"In the brain, the greater the challenge, the greater the changes - up to a point. Recent studies have shown that learning a new skill is much more effective at triggering structural changes in the brain than simply continuing to practice a skill that one has already learned. On the other hand, pushing too hard for too long can lead to burnout and ineffective learning. The brain, like the body, changes most quickly in that sweet spot where it is pushed outside - but not too far outside - its comfort zone."

-- Peak: Secrets from the New Science of Expertise by Ericsson and Pool

CSCI 136:
Data Structures
and
Advanced Programming

Lecture 3

Program Design

Instructor: Kelly Shaw

Williams

Topics

- Quiz Answers
- Classes
- Program design
- Nim
- Maybe: classes vs objects

Your to-dos

1. Reminder: lab meeting today/tomorrow, **in person!**

2. Lab 1, **due Tuesday 9/20 by 10pm**.
3. Read **before Fri**: Bailey, Ch 1.5-1.10.
4. Study for quiz on Friday/Saturday

Announcements

- CS Colloquium this **Friday, Sept 16 @ 2:35pm in Wege Auditorium (TCL 123)**

Ina Fiterau Brostean (UMass Amherst)

Machine Learning for Healthcare

Fiterau's research lies at the intersection of machine learning and healthcare. Her Information Fusion Lab is currently working on a project combining features extracted from brain MRIs with patient demographics, test results, and contextual information, to detect Alzheimer's disease earlier than traditional diagnostics can.

Quiz Solutions

How many hours per week should you budget for work beyond the time you spend in lecture and our scheduled lab?

At least 10 hours. (98% got this)

What is the deadline for assigned labs in this course?

Tuesday at 10pm (100% got this)

Is late work accepted in this class? (100% got this)

Only with prior arrangement, otherwise -20% per day.

What is the outcome for not attending your assigned lab?

Course failure. (98% got this)

How many assignments may you resubmit?

Two assignments. (100% got this)

Quiz Solutions

How many licks does it take to get to the Tootsie Roll center of a Tootsie Pop?

Three. (13% got this!!!)

Classes

Classes

A **class** is a mechanism for **data abstraction**. The purpose of a class is to separate the details that are important to the programmer (the **interface**) from the details that are important to the computer (the **implementation**). *Classes are a key building block in designing data structures.*

Nim

- Game starts with **random** piles.
- Each player removes **one or more** objects from **ONE** pile.
- The last player to remove the **last object** lose**s**.

Nim demo

Design doc

Design doc

Four basic questions you should answer:

- **Overview**
  - **Q:** What is the program trying to do at a **high level**?
  - Should be written exclusively in English.
- **State**
  - **Q:** What **data** needs to be **stored**?
  - OK to use a little code here, but be sure to explain.
- **Functions**
  - **Q:** What **operations** does the program perform?
  - Start by refining in English.
  - Eventually, refine into **method signatures**.
- **Procedure**
  - **Q:** What **steps** does the program carry out, and **in what order**?
  - Stay high level, and keep it in English, but refer things you described in your **State** and **Functions** sections.

Important: we are not writing code; we're just **thinking**.

Activity: Nim design doc

`TwoPlayerGame` interface

Let's build this together

Recap & Next Class

Today:

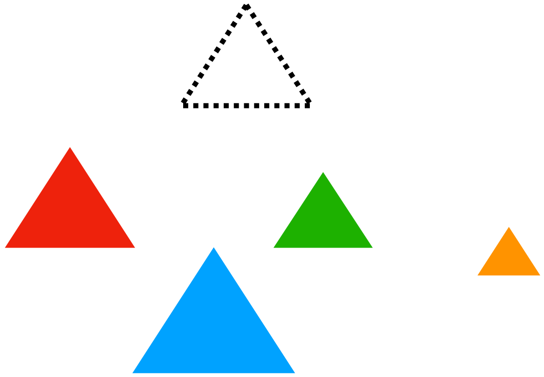
- Classes
- Program design
- Nim

Next class:

- Classes vs objects
- Scanner

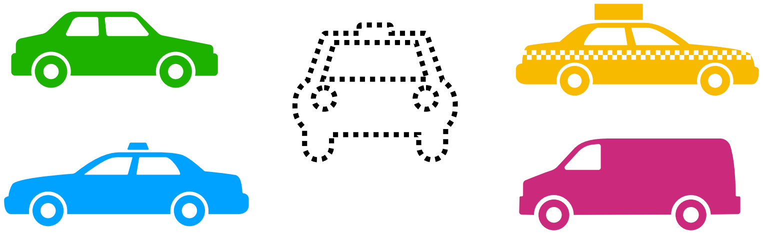
Classes are prototypes.

Objects are copies ("instances").



"Car" is a prototype.

There are many instances of cars.

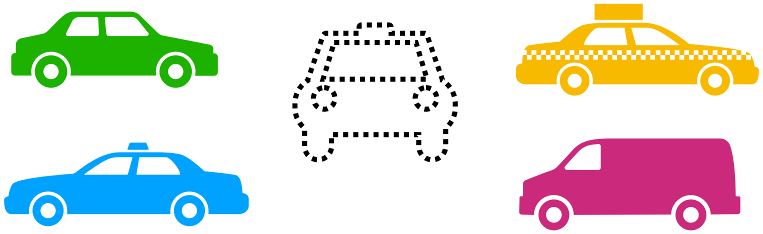


All cars have the same interface.

(wheels, doors, steering wheel, etc.)

