

Discussion 8

Scheme and Scheme Lists 🤖

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All slides can be found on

teaching.roux1.es

Announcements

- Ants Checkpoint due today (Project Party from 3PM - 5:30PM today in Warren 101B)
- HW 5 due two days from now
- The Scheme project gets released on Friday; will have a lab to help with getting started next Monday, as well as a lecture this Wednesday to help with understanding interpreters.
 - The project is a pretty funny mix of content from the end of the course with content from the start of the course
- I'm giving a lecture on SQL on August 1st. Please pull up
 - I will be ending discussion earlier on that day so I can get to Dwinelle on time to get everything prepared
- Reminder to finish the mid-semester feedback form

Notes from last section

- I like when you give us tips that helped you understand stuff because it often helps me also!
 - 🙄 that's very nice to hear
 - also extends to a lot of you during labs/discussions - if you have a way that you like seeing things that can help you, please also discuss with other people! something that you find helpful can usually really help other people
- potato >> all
 - agreed
 - i had slivers yesterday cause they had the pizza with potatoes and corn 🍌

Notes from last section

- If you could travel anywhere in the world (or galaxy), where would you go?
 - still haven't gone to nyc but i really want to go just cause i want to try good US public transport lol
 - ive been spoiled by asian city public transport
- In the game Kirby Return to Dreamland, inhaling 2 enemies at once causes you to get a randomized ability, and outside of a specific stage, this is the only way to get the UFO Kirby power up, which has a laser attack and allows for infinite flight
 - what type of conditions do you need to be able to inhale 2 enemies at once? it seems pretty difficult to do, but ive also never played anything kirby related

Temperature Check

- Linked Lists
- Scheme
- Scheme Lists
- Would like to mention that I will be talking *a lot* this discussion at the start cause a lot of this is syntax

What is Scheme

- Scheme is another language that you need to learn 🙄
- It's a dialect of Lisp (List Processor)
- Everything is done with recursion 🎉 📄
 - No `while` / `for` loops
 - Good thing about this is that you get a **lot** of recursion/tree recursion practice with scheme
- No mutation in scheme
- IMO Scheme is a very good way to demonstrate that once you learn the logic for one programming language, learning a second one is way easier!
- There are a lot of parentheses 😓

Why learn scheme

- ramble about something anto

Primitives

- Scheme has a set of **atomic** primitive expressions.
 - Similar to the primitives in Python
 - These expressions cannot be divided up further

```
scheme> 1
1
scheme> 2
2
scheme> #t
True
scheme> #f
False
```



Booleans (Python)

Remember this table?

Falsey	Truthy
<code>False</code>	<code>True</code>
<code>None</code>	Everything else
<code>0</code>	
<code>[]</code> , <code>""</code> , <code>()</code> , <code>{}</code>	

Booleans (Scheme)

Falsey	Truthy
#f	Everything else

 This is something you need to remember 

define

- In scheme, everything that isn't a primitive is done with **prefix notation**
 - (`<keyword> [<arguments> ...]`)
- In scheme, we use the `define` keyword in order to bind values to symbols, which work the same way as variables.
 - This is also used to define functions - more on this later
 - This keyword returns the symbol:

- In scheme, everything that isn't a primitive is done with **prefix notation**
 - (`<keyword> [<arguments> ...]`)
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 - This is also used to define functions - more on this later
 - This keyword returns the symbol:

```
>>> x = 3
```

```
scm> (define x 3)
```

```
x
```

Intro WWSD (Maybe)

Call Expressions

- Call expressions apply a procedure to some arguments
 - (`<operator> [<operands> ...]`)
- Exactly the same process as Python
- Evaluate the operator (make sure it's a procedure/function)
- Evaluate each of the operands (from left to right)
- Apply the operands to the operator

Call Expression WWSD (Maybe)

Call Expressions

```
>>> add(1, 2)
```

```
3
```

```
scm> (+ 1 2)
```

```
3
```

- Important to note that all the operands are evaluated!

Special Forms

- They still look like call expressions (syntax-wise), but instead of evaluating all the operators, there are certain rules for evaluation.

