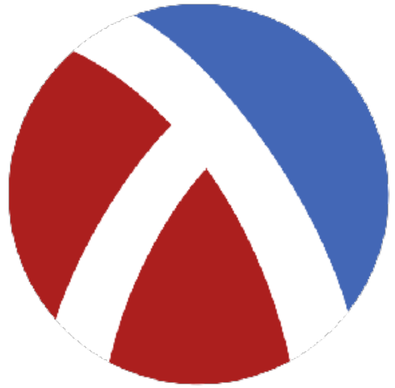


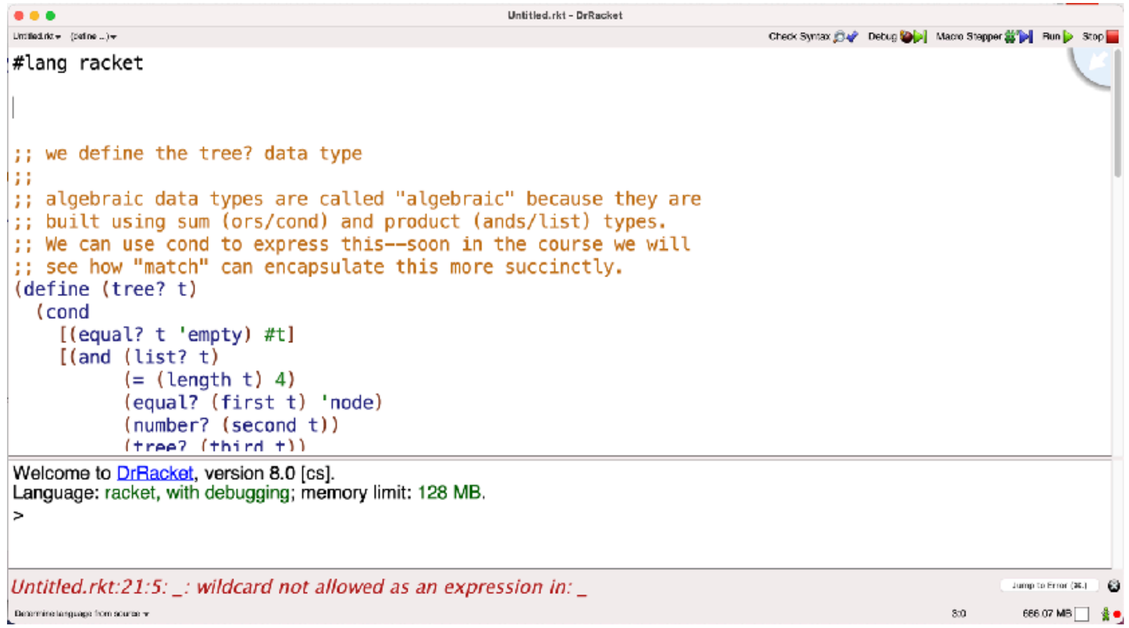
Development Experience

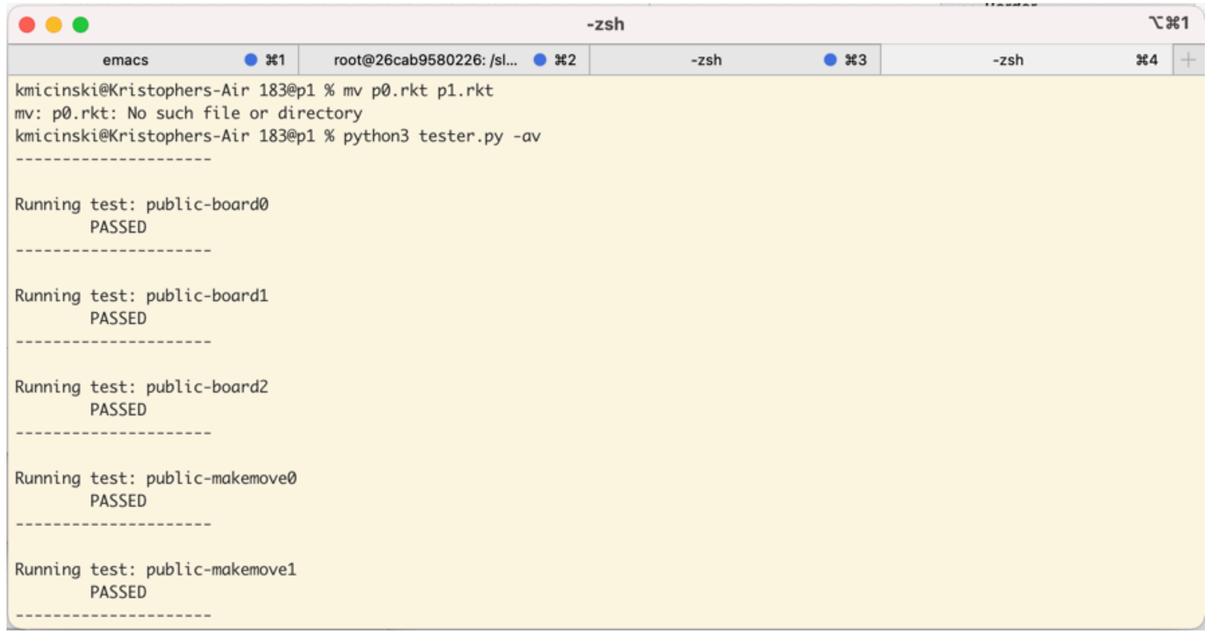
CIS352 — Fall 2022

Kris Micinski

Development Environment

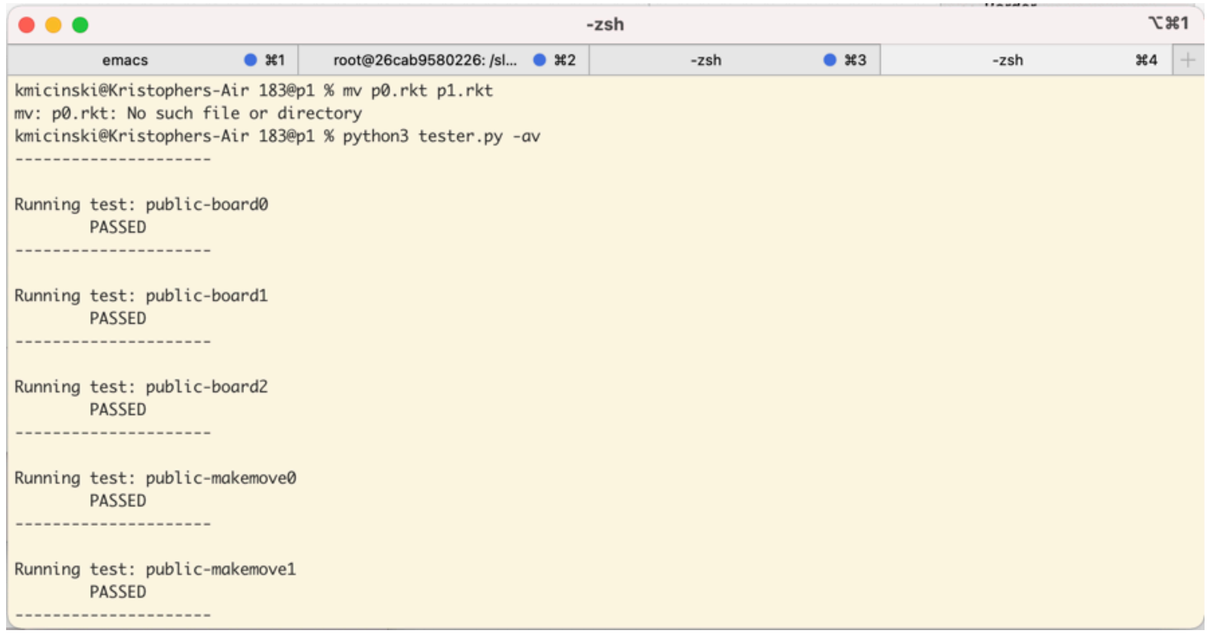
- I keep two windows open:
  - (a) an editor (Dr. Racket, emacs, VSCode, …)
