Lecture 1: Overview & Java

CS 62

Fall 2017

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http://www.cs.pomona.edu/classes/cs062

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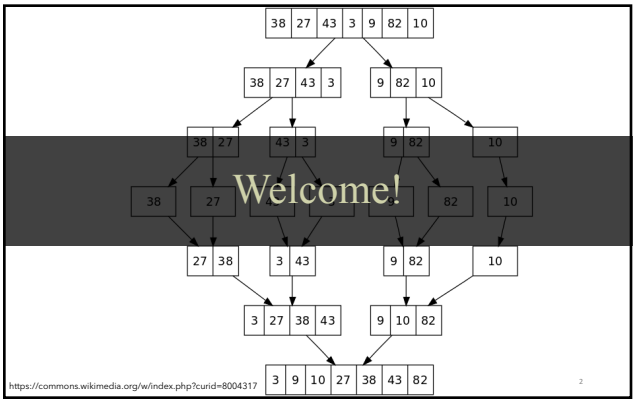

Welcome!

https://commons.wikimedia.org/w/index.php?curid=8004317

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Who we are:


Kim Bruce


Alexandra Papoutsaki


David Ahia


Bradley Bain


Emily Chen


Victor de Fontnouvelle


Samuel Gearou


Daniel Rosenbaum


Erinna Woo

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Why take CS62?

- How to implement algorithms and data structures in Java.
- How to design large programs (in object-oriented style) so that it is easy to modify them.
- How to analyze complexity of alternative implementations of problems.

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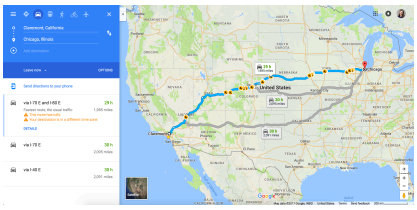
Sample Problems

- Find the shortest path from Claremont to Chicago on interstate system (and do it efficiently).



Google maps

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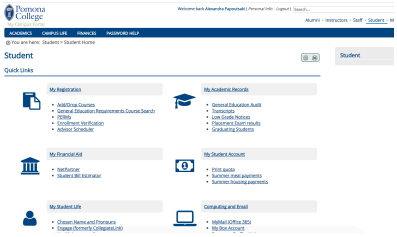
Sample Problems

- Schedule final exams so there are no conflicts.



my.pomona.edu

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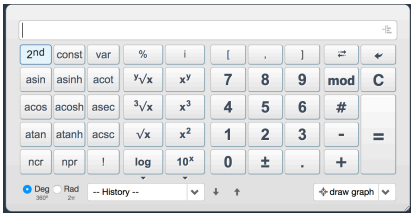
Sample Problems

- Design and implement a scientific calculator.



web2.0calc

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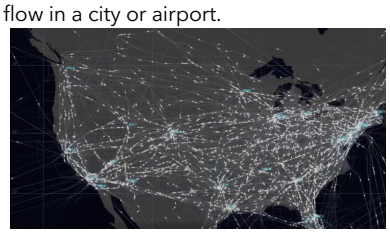
Sample Problems

- Design and implement a simulator that lets you study traffic flow in a city or airport.



airtopsoft

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Your responsibilities

- Skim reading in advance of lecture.
- After lectures, review notes and study examples carefully until you understand them.
- Come to labs prepared.
- Don't remain confused. Faculty and TAs are here to help.
- Follow academic integrity guidelines

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Assignments

- Lab work:
  - Learn tools and prepare work for weekly assignments.
  - Lab attendance is mandatory! *No lab today!!!*
- Weekly assignment is separate
  - Programs generally are due on Sunday nights.
  - See late policy on syllabus. 3ⁿ% penalty per day late.
- Daily homework
  - Not collected, but often on **regular Friday quizzes**.
  - *No quiz this Friday!*

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Text

- Java Structures, √7 edition, by Duane Bailey
  - available online for free
  - http://www.cs.williams.edu/~bailey/JavaStructures/Book.html
- Various online resources

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Slides

- Will generally be available before class
  - with code, where applicable
- Designed for class presentation, not for complete notes.
- Will need to take notes (perhaps on slides).
- No laptops or other electronics open in class
  - If you have a disability affecting this, come see me.