"Car" is a prototype.

There are many instances of cars.



But most cars vary in the details

(wheels, doors, steering wheel, etc.)

```
public static void main(String[] args) {
    System.out.println("I'm static!");
}
```

Methods are functions that are tied to either:

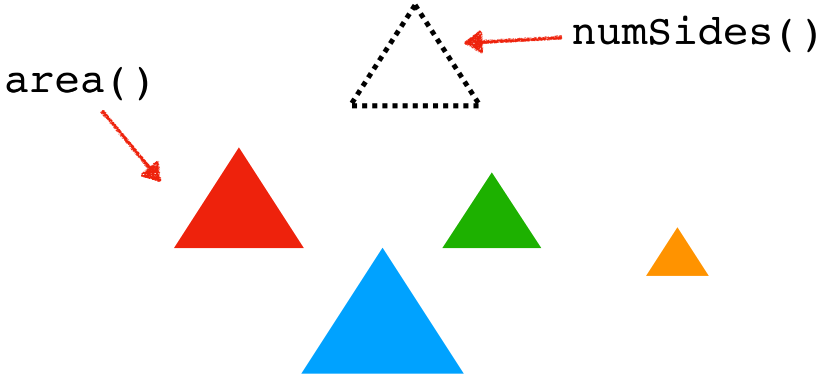
1. a class, or
2. an instance of a class (an object).

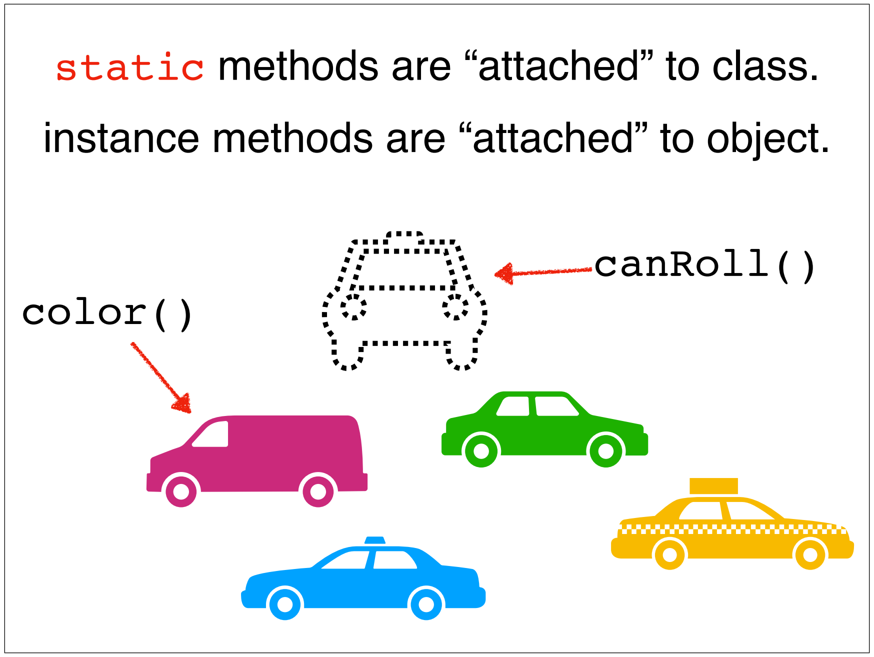
static method

instance method

static methods are "attached" to class.

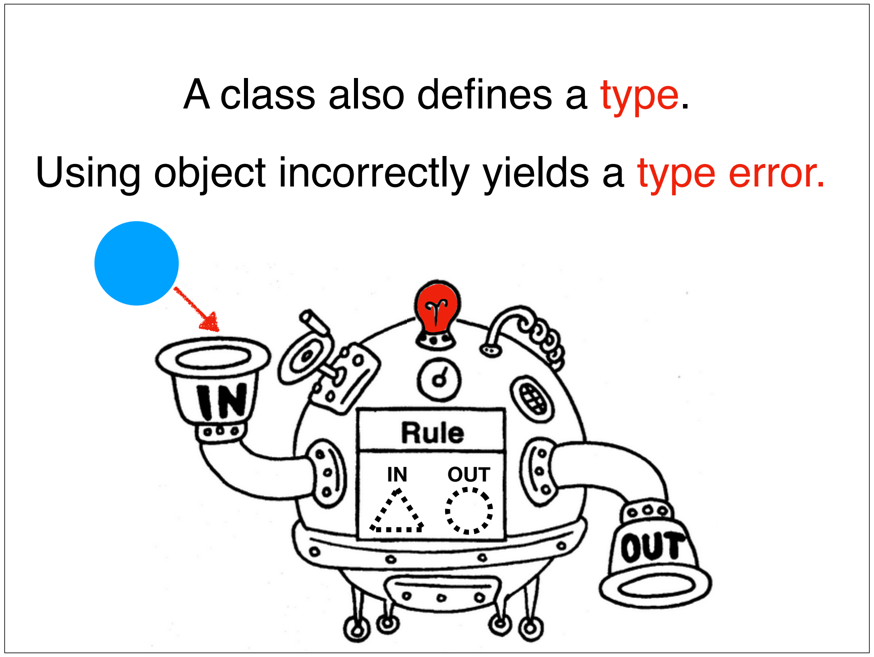
instance methods are "attached" to object.





`static` methods are “attached” to class.

instance methods are “attached” to object.



A class also defines a type.

Using object incorrectly yields a type error.