  - (b) a command-line application (iTerm2)





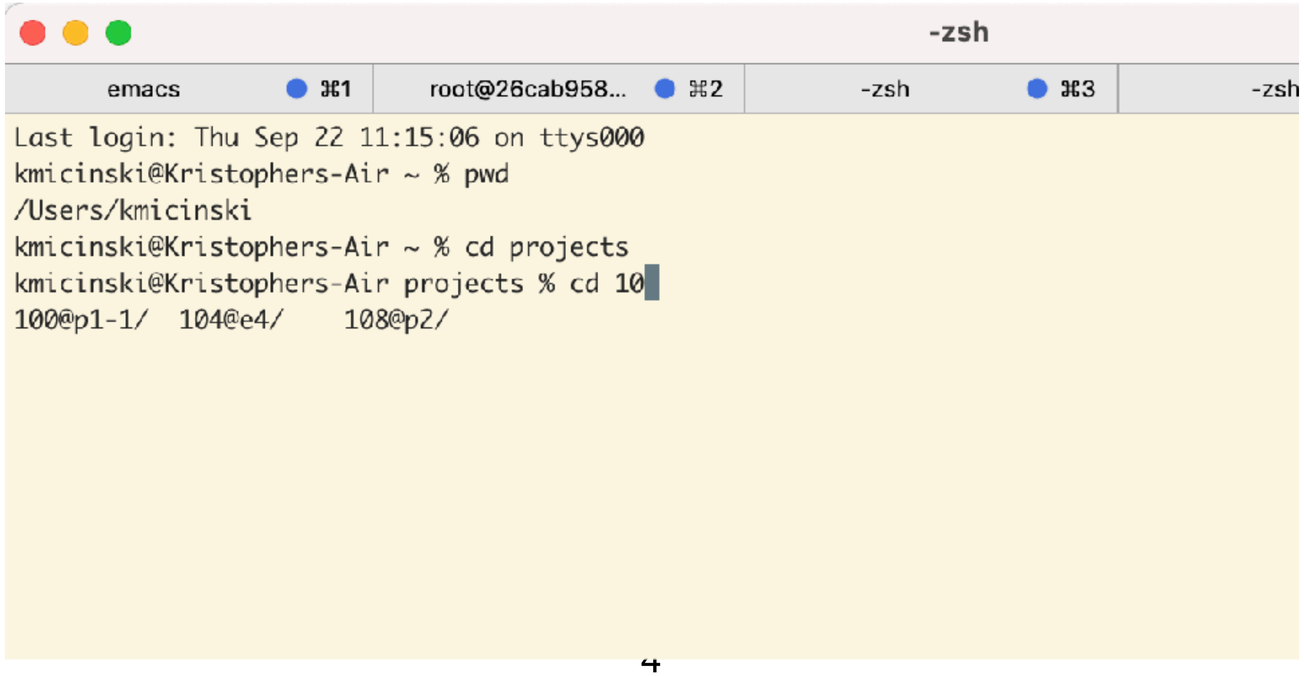
Starting my development

- Every day when I begin my work I:
  - (a) open a new tab in the command line
  - (b) navigate to the project folder I want
    - Everything kept in git, so this is a git repo



