Lecture 1: Overview & Java

CS 62
Fall 2016
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Course web page: http://www.cs.pomona.edu/classes/cs062

Who we are:

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Why CS 62?

- How to implement algorithms and data structures in Java & C.
- 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.

Sample Problems

- Find the shortest path from Claremont to Chicago on interstate system
  - (and do it efficiently)
- Schedule final exams so there are no conflicts.
- Design and implement a scientific calculator.
- Design and implement a simulator that lets you study traffic flow in a city or airport.
- Design parallel algorithms to run on multicore computers

Your Responsibilities

- Skim reading in advance of lecture.
- After lecture, review lecture notes, sample code, and text until well understood.
- Come to labs prepared.
- Don’t remain confused. Ask faculty or TAs.
- Follow academic integrity guidelines.

Assignments

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

Text

- Java Structures, $\sqrt{7}$ edition, by Duane Bailey
  - available on-line for free
- C: various on-line resources

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.

Prerequisite

- One of:
  - CS 51 at Pomona or CMC (*not CS 5 from HMC!)*
  - AP CS A exam with score of 4 or 5
  - Fluent in Java and object-oriented programming & permission of instructors
- Come see one of faculty if any questions
- Assume comfortable with classes & objects, recursion, multi-dimensional arrays, etc. in Java

Heavy Workload Course

- ... 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”

See on-line syllabus for other important information!

Especially Academic Honesty!!

Object-Oriented Design

- Objects are building blocks.
- Program is collection of interacting objects.
- Objects cooperate to compute solution.
- Objects communicate via sending messages.

Objects

- Model physical and conceptual world, as well as processes.
- Objects have:
    - Properties, e.g. color, size, manufacturer, ...
    - Capabilities, e.g. drive, stop, admit passenger
- Objects responsible for knowing how to perform actions.
    - Commands: change state
    - Queries: response based on properties

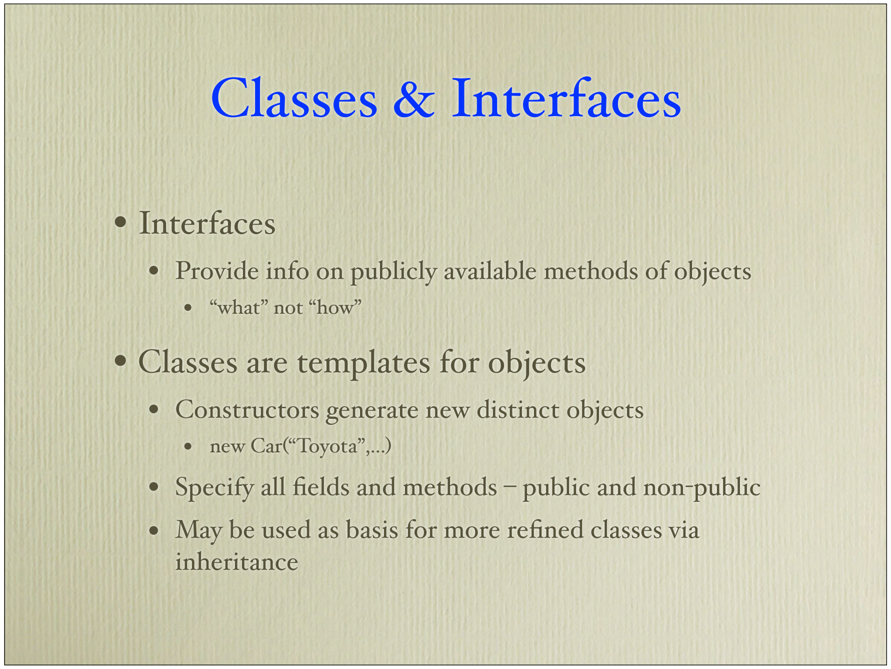
More Objects

- Properties typically implemented as “fields” or “instance variables”
    - Affect how object reacts to messages
    - Can be
        - Attributes, e.g., color
        - Components, e.g., doors
        - Associations, e.g., driver
- Capabilities as “methods”
    - Invoked by sending messages

