Discussion 8

Scheme and Scheme Lists 🥶

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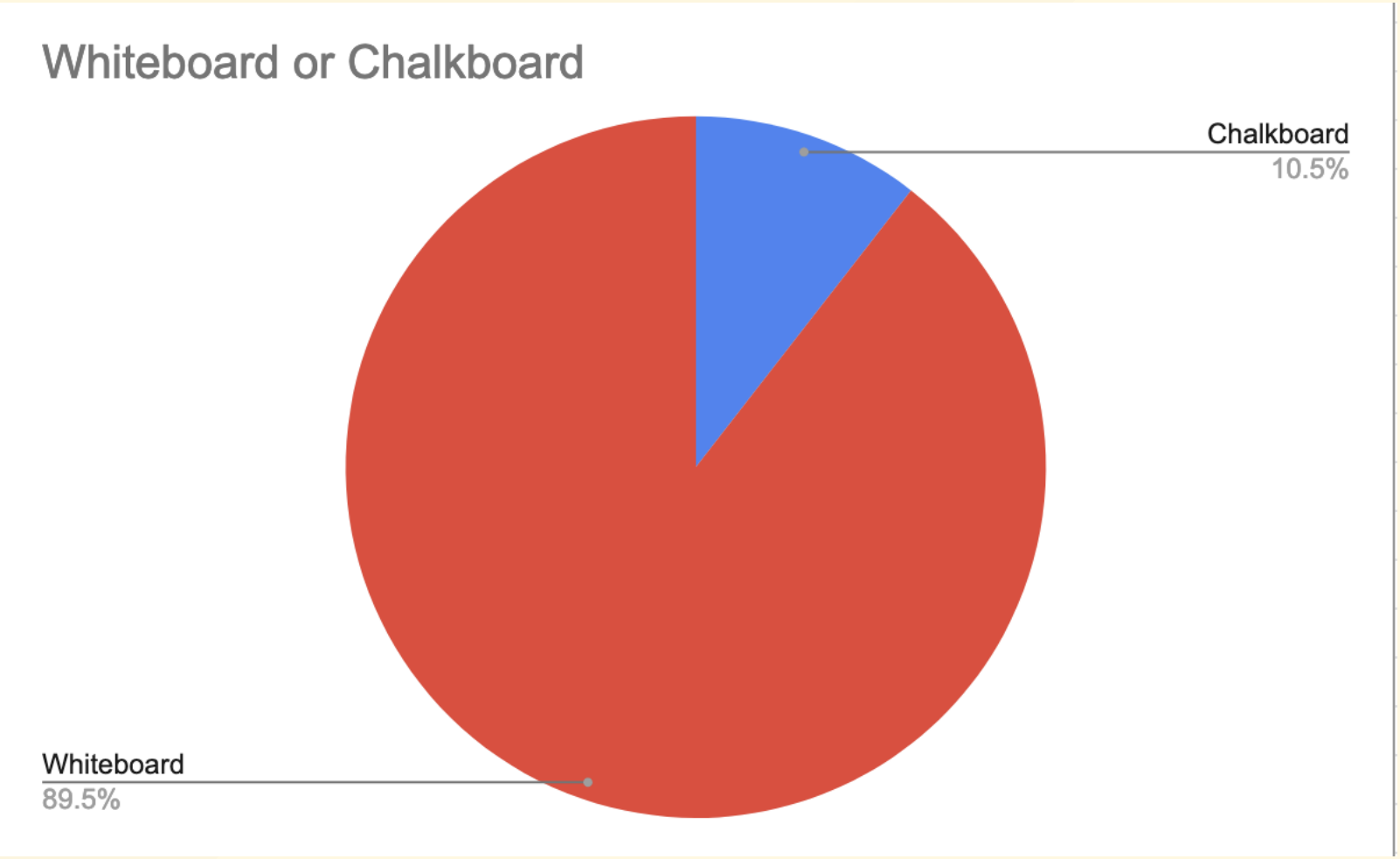
All slides can be found on

`teaching.rouxl.es`

Announcements

- When making a private Ed question, make sure to select *question* rather than *post*
  - We will greatly appreciate it
- HW 8 Released today
- As for midterm → final tips, I think something that might be super important to practice is recursion (the rest of the course pretty much deals with recursion, so getting comfortable with recursion sooner rather than later will greatly help)

Results from last section



Notes from last section

- Which is better to study if you had to choose: csm worksheets and discussion worksheets or practice midterm questions?
  - Ideally both, but if you were only able to choose one, then I'd say do practice midterm questions more so than CSM/discussion worksheets (however, I do think that doing discussion worksheets will help give you the foundation to do exam problems, so don't skip on those)
- More tree recursion please
  - This is going to happen with Scheme naturally because it's a language where you can't do any iteration

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 😭

Primitives

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

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

Booleans (Python)

Remember this table?

Falsey	Truthy
`False`	`True`
`None`	Everything else
`0`	
`[]`, `""`, `()`, `{}`	

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**
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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 (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))
```

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)
```

Attendance

`links.rouxl.es/disc`

Worksheet!

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.rouxl.es/feedback`

Thanks for coming! 🥳

Please give me feedback on what to improve!