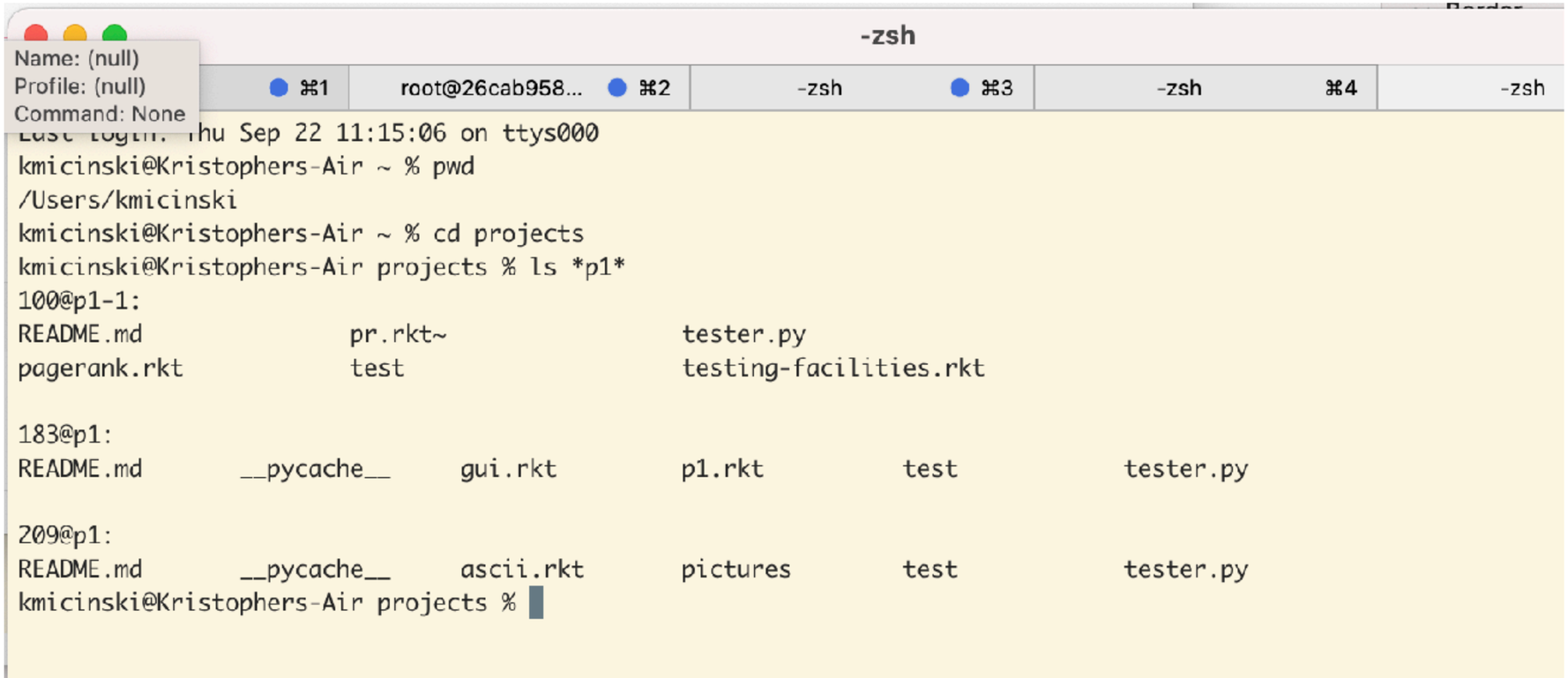
Useful commands

- When I open up the command line, I'm in my **home** directory
- Use **cd** to change into the directory I want
- Use **tab completion** *always* when I use the shell
  - You should too!



Globs

- You can use search patterns (“globs”) with most commands
  - Regular-expression-like language (not standard)
- Lets me search ***p1*** to say “find anything with p1 in it”



Git status

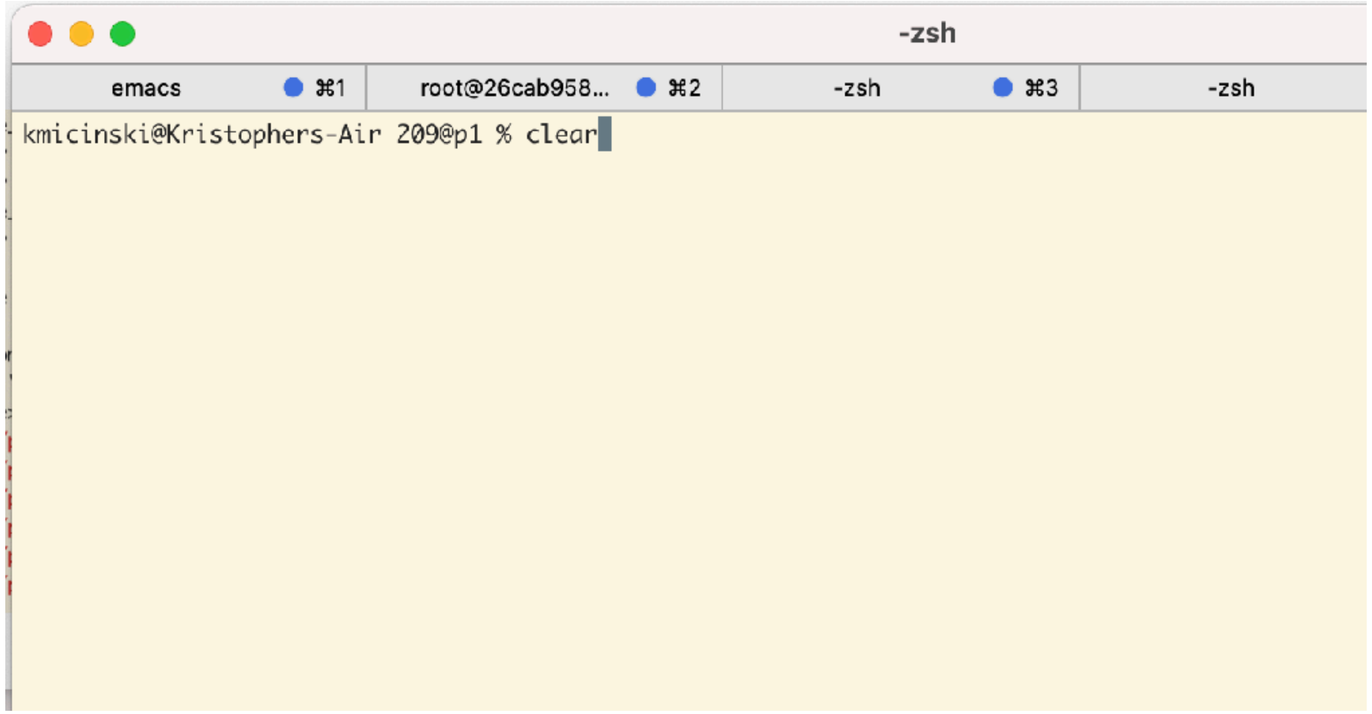
- After getting into the work directory, I use “git status” to see what’s new
  - Shows any uncommitted work

```
README.md       __pycache__     ascii.rkt       pictures        test            tester.py
kmicinski@Kristophers-Air projects % cd 209@p1
kmicinski@Kristophers-Air 209@p1 % ls
README.md       __pycache__     ascii.rkt       pictures        test            tester.py
kmicinski@Kristophers-Air 209@p1 % git status .
On branch master
Your branch is up to date with 'origin/master'.

Changes not staged for commit:
  (use "git add <file>..." to update what will be committed)
  (use "git restore <file>..." to discard changes in working directory)
        modified:   test/public-draw-0/output
        modified:   test/public-draw-1/output
        modified:   test/public-draw-line-0/output
        modified:   test/public-draw-line-1/output
        modified:   test/public-newlines-0/output
        modified:   test/public-newlines-1/output
```

