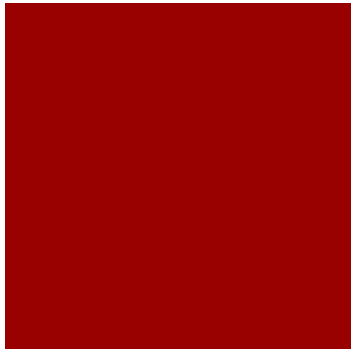
COti S 342

Recitation 11/11/2019 – 11/13/2019



Topic

- Reflang Programming
- Type Concepts
- Q&A

Reflang

- We add extensions to our language to support side effects
- These extensions focus on readingand writing memory locations
- We need two concepts and definitions:
  - Heap: memory reserved for dynamic alloc
  - References: locations in the heap

Reflang-Reference

- (ref 1): stores the value 1 in a fresh location
- (free (ref 1)): deallocate the location for (ref 1)
- (deref (ref 1)): dereference a previously allocated memory location

-$(define loc (ref 3))

-$(deref loc)

-$3

-$(free loc)

-$(deref loc)

-$Error: null

Reflang-Reference

- (set! loc v): mutates the value of location loc, assigning value v

-$(define loc (ref 3))

-$(deref loc)

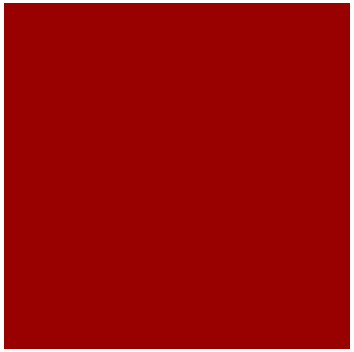
-$3

-$(set! loc 10)

-$(deref loc)

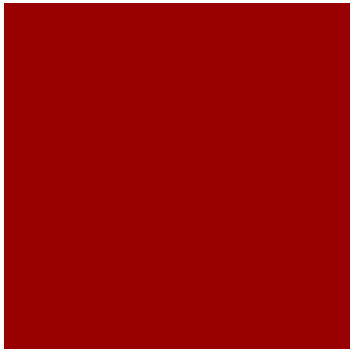
-$10

Reflang-Exercises



```
$(define l1 (ref 3))
$(define l2 (ref 42))
$l1
$??
$l2
$??
$(free 12)
$l2
$??
$(deref l2)
$??
$(set! l2 20)
$20
$(deref l2)
$??
$((define l2 (ref 30))
$l2
$??
```

Reflang-Exercises



$(define l1 (ref 3))
$(define l2 (ref 42))
$l1
$loc:0
$l2
$loc:1
$(free 12)
$l2
$loc:1
$(deref l2)
$Error:null
$(set! l2 20)
$20
$(deref l2)
$20
$((define l2 (ref 30))
$l2
$loc 2

Type

- Type is a property of program constructs such as expressions
- Contract between producer and consumer regarding what values to expect
  - Procedure: e.g., parameter should be a function
  - Client that calls the procedure needs to follow

Type

- Static vs dynamic types
  - Static: the type inferred at compile time (Java)
  - Dynamic: the type inferred at run-time (Python)
- Sound static typing: Dynamic type of an entity is a subset of Static type of the entity

Type

- A type system is a collection of rules that assign types to program constructs (more constraints added to checking the validity of the programs, violation of such constraints indicate errors)
- Type rules are defined on the structure of expressions
- Type rules are language specific

Assert a Fact

(Fact A)

A

Imply: conditional assertion

(B if A)

$$\frac{A}{B}$$

(C if A and B)

$$\frac{A \quad B}{C}$$

Type

- Type Checking is the process of verifying fully typed programs
  - Static checking process to prevent unsafe and ill behaved program from ever running
  - Check if the program confirms to the type rules
- Type Inference is the process of filling in missing type information

Q&A