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Prerequisite

- Officially, CS 52 at Pomona
- Knowledge of Java equivalent to CS 51 at Pomona or CMC or the AP Test with 4 or 5.
  - *not CS 5 from HMC or* CS 30 from Pomona*!*
- Come see one of faculty if having any questions
- Assume comfortable with classes & objects, recursion, multi-dimensional arrays, etc. in Java

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Heavy Workload

- students spend average of 8+ hours outside of class.
- … but not "weeder"
- Must both learn practical (programming) skills and more theoretical analysis skills
  - Learn about tools to become better programmer
  - Be ready to answer "interview questions"

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Grading Policy

Weekly Programming Assignments		35%
Exams:	Total:	55%
	Midterms: 15% each	
	Final Exam: 25%	
In-lab exercises and quizzes		10%
Total:		**100%**

- We drop the two quizzes with the lowest grade
  - Keep this option for *real* emergencies and unpredictable events

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See online syllabus for other important information!

Especially *academic honesty*!!

http://www.cs.pomona.edu/classes/cs062

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Object-Oriented Design

- Objects are building blocks.
- Programs are collections of interacting objects.
- Objects cooperate to compute solutions or complete tasks.
- Objects communicate via sending messages.

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Objects

http://www.trover.com/d/MHOV-laemles-claremont-5-theatres-claremont-california

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Objects

- Objects can model objects from world:
  - Physical things
    - e.g., car, student, card, deck of cards
  - Concepts
    - e.g., meeting, date
  - Processes
    - e.g., sorting, simulations

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More objects

- Objects have:
  - Properties, e.g., color, model, manufacturer
  - Capabilities, e.g., drive, stop, admit passenger
- Objects responsible for knowing how to perform actions.
  - Commands: change object's properties, (e.g., set speed)
  - Queries: respond based on object's properties (e.g., how fast?)

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Even more objects

- Properties typically implemented as "fields" or "instance variables"
  - Affect how objects reacts to to messages
  - Can be:
    - Attributes, e.g., color
    - Components, e.g., door
    - Associations, e.g., driver
- Capabilities as "methods"
  - Invoked by sending messages

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Quick Java Review

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Primitive vs Object Types

- Objects: String, anything created by a class with "**new**"
  - respond to messages
- Primitives: `int`, `double`, `float`, `boolean`
  - do not respond to messages
  - cannot be used to instantiate type variables
  - have corresponding object types:
    - `Integer`, `Double`, `Float`, `Boolean`

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Classes

- Classes are templates for objects
  - Constructors generate new distinct objects
    - `new Car("Toyota")`
    - Specify all fields and methods – public and non-public
  - May be used as basis for more refined classes via inheritance
    - `class Car extends Vehicle`

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All classes inherit "Object" class

- Object class has methods:
  - `public boolean equals (Object other)`
    - Default behavior returns true only if same object
  - `public String toString()`
    - Returns string representation of object – default is hexadecimal
    - Does not print the string
    - Typically needs to be overwritten to be useful
  - `public int hashCode()`
    - Unique identifier defined so that if `a.equals(b)` then a, b have same hashCode

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Enum Types

- Example
  - `enum Suit {CLUBS, DIAMONDS, HEARTS, SPADES}`
- Operations:
  - `int compareTo(Suit other)`
  - `String toString()`
  - `int ordinal()` *starts with 0, not 1*
  - `static Suit valueOf(String name)`
  - `static Suit[] values()` *returns array of all values*

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Java Keywords

- `abstract` class -- can't be instantiated
  - usually some methods missing
- Information hiding qualifiers:
  - `public`
  - `private`
  - `protected`
- `static` -- copy associated with class, not objects
- `final` -- only assigned to once
  - in its declaration or constructor

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Interfaces & Inheritance

- Provide info on publicly available methods of objects
  - "what not how"
- Class implements interface if it supports all methods of interface
  - Try to use interfaces as types for flexibility
- Interface can extend another by adding methods
  - If A extends B and x has type A, then also has type B
- One class can extend another
  - inherits fields and methods
  - can override existing methods, add new ones
- `instanceof` & casts
  - Ex: in Ratio class later

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Card Deck Example

- `CardInterface` -- interface
- `AbsCard`
  - abstract class, implements `CardInterface`
- `Card` extends `AbsCard`
- `OtherCard` extends `AbsCard`
- `Deck`
  - Class holding array of `Card` objects

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Extending vs Implementing

- Extending a class allows sharing behavior:
  - **`Card`**, **`OtherCard`** extend **`AbsCard`**
- Implementing an interface provides an implementation
  - **`Card`**, **`OtherCard`** implement **`CardInterface`**
  - Either can be associated with variable of type **`CardInterface`**.
  - Makes it easier to replace implementations.

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