

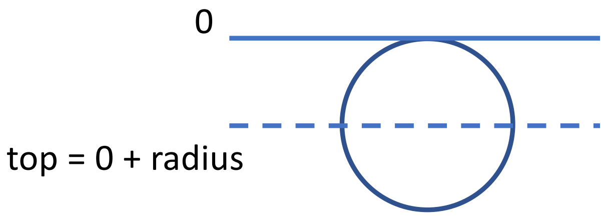
compound	predicate
	`(firework? x)`
		all selectors
		`(... (balloon-x b)`
		`     (balloon-y b))`

self-reference		form natural recursion `(fn-for-los (rest los))`
reference		call to other type’s templates function `(fn-for-drop (first lod))`

for additional parameters with atomic type add parameter everywhere after ...







Constant

width
height
center x
speed
spider radius

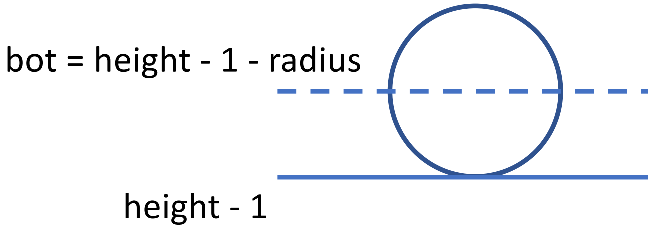
spider image
mts

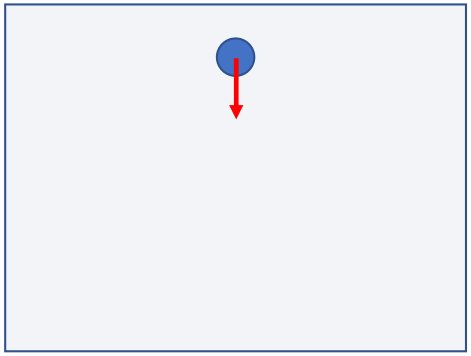
Changing

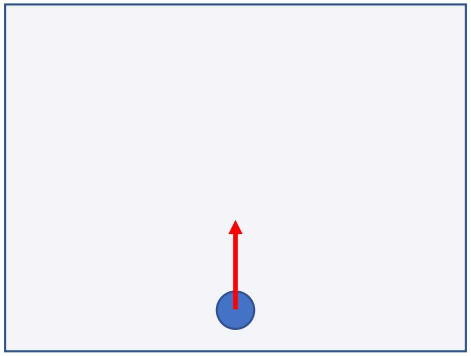
spider y

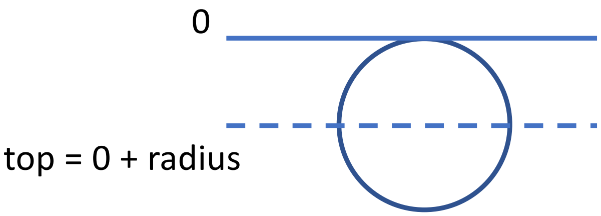
BB options

on-tick
to-draw
~~on-key~~
~~on-mouse~~