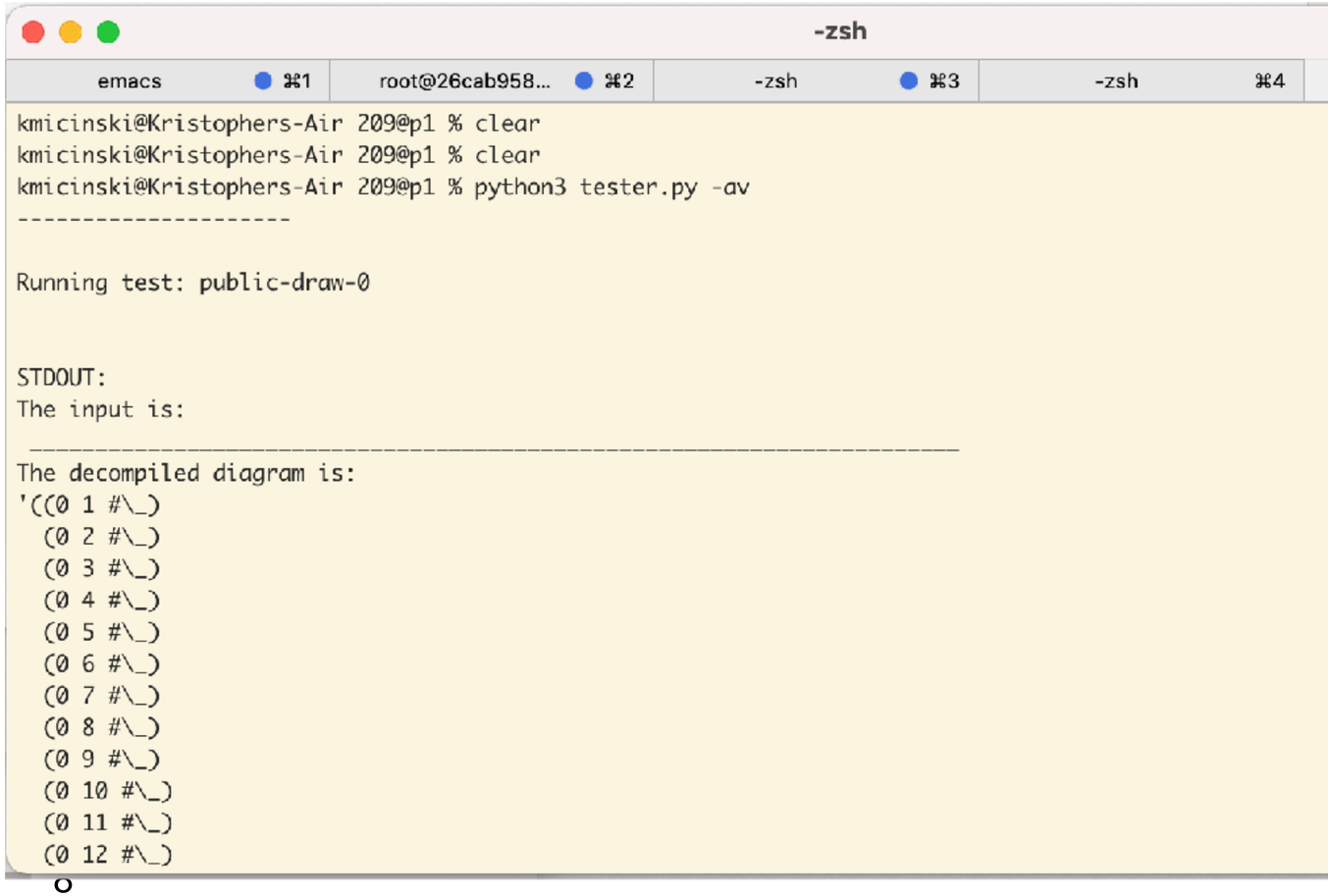
clear

- I hate seeing too text on the screen



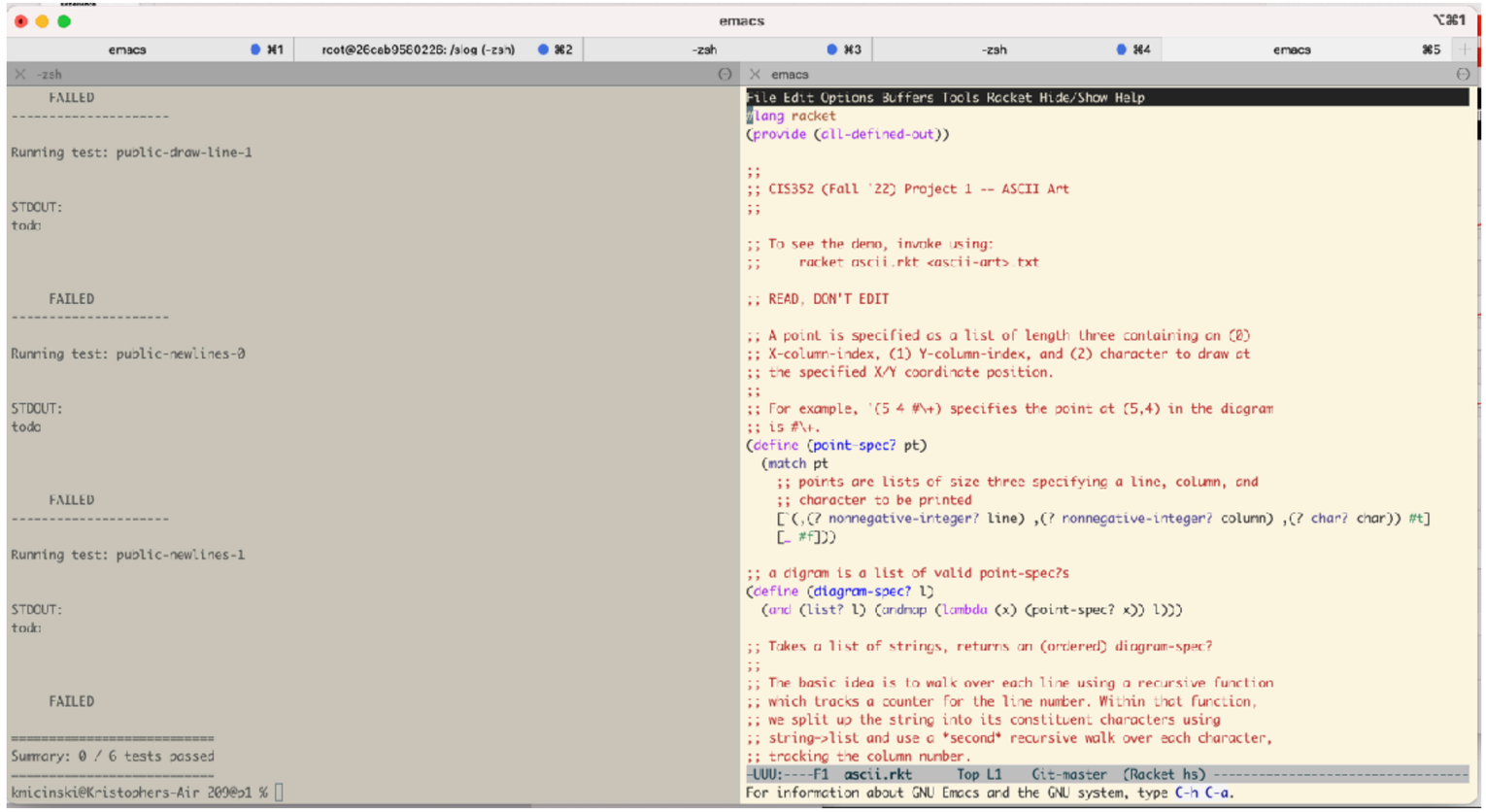
Running the tests

- Once in a while, I'll run the tests
  - Always use **python3**
    - Old python is python 2, it is now dead
  - Run it from the command line
    - Same project folder that holds our git repo
- I encourage you to go **read** tester.py
  - But it uses several helper scripts