Quick Java Review

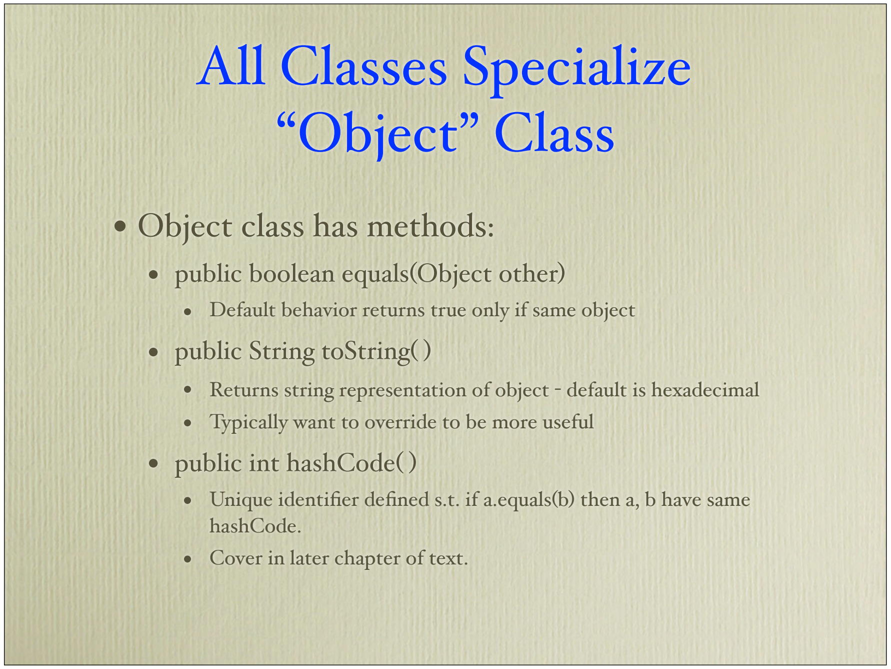
Primitive vs Object Types

- Objects: String, anything created by class
    - 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



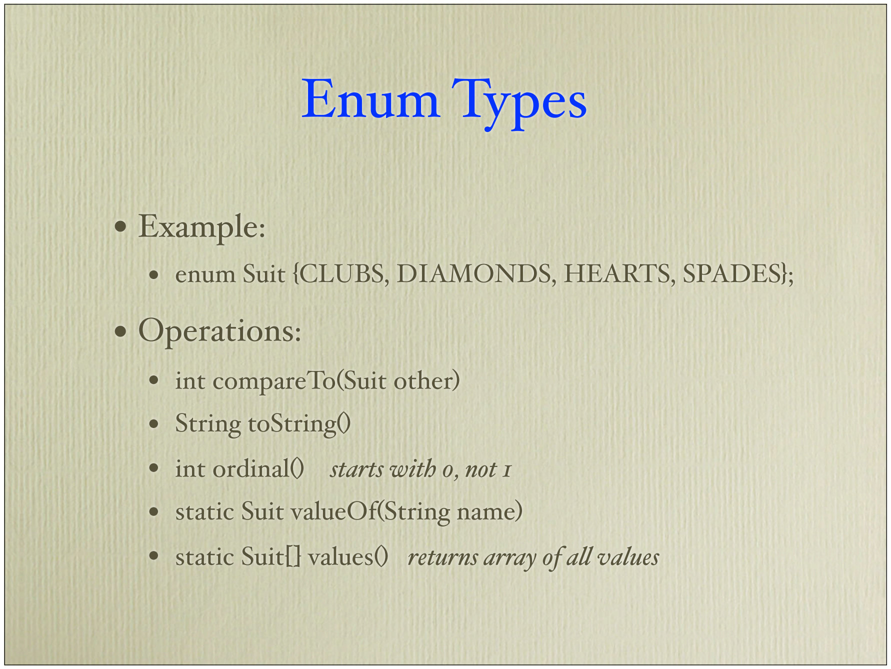
Classes & Interfaces

- Interfaces
  - Provide info on publicly available methods of objects
    - “what” not “how”
- 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



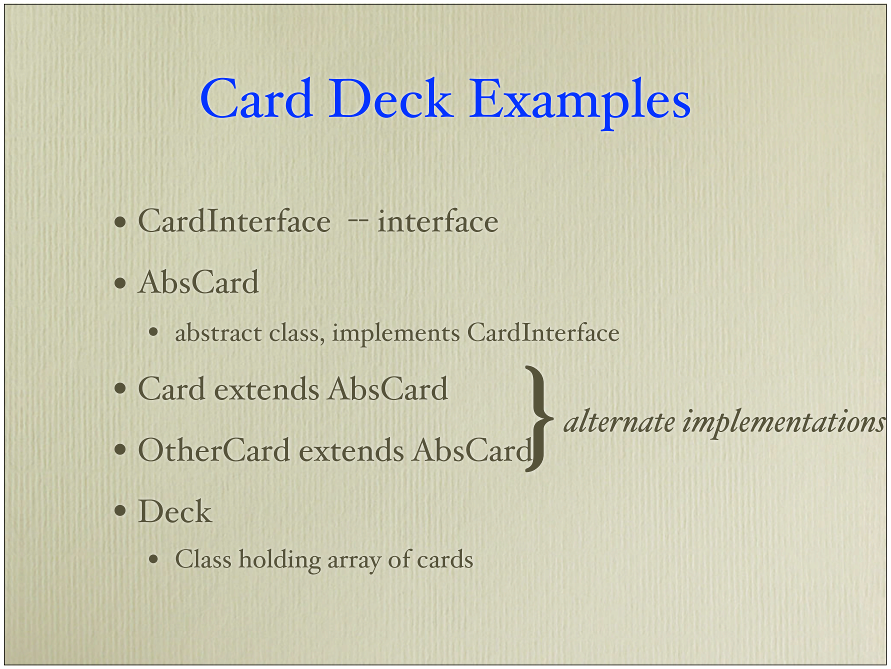
All Classes Specialize “Object” Class

- 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
    - Typically want to override to be more useful
  - public int hashCode( )
    - Unique identifier defined s.t. if a.equals(b) then a, b have same hashCode.
    - Cover in later chapter of text.