Constant

width
height
center x
~~speed~~
spider radius

spider image
mts

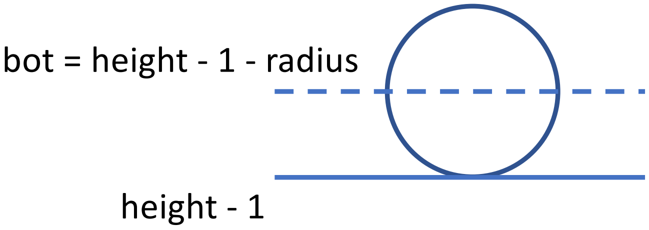
Changing

spider y
spider dy

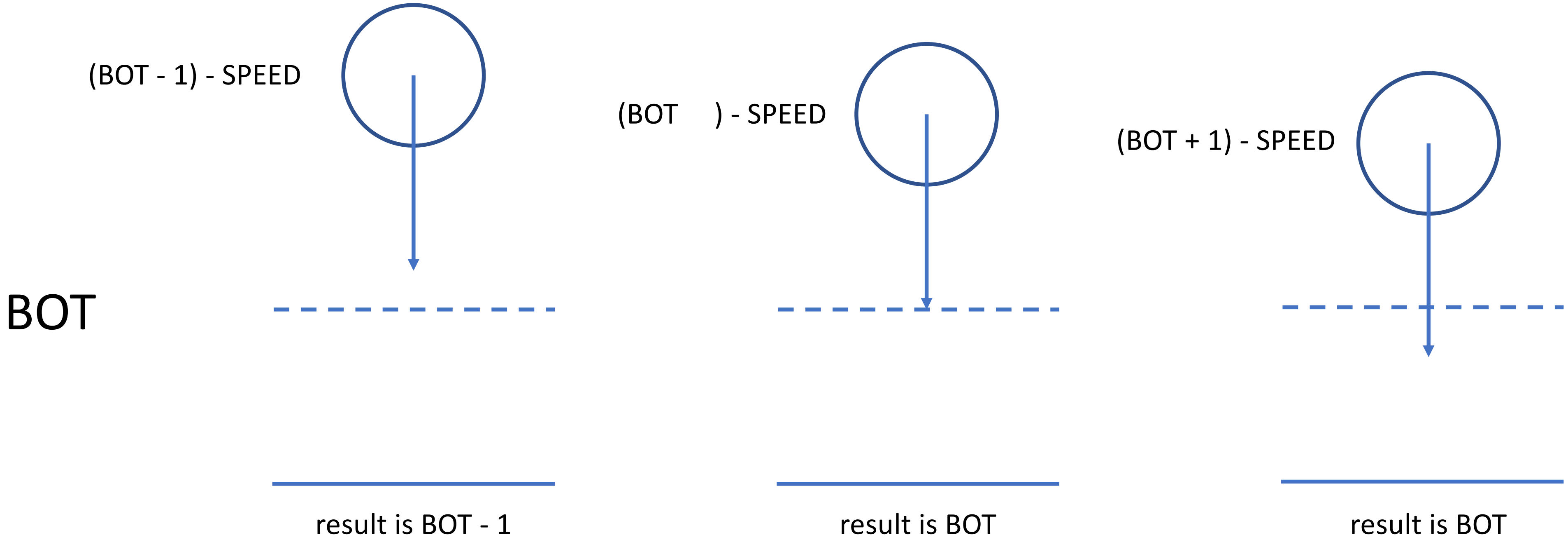
BB options

on-tick
to-draw
on-key
~~on-mouse~~

change direction at, and
don't go past top/bot



boundary case analysis for tock



BOT

(BOT - 1) - SPEED

result is BOT - 1

(BOT) - SPEED

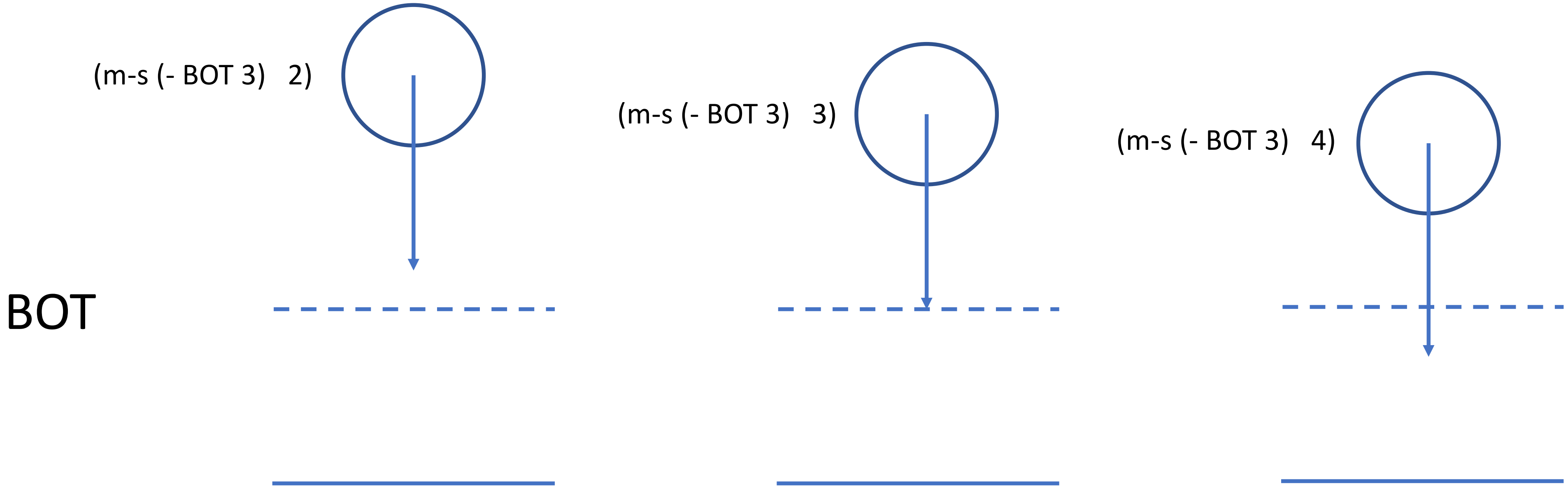
result is BOT

(BOT + 1) - SPEED

result is BOT

boundary case analysis for tock

plus symmetric (mirror image) cases with TOP



BOT

(m-s (- BOT 3) 2)

(m-s (- BOT 3) 3)

(m-s (- BOT 3) 4)

result is y= BOT - 1,
same dy

result is y= BOT,
flip dy

result is y= BOT,
flip dy