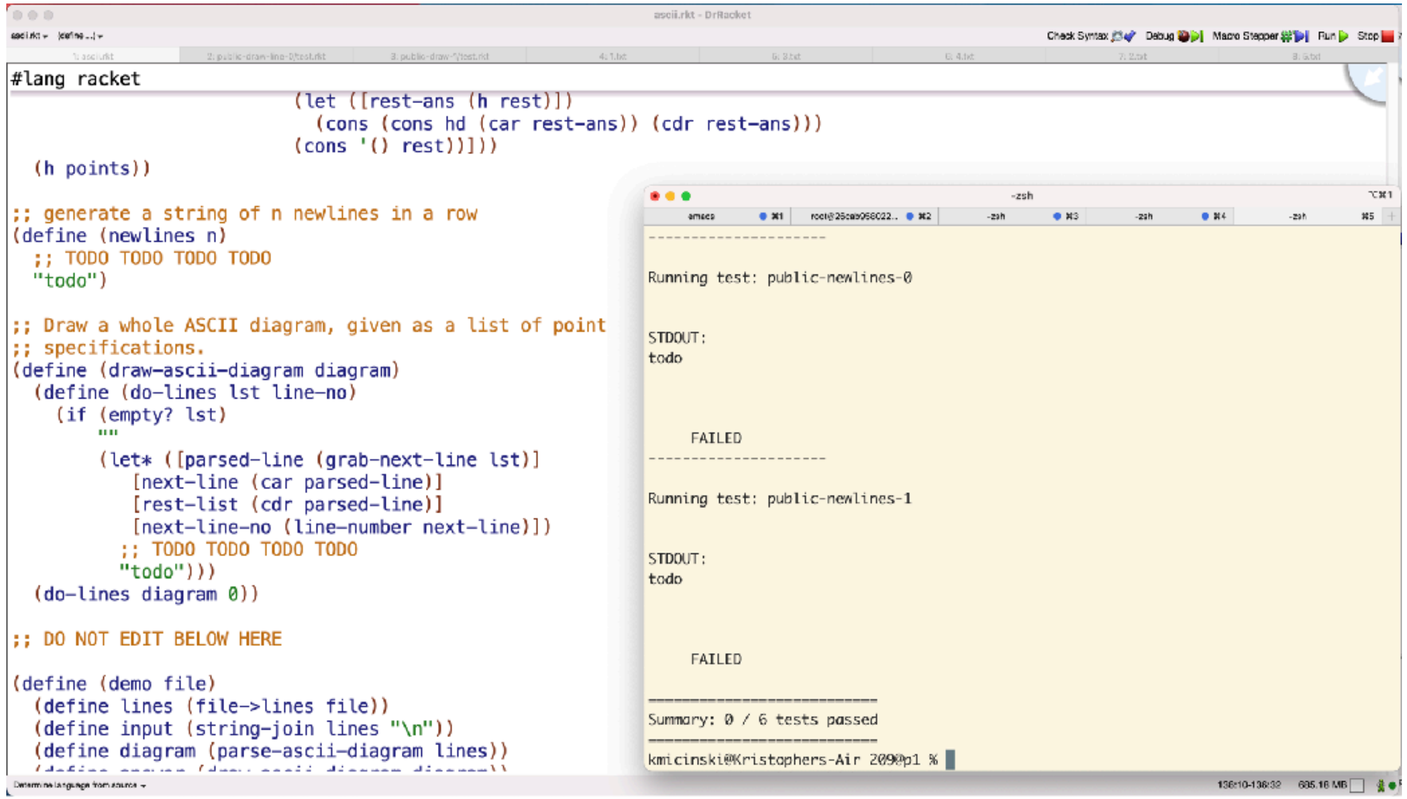
Editing the code

- Several choices:
  - Emacs / vi in the terminal
    - Probably want side-by-side terms



