OO Basics: Pointers

COMP 2150

Winter 2020

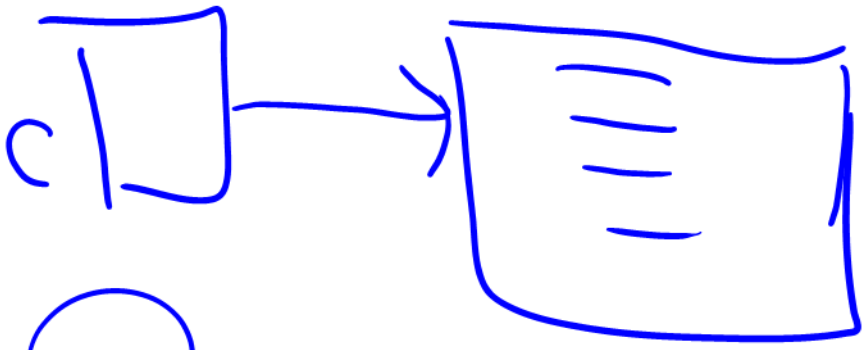
Outline

- Pointers in Java
- Pointers in C
- Pointers in C++
- Pointers in other languages

Pointers

- OO languages need pointers
- Differences between languages:
  - What types of variables have pointers?
  - How much does the programmer need to manage?

Java Pointers



- Implicit
- Java has tool for allocating new memory

```
Class c = new Class();
```

- No explicit dereference of pointers
- No explicit memory management tools when done
- Automatic garbage collection

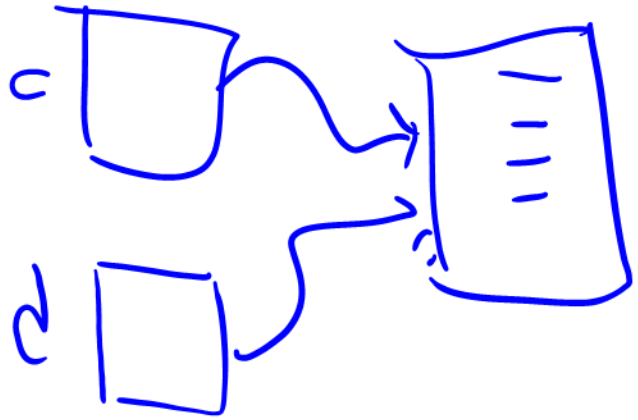
Java Challenges

int
char
double
boolean

- Primitive types are not pointers
- Hard to see where pointers are
- Assignment operations
- Casting?

Class c = new Class
Class d = c;

c instanceof (Class)



In class: Java node class example

C pointers

- 2160 Review:
  - explicit pointer type, specific size
  - need to dereference pointer to use data
  - Shorthand for dereferencing fields with pointers (C structs; also applies to methods in C++)

malloc / free

*

(*y).field ⟹ y->field

In class: C pointer manipulation example, review questions.

C++ Pointers

- C++ has new tools for pointers to objects
- Easier to use than free/malloc

New C++ tools

- Memory allocation: high level
- Memory management: high level
- Type conversion with pointers.
- (C++11) `nullptr` keyword. Use instead of NULL or zero.

More on new

- New will feel most like Java
- Watch out for * still
- No () if there's no parameters.

```
Class *c = new Class;
Class &c = new Class();
```

More on delete

- `delete` keyword
- Like `free`, only frees memory that variable points to.
- **Memory leaks** can still happen.
- Later: **destructors –** special C++ tool, opposite of constructors.

More on casting in C/C++

- Can’t assign different types of pointers to each other.
- Caught by run-time checks
- Solution: use casting.
- C++ tools later: `dynamic_cast<>`

Other Languages

- Other languages hide pointers even more
- Python and **javascript –** can't access pointers.