Expanding the Zoo

We have snakes and armadillos. Let's add ants.

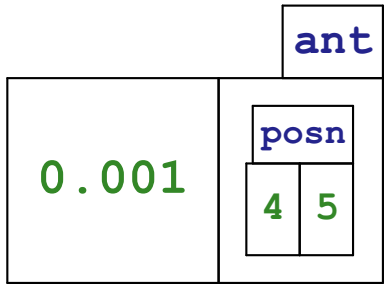
An ant has

- a weight
- a location in the zoo

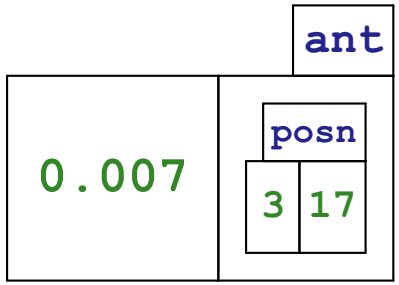
```
; An ant is
;   (make-ant num posn)
(define-struct ant (weight loc))

(make-ant 0.001 (make-posn 4 5))

(make-ant 0.007 (make-posn 3 17))
```

Ants

```
(make-ant 0.001 (make-posn 4 5))
```




```
(make-ant 0.007 (make-posn 3 17))
```



Programming with Ants

Define `ant-at-home?`, which takes an ant and reports whether it is at the origin

Contract, Purpose, and Header

```
; ant-at-home? : ant -> bool
```

Contract, Purpose, and Header

```
; ant-at-home? : ant -> bool
; Check whether ant a is home
```

Contract, Purpose, and Header

```
; ant-at-home? : ant -> bool
; Check whether ant a is home
(define (ant-at-home? a)
  ...)
```

Examples

```
; ant-at-home? : ant -> bool
; Check whether ant a is home
(define (ant-at-home? a)
  ...)
```

```
(check-expect (ant-at-home? (make-ant 0.001 (make-posn 0 0)))
              true)
(check-expect (ant-at-home? (make-ant 0.001 (make-posn 1 1)))
              false)
```

Template

```
; ant-at-home? : ant -> bool
; Check whether ant a is home
(define (ant-at-home? a)
  ...)
```

```
(check-expect (ant-at-home? (make-ant 0.001 (make-posn 0 0)))
              true)
(check-expect (ant-at-home? (make-ant 0.001 (make-posn 1 1)))
              false)
```

Template

```
; ant-at-home? : ant -> bool
; Check whether ant a is home
(define (ant-at-home? a)
  ...)


; An ant is
;  (make-ant num posn)
```

```
(check-expect (ant-at-home? (make-ant 0.001 (make-posn 0 0)))
              true)
(check-expect (ant-at-home? (make-ant 0.001 (make-posn 1 1)))
              false)
```

Template

```
; ant-at-home? : ant -> bool
; Check whether ant a is home
(define (ant-at-home? a)
  ... (ant-weight a)
  ... (ant-loc a) ...)

; An ant is
;  (make-ant num posn)
```

```
(check-expect (ant-at-home? (make-ant 0.001 (make-posn 0 0)))
              true)
(check-expect (ant-at-home? (make-ant 0.001 (make-posn 1 1)))
              false)
```

Template

```
; ant-at-home? : ant -> bool
; Check whether ant a is home
(define (ant-at-home? a)
  ... (ant-weight a)
  ... (posn-at-home? (ant-loc a)) ...)
```

New template rule: data-defn reference ⇒ template reference

Add templates for referenced data, if needed, and
implement body for referenced data

```
(check-expect (ant-at-home? (make-ant 0.001 (make-posn 0 0)))
              true)
(check-expect (ant-at-home? (make-ant 0.001 (make-posn 1 1)))
              false)
```

Template

```
; ant-at-home? : ant -> bool
; Check whether ant a is home
(define (ant-at-home? a)
  ... (ant-weight a)
  ... (posn-at-home? (ant-loc a)) ...)

(define (posn-at-home? p)
  ... (posn-x p) ... (posn-y p) ...)
```

```
(check-expect (ant-at-home? (make-ant 0.001 (make-posn 0 0)))
              true)
(check-expect (ant-at-home? (make-ant 0.001 (make-posn 1 1)))
              false)
```

Body

```
; ant-at-home? : ant -> bool
; Check whether ant a is home
; (define (ant-at-home? a)
;   ... (ant-weight a)
;   ... (posn-at-home? (ant-loc a)) ...)
; (define (posn-at-home? p)
;   ... (posn-x p) ... (posn-y p) ...)
(define (ant-at-home? a)
  (posn-at-home? (ant-loc a)))
(define (posn-at-home? p)
  (and (= (posn-x p) 0) (= (posn-y p) 0)))

(check-expect (ant-at-home? (make-ant 0.001 (make-posn 0 0)))
              true)
(check-expect (ant-at-home? (make-ant 0.001 (make-posn 1 1)))
              false)
```

Shapes of Data and Templates

The shape of the template matches the shape of the data

```
; An ant is
;   (make-ant num posn)

; A posn is
;   (make-posn num num)


(define (ant-at-home? a)
  ... (ant-weight a)
  ... (posn-at-home? (ant-loc a)) ...)

(define (posn-at-home? p)
  ... (posn-x p) ... (posn-y p) ...)
```