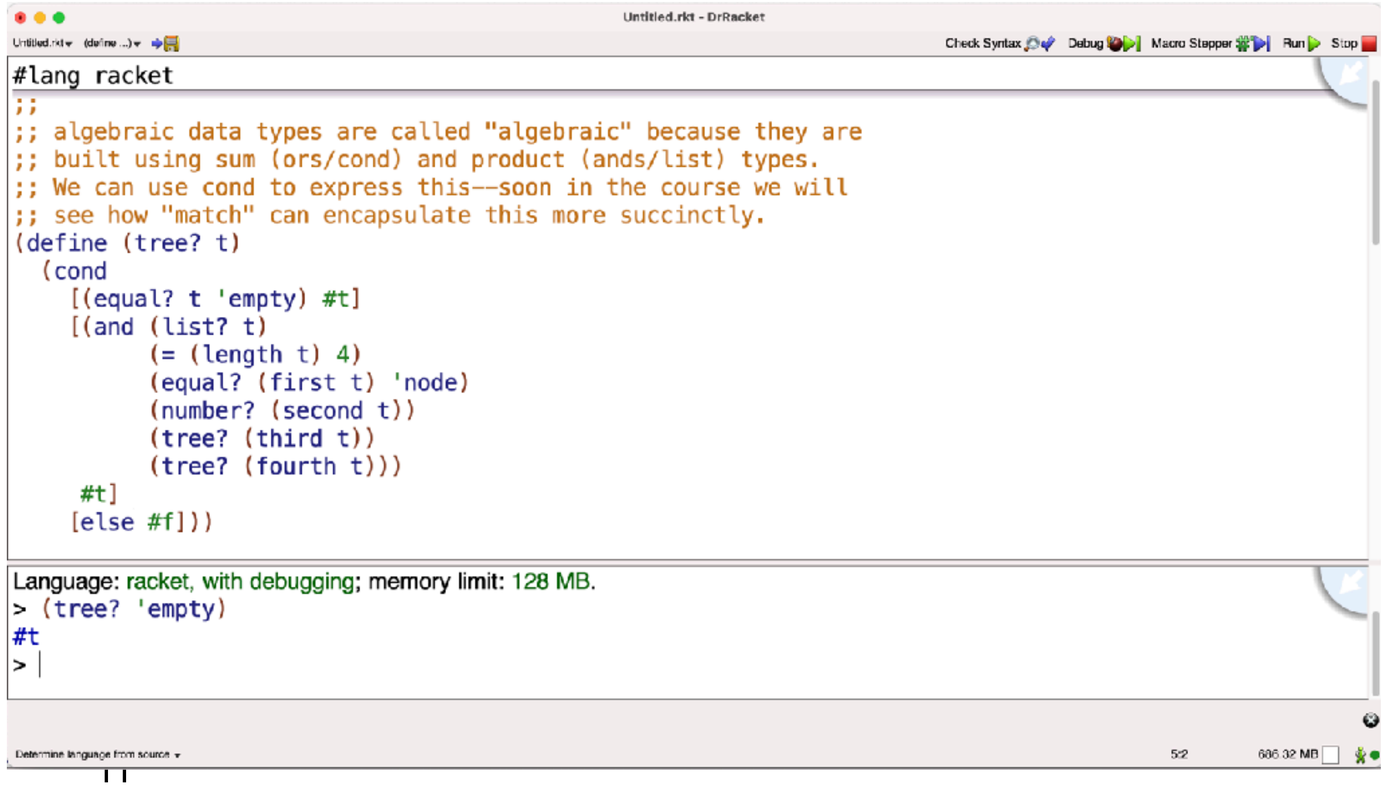
Editing the code

- Most students will simply use Dr. Racket **and** a terminal
  - This is fine—keep them both side-by-side
    - (Switch between with command-tab on MacOS, …)



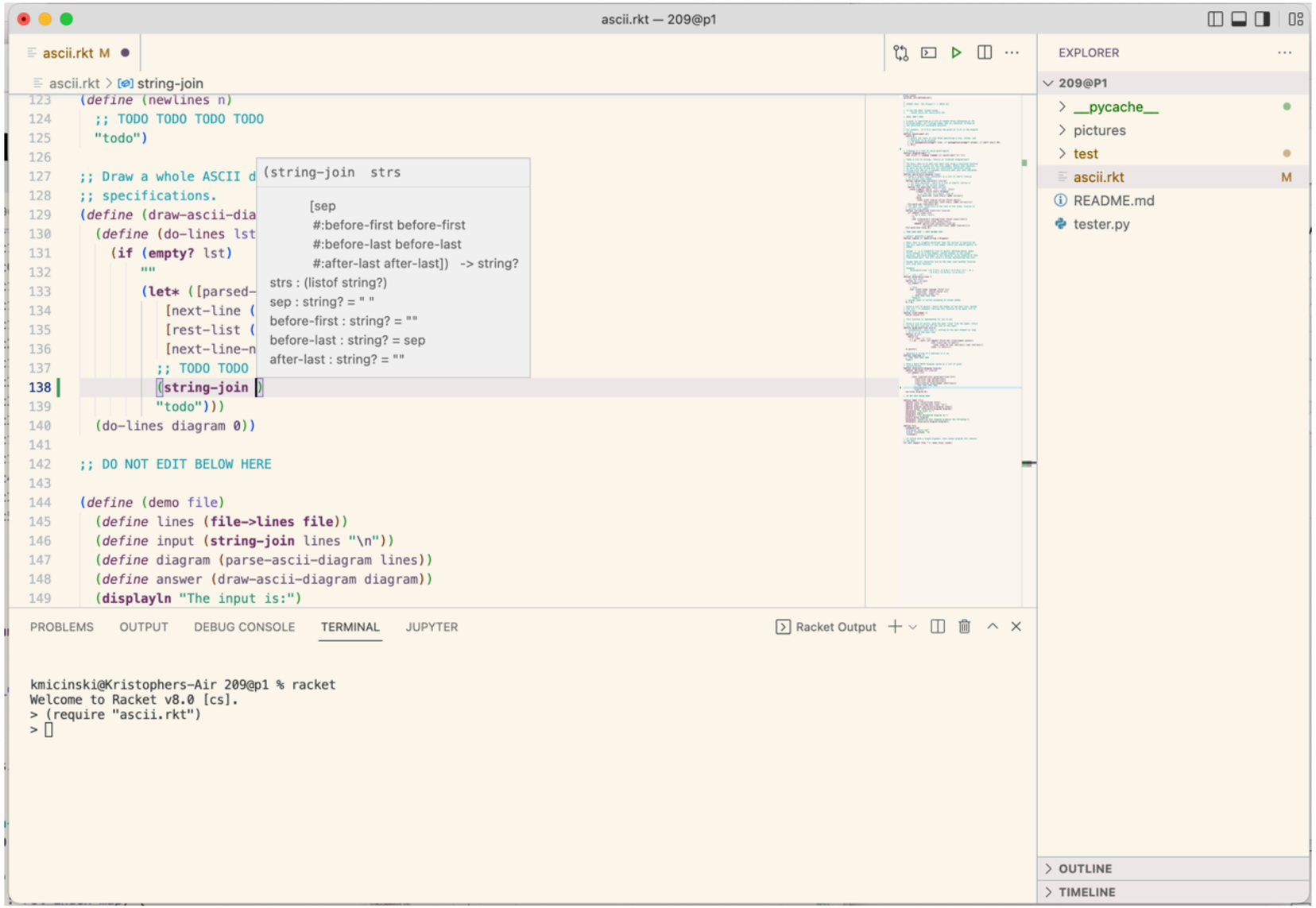
Test Always

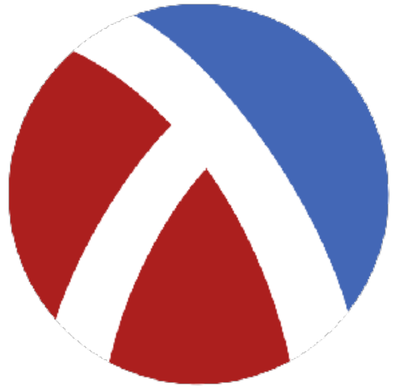
- Whenever you do *something*, test it as **fast as possible**
  - Otherwise you will lose context, context is crucial for bug finding!
- Get in the habit of pressing “run” a bunch
  - Even if you run no tests, it does “rough check” of syntactic correctness
- Type tests in the REPL “manually” for small things, use the terminal to run larger tests



Other Editors

VSCode is worth trying





Cons Diagrams and Boxes

CIS352 — Fall 2022

Kris Micinski

Derived Types

- **S-expressions** (**symbolic** expression)
  - Untyped lists that generalize neatly to trees:

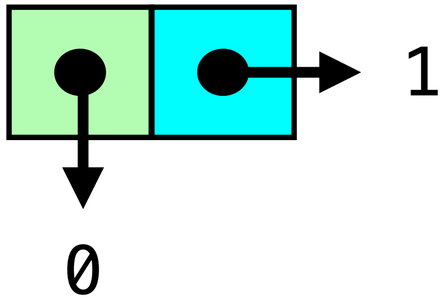
```
(this (is an) s expression)
```

- Computer represents these as **linked** structures
  - Cons cells of head & tail `(cons 1 2)`