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*

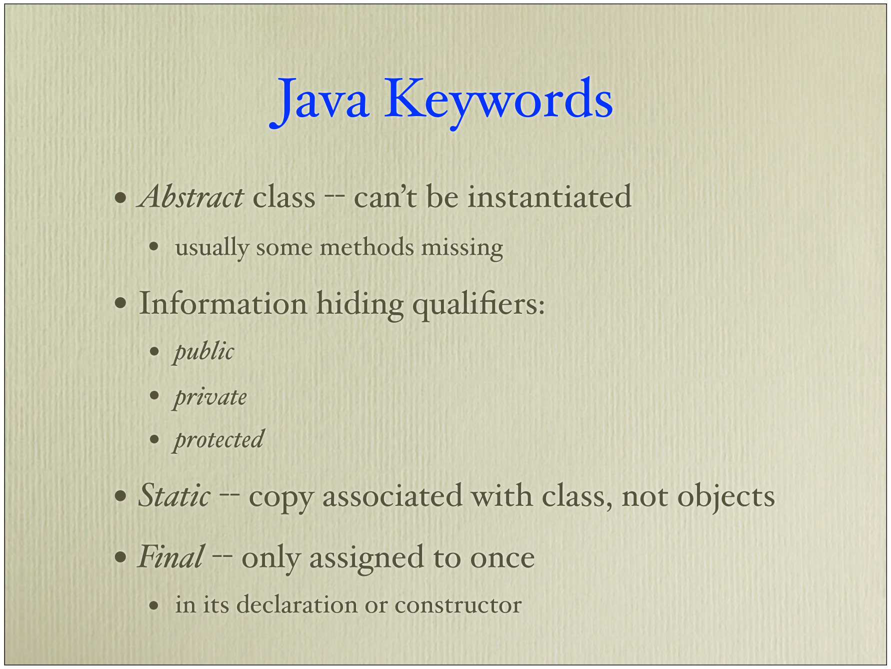


Card Deck Examples

- CardInterface -- interface
- AbsCard
  - abstract class, implements CardInterface
- Card extends AbsCard
- OtherCard extends AbsCard

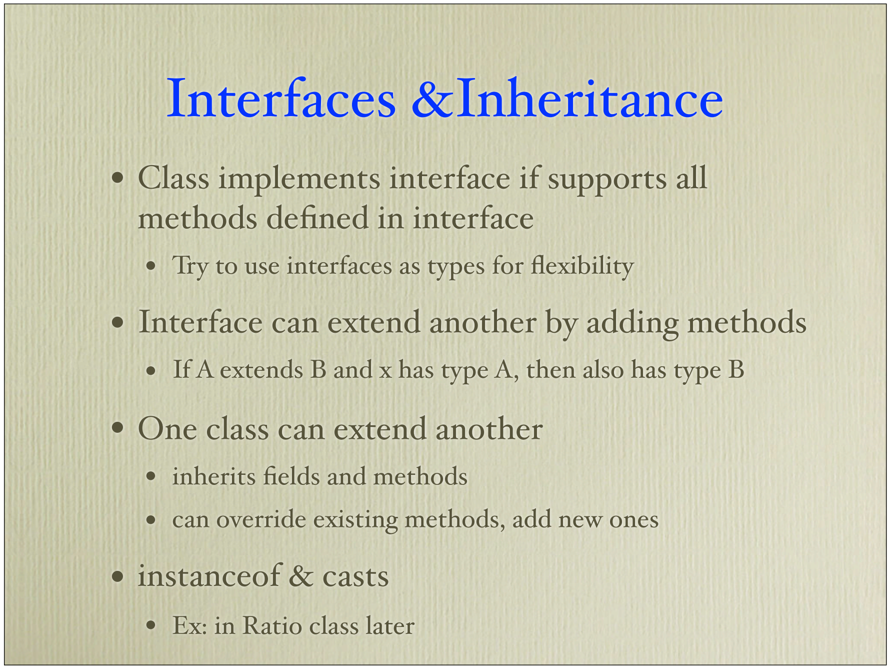
} *alternate implementations*

- Deck
  - Class holding array of cards



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



Interfaces &Inheritance

- Class implements interface if supports all methods defined in 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