LEC 11: Introduction to Objects

Introduction to Objects

Talk to your neighbors:
Best places to study on campus?

Music: 122 24sp Lecture Tunes

Instructors: Miya Natsuhara and Kasey Champion

TAs:
Ayush
Poojitha
Chloe
Ailsa
Jasmine
Lucas
Logan

Kyle
Jacob
Atharva
Rucha
Megan
Eesha
Zane

Colin
Ronald
Saivi
Shivani
Kavya
Steven
Ken

Chaafen
Smriti
Ambika
Elizabeth
Aishah
Minh
Katharine
Lecture Outline

• Announcements

• SearchEngine Recap

• OOP Review

• Example

• Abstraction
Announcements

• Programming Assignment 2 (P2) out
  - Due Thursday, May 9th by 11:59 PM
  - Which means... no assignment releasing tonight!

• Quiz 0 grades released yesterday
  - Check them out and use results to calibrate how you should study over the weekend!

• Quiz 1 on Tuesday, May 7th in your registered quiz section

• Resubmission Cycle 3 (R3) out
  - Due Tuesday, May 7th by 11:59 PM
  - Eligible assignments: **PO**, C1, P1
Lecture Outline

- Announcements

- **SearchEngine Recap**

- OOP Review

- Example

- Abstraction
searchEngine & Inverted Index

• An inverted index is a Mapping from possible query words to the set of documents that contain that word
  - Answers the question: “What documents contain the word ‘corgis’?”
Data Bias

• Google’s autocomplete recommendations used to actually look like this
  - Fix: Don’t display autocomplete results for phrases like “why are [group] ____”

Are these changes fixing the right thing?

Btw, this is a great book that you should check out if you’re interested ->
What to do?

• Obviously, ideal to have datasets that aren’t biased in the first place.
  - But might not always be possible if we can’t fix the sources of bias in the real world...

• AI/Models aren’t “neutral” or “more objective”, they just quickly and automatically codify the status quo (and perpetuate biases)
  - Garbage in -> Garbage out

• Lots of work going into how to de-bias models even if they are trained on biased data. Active area of research!
  - Key take-away: None of this comes “for free”, requires hard word to fight bias

• Ask ourselves:
  - What biases might be present in my data?
  - What assumption might I be making about who is using my program?
  - How can I write code to be more inclusive?
  - What happens when (not if) mistakes happen? Who potentially benefits and who is potentially harmed?
Lecture Outline

• Announcements
• SearchEngine Recap
• OOP Review
• Example
• Abstraction
Object Oriented Programming (OOP)

- **Procedural programming**: Programs that perform their behavior as a series of steps to be carried out
  - Classes that *do* things

- **Object-oriented programming (OOP)**: Programs that perform their behavior as interactions between objects
  - Classes that *represent* things
  - We’re going to start writing our own objects!
Classes & Objects

• **Classes** can define the *template* for an object
  - 📋 Like the blueprint for a house!
    “*What does it mean to be this thing?*”

• **Objects** are the actual *instances* of the class
  - 🏡 Like the actual house built from the blueprint!
    “*It is an example of this thing!*”

We create a new instance of a class with the **new** keyword
e.g., `Scanner console = new Scanner(System.in);`
State & Behavior

- **Objects** can tie related *state* and *behavior* together

- **State** is defined by the object’s *fields* or *instance variables*
  - *Scanner’s state may include what it’s scanning, where it is in the input, etc.*

- **Behavior** is defined by the object’s *instance methods*
  - *Scanner’s behavior includes “getting the next token and returning it as an int”, “returning whether there is a next token or not”, etc.*
Syntax

public class MyObject {
    // fields
    type1 fieldName1;
    type2 fieldName2;
    ...

    // instance methods
    public returnType methodName(...) {
        ...
    }
}

Instance Variables

• Fields are also referred to as **instance variables**

• Fields are defined in a class

• Each instance of the class has their own copy of the fields
  - Hence *instance* variable! It’s a variable tied to a specific instance of the class!
Instance Methods

• **Instance methods** are defined in a class
• Calling an instance method on a particular *instance* of the class will have effects on that instance
Lecture Outline

• Announcements

• SearchEngine Recap

• OOP Review

• Example

• Abstraction
Representing a Coordinate Point

How would we do this given what we knew last week?

Maybe \texttt{int $x, int $y$}?

Maybe \texttt{int[]}?
Representing a point

```java
int x, int y
```

- Easy to mix up x, y
- Just two random ints floating around — easy to make mistakes!

```java
int[]
```

- Not really what an array is for
- Again, just two ints — just have to “trust” that we’ll remember to treat it like a point

Let’s make a class instead!
Instance Methods

• **Instance methods** are defined in a class

• Calling an instance method on a particular *instance* of the class will have effects on that instance
Instance Methods

• **Instance methods** are defined in a class
• Calling an instance method on a particular *instance* of the class will have effects on that instance
Lecture Outline

• Announcements

• SearchEngine Recap

• OOP Review

• Example

• Abstraction
Abstraction

The separation of ideas from details, meaning that we can use something without knowing exactly how it works.

You were able use the Scanner class without understanding how it works internally!
Client v. Implementor

We have been the **clients** of many objects this quarter!

Now we will become the **implementors** of our own objects!