Class: CSc 335

Date: Feb 2, 2023 (Thursday)

QUIZ NEXT THURSDAY

- Enbironment diagram

Lambda Function

- creating a closure
  - closure has 3 parts → reserved word, formal and body

```
(lambda (x) (* x x))
> #<procedure>
```

- to use lambda

```
((lambda (x) (* x x)) 8)
> 64
```
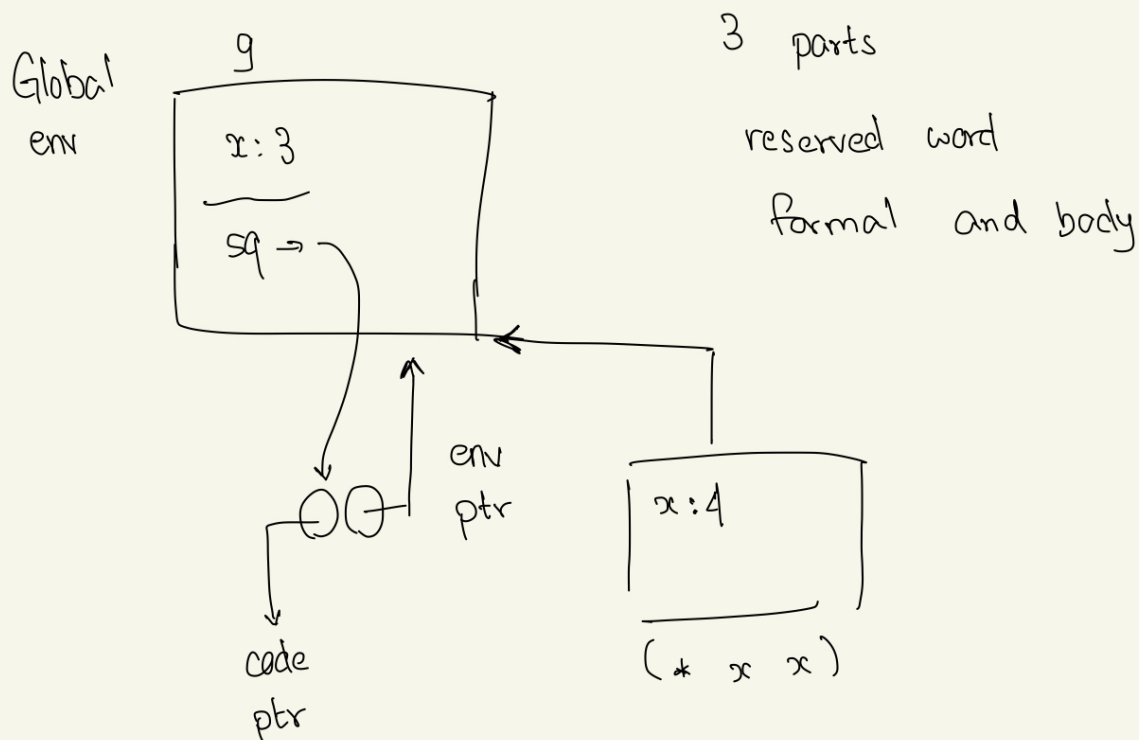
- with two parameters

```
((lambda (x y) (+ x y)) 3 4)
> 7
```

- When you use define, you're installing variables in global env (knows all about scheme, but not about x or sq.)

Global Env	Define
x: 3	(define x 3)
sq → ?	

(define sq (lambda (x) (* x x))) → creates a closure

formal is like a parameter of the lambda.

Global
env

g

x: 3

sq →

3 parts

reserved word

formal and body

env
ptr

x: 4

code
ptr

(* x x)

formal (x)

body : (x * x)

- A&S use a sugared form of function definition

```
eg. (define(sq x) (* x x))
```

QUESTION: What happens when (sq 4) is evaluated, given g as shown?

ANSWER:

1. Create a new frame with the same enclosing frame as sq
2. In the new frame, bind the formal parameter x to the value of the actual parameter 4.
3. Evaluate the body of sq in the frame. This evaluation entails same lookups
   - * is not defined in the new frame so the system looks in the containing frame and finds the primitive x.
   - Take the first value of x found in any of the enclosing frames → in this case, 4. Note that x=3 in g is ignored for this evaluation → one says that it is shadowed. (This is the essence of the implementation of local variables)
4. The value (* 4 4) = 16 is returned.
5. Next Garbage collector kicks in → it stores the newly allocated frame (memory) to the keys because there's no directed path from g to the new frame. The contents of the new frame are

immediately inaccessible or disappeared.

Functions

- functions in scheme are `First Class`
    - can be returned by a function call
    - can occur in data structure → we can, for example, have lists of functions
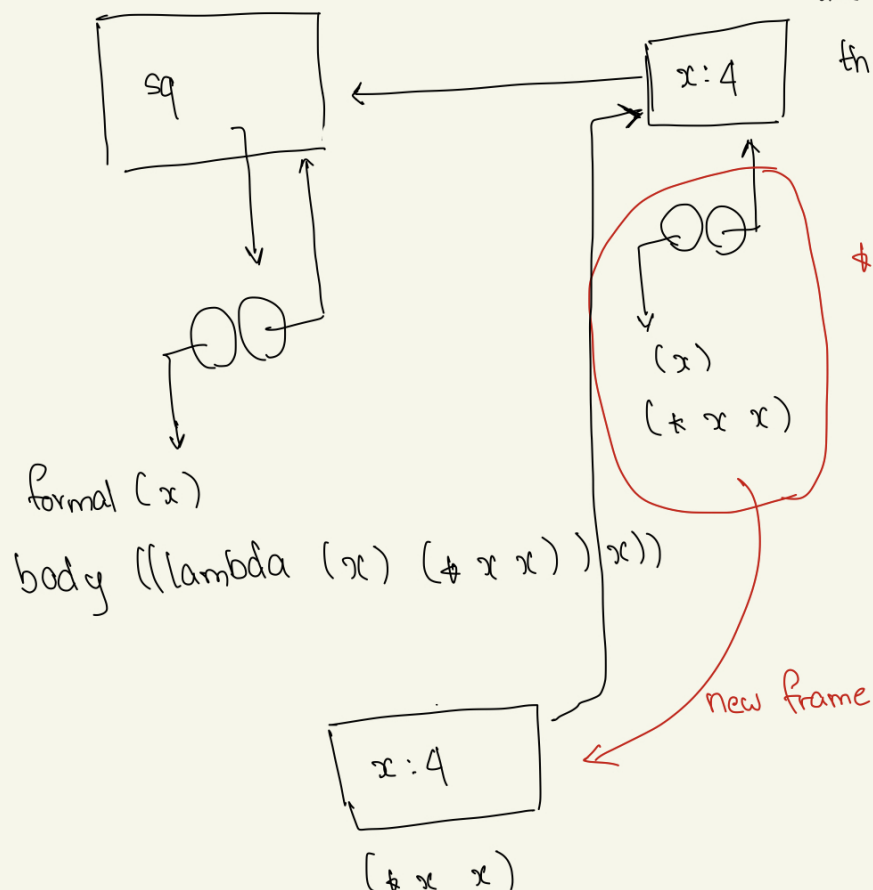

QUIZ ON THURSDAY FEB 9

- Environemnt diagram for sure

```
(define (sq x)                                    (sq 4)
    ((lambda (x) (* x x)) x ))
```

& now need to evaluate
the function body in
the frame &

sq

x: 4

formal (x)

& now we have to
apply this closure
to 4, and
requires a new
frame

(x)
(* x x)

body ((lambda (x) (* x x)) x))

new frame

x: 4

(* x x)