Derived Types

- Racket also has **structural** types
  - Defined via **struct**; aids robustness
  - We will usually prefer agility of “tagged” S-expressions
- Also an elaborate object-orientation system (we won’t cover)

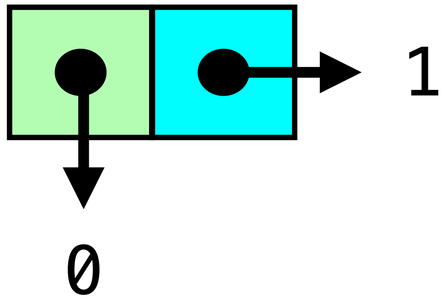
```
(cons 0 1)
```



The function **cons** builds a cons cell

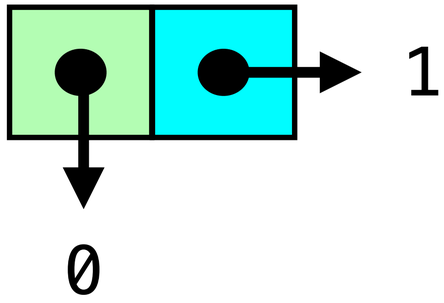
The function **car** gets the left element

`(car(cons 0 1))` is `0`



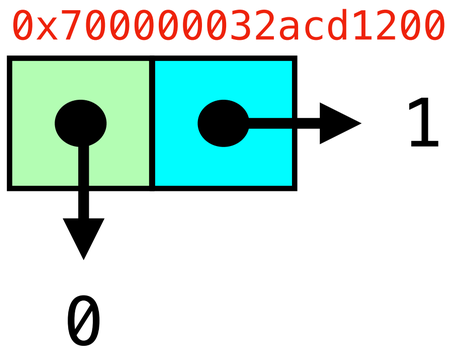
The function **cdr** gets the left element

`(cdr(cons 0 1))` is `1`



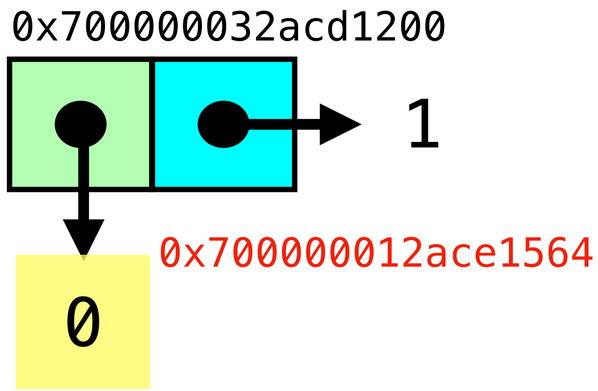
At runtime, each cons cell sits at an **address** in memory

`(cdr (cons 0 1))` is `1`

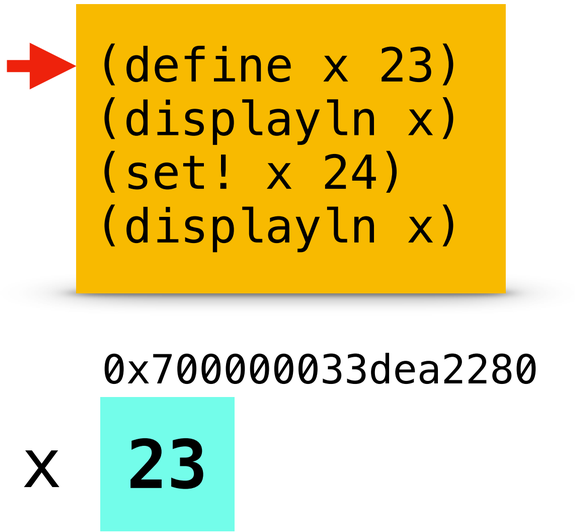


In fact, numbers are **also** stored in memory locations.

They are thus said to be a “boxed” type



Actually, every Racket variable stores a value
in some “box” (i.e., memory location)



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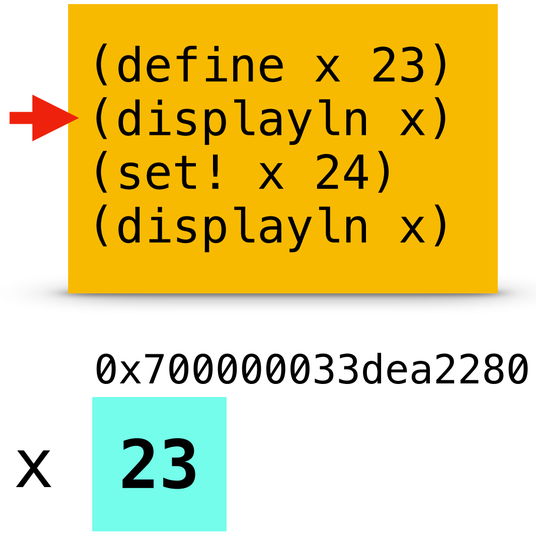

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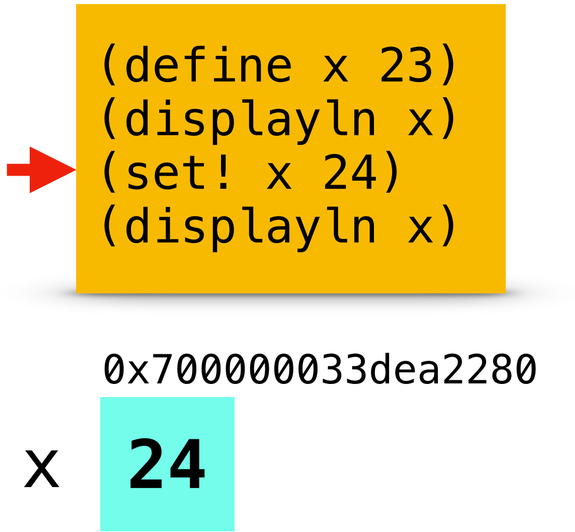


x’s value **changes** to 24

```
(define x (vector 1 2 3))
(vector-set! x 1 0)
x
;; '#(1 0 3)
```