Special Forms (`if`)

- `(if <predicate> <if-true> [<if-false>])`
- `<predicate>` and `<if-true>` are required, `<if-false>` is optional
- Rule for evaluation:
 - Evaluate `<predicate>`
 - If `<predicate>` is truthy (don't forget what Scheme does!), evaluate `<if-true>`
 - Else evaluate `<if-false>` (if it exists)
- This means that not all of its operands will be evaluated!

Special Forms (`if`)

```
scm> (if (> 4 3) 3 2)
```

```
3
```

```
scm> (if 0 3 2)
```

```
3
```

```
scm> (if #f 3 2)
```

```
2
```

```
scm> (if (= 3 2) (/ 1 0) 3)
```

```
3
```

```
scm> (if (= 3 3) (/ 1 0) 3)
```

```
Error
```

Special Forms (`cond`)

- This is the better one 😊 (I default to this even when it's not necessary)
- It's the way to handle `elif` statements in Scheme

```
(cond
  (<pred1> <if-pred1>) ; usually <pred> is something like (= x 2)
  (<pred2> <if-pred2>)
  ...
  (<predn> <if-predn>)
  [(else <else-expression>)]
)
```

Special Forms (`cond`) Example

```
(cond
  ((= x 2) 3)
  ((= x 3) (+ x 1))
  (else 'hello)
)
```

Special Forms (Boolean Operators)

- `and`, `or`, `not`
 - `(and 1 2 3)` → `3`
 - `(or 1 2 3)` → `1`
 - `(not 0)` → `#f`
- Equivalence
 - `=` - used for numbers
 - `eq?` - `is` in Python
 - `equal?` - `==` in Python

Defining Functions

- All functions are `lambda` functions in scheme.

```
(lambda ([<params> ...]) <body>)
```

```
scm> (lambda (x) (+ x 2))
```

```
(lambda (x) (+ x 2))
```

```
scm> (define f (lambda (x) (+ x 2)))
```

```
f
```

```
scm> f
```

```
(lambda (x) (+ x 2))
```


Defining Functions

- There is a bit of a shorthand to write functions:

```
(define (<name> [<params> ...]) <body>)
```

```
scm> (define (f x) (+ x 2))
```

```
f
```

```
scm> f
```

```
(lambda (x) (+ x 2))
```

Executing Functions

- By default, functions will return the last expression in the body:

```
(define (f x)
  (+ 1 2) ; doesn't get returned in the terminal
  (+ 2 x) ; this implicitly gets returned
)
```

```
def f(x):
  1 + 2
  return 2 + x
```

Worksheet!

Pairs and Lists

What are Scheme Lists?

- All Scheme lists are *very* similar to the Python linked lists that we've been dealing with.
- Python:
 - `lnk.first` - gets the first element
 - `lnk.rest` - gets the rest of your linked list
- Scheme:
 - `(car lnk)` - gets the first element
 - `(cdr lnk)` - gets the rest of your scheme list
- Weird names!

Creating Scheme Lists

```
>>> Link(1, Link(2, Link(3)))  
Link(1, Link(2, Link(3)))
```

```
scm> (cons 1 (cons 2 (cons 3 nil)))  
(1 2 3)  
scm> (list 1 2 3)  
(1 2 3)  
scm> '(1 2 3)  
(1 2 3)
```

Worksheet!

Results from last section (links.roux1.es/disc)

- baked (4)
 - "like the baked potato in minecraft"
- I would like to be cooked whole since I don't want to get cut up
- fried (2)
 - I would like to be fried because it would be like a jacuzzi, but I can't decide if I want to be made into french fries, wedges, hasselback, or pave because they all involve getting cut up :(
- mashed (2)
- scalloped
- raw
- roasted
- made into chips

Mental Health Resources

- CAPS:
 - If you need to talk to a professional, please call CAPS at 510-642-9494.
- After Hours Assistance
 - For any assistance after hours, details on what to do can be found at [this link](#)

Anonymous Feedback Form

links.roux1.es/feedback

Thanks for coming! 🎉

Please give me feedback on what to improve!