Vectors (similar to arrays) are mutable, and give O(1) indexing and updating

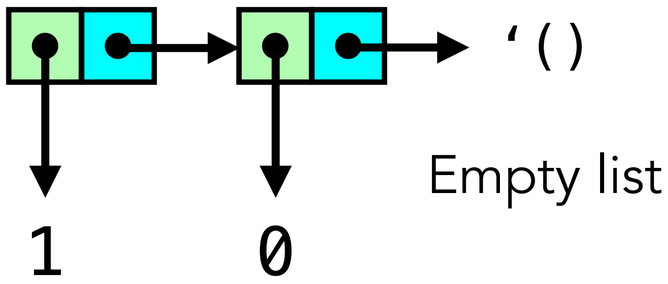
Unless we say otherwise, you should avoid using set!, any use will be at your own risk

Similarly, avoid vector-set!, hash-set!, …

Using `set!` will, in CIS352, lead to hard-to-debug code that will make it much harder for instructors to understand your code

Pairs enable us to build **linked lists** of data

```
(cons 1 (cons 0 '()))
```



This is how Racket represents lists in memory

Note that in Racket, the following are equivalent

```
(cons 2 (cons 1 (cons 0 '())))
'(2 1 0)
```

But the following is called an **improper list**

```
(cons 2 (cons 1 0))
'(2 1 . 0)
```

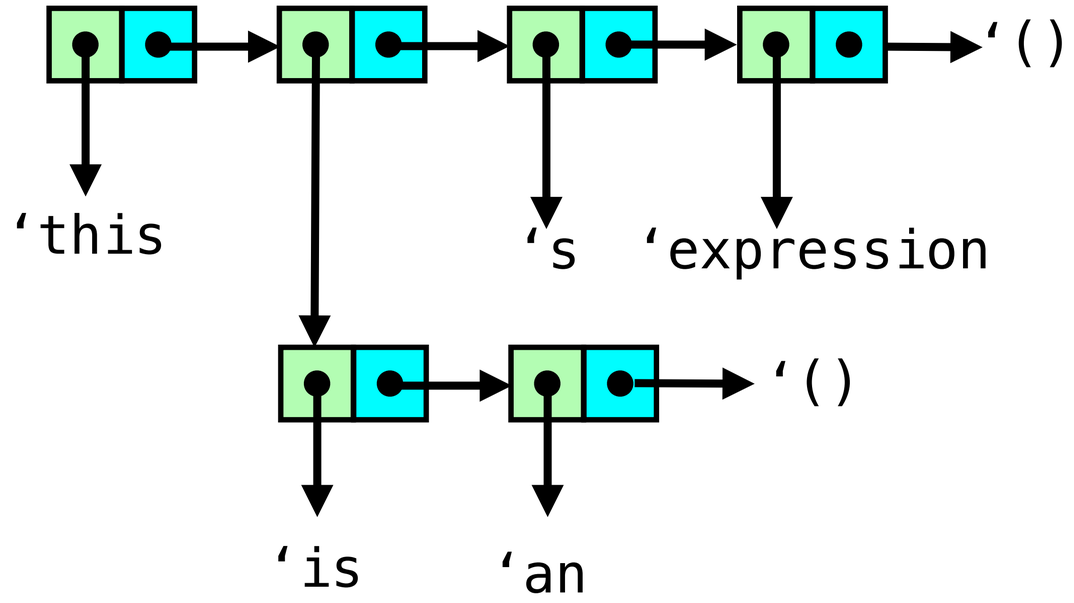
Dot indicates a cons cell of a left and right element

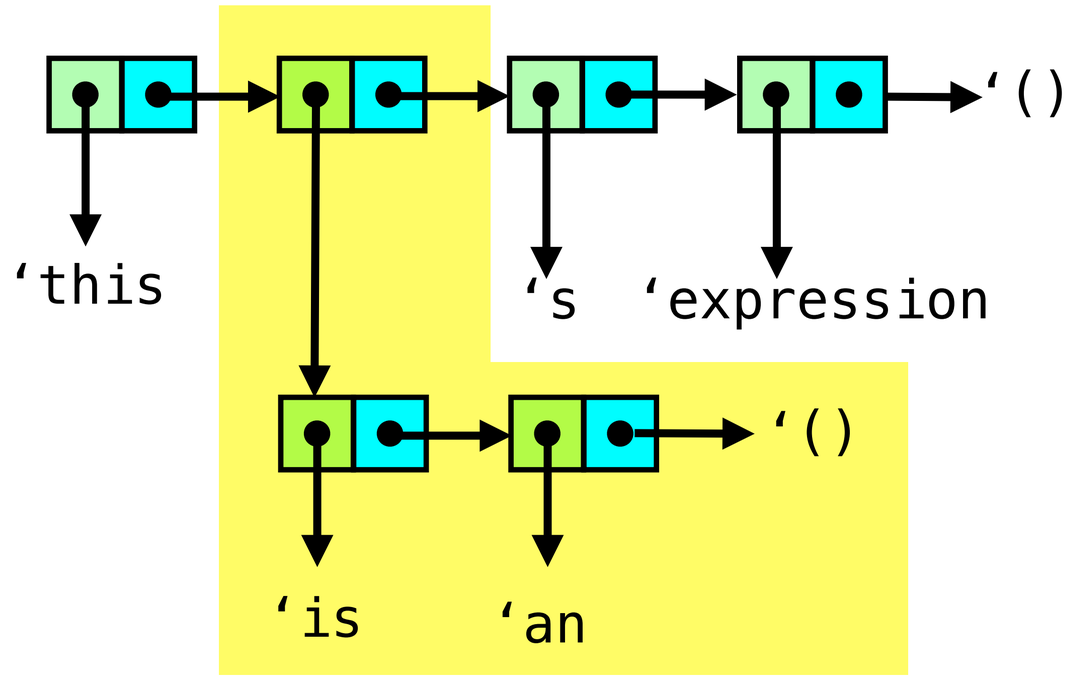
Also can build **compound** expressions

```
'(this (is an) s expression)
```

Also can build **compound** expressions

```
'(this (is an) s expression)
```

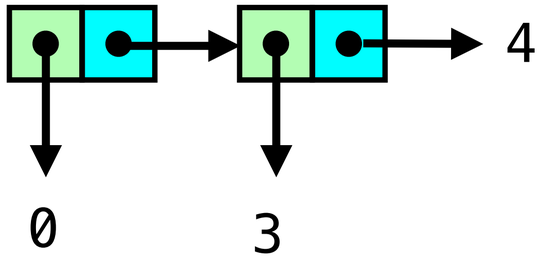



‘this
‘s
‘expression
‘()
‘is
‘an
‘()

Draw the cons diagram for…

- (cons 0 (cons 3 4))
- Is this a list? If not, what is it?
- (cons 0 (cons 3 (cons 4 '())))
- Is this a list? If not, what is it?

(cons 0 (cons 3 4))



This is *not* a list (an improper list)

(cons 0 (cons 3 (cons 4 '())))