Methods

• A collection of grouped statements that perform a logical operation and control the behavior of objects

• Syntax:
  • modifier return-type method-name(type parameter-name,...)
  • e.g., `public int enrollInClass(int classID){...}`
  • Signature: method name and the number, type and order of its parameters

• Can also be `static`, therefore shared by all instances of a class

• Can be overloaded (same name, different parameters)
this

• Within an instance method or a constructor used to refer to current object
  • can be used to call instance variables, methods, and constructors

```java
public class Car{
    private String color;

    public Car(){
        this("undefined");
    }
    public Car(String color){
        this.color = color;
    }
}
```
Inheritance

• When you want to create a new class and there is already a class that includes some of the code you want your new class to have, you can derive the new class from the existing class → reuse code!

• We say that a class extends or inherits another class

• E.g., public class Car extends Vehicle

• Car is a subclass of Vehicle

• Vehicle is a superclass of Car

• Car IS-A Vehicle
Inheritance in Java

• A subclass inherits all of the **public** and **protected** members of parent

• **Hiding**: same name of variables between super and subclass

• **Overriding**: same signature of methods between super and subclass
  - **Hiding** if static

• Single inheritance!
  - A class can only extend ONE AND ONLY ONE class

• Multilevel inheritance
  - Class **SUV** extends class **Car** which extends class **Vehicle**
**super keyword**

- refers to the direct parent class of the current class
- `super.variable` (for hidden fields → avoid altogether)
- `super.method()` (for overridden methods)
- `super(args)` → to call the constructor of the superclass
All classes inherit Object

• Directly (if they do not extend any other class) or indirectly

• Object class has methods (and more):
  • `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
final

• variable – only assigned once in its declaration or constructor
  – cannot change

• method – cannot be overridden by subclass
  • Methods called from constructors should generally be declared final

• class - cannot be extended
abstract

- Class – cannot be instantiated but can be extended

- Method – declared without an implementation
  - no braces and body, just semicolon
  - `public abstract int enrollInClass(int classID);`

- If a class has at least one abstract method then it should be declared abstract itself

- If you extend an abstract class either declare subclass as abstract too or implement the methods
Interfaces

• Contracts on how the program should work, abstracting from implementation
  • `public interface Moveable{...}`

• A class can *implement* many interfaces
  • `public class Car extends Vehicle implements Moveable`

• Variables - automatically `public, static, and final`
• Methods - `public` (declared or default)
• Cannot be instantiated
Nested class

• A class defined within a class, e.g., it’s useful only within that one
• class Outer{
    ...
    (static) class Inner{...}
}
• Can be static or non-static (inner)
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`
Documentation

• Important for code maintainability
  • This matters even for 1st week assignments

• Critical when working on a team

• Create documentation first—this is design work!
JavaDoc

- Document generation system
  - Reads JavaDoc comment → HTML pages

- JavaDoc comment = description written in HTML + tags

- Enclosed in /**     */

- Must precede class, variable, constructor or method declaration

- Read the style guide
JavaDoc

• Common tags:
  • for class:
    • @author author name - classes and interfaces
    • @version date - classes and interfaces
  • for method:
    • @param param name and description - methods and constructors
    • @return value returned, if any - methods
    • @throws description of any exceptions thrown - methods
Packages

• Use them! E.g., `package assignment1;` ... before everything else

• Package name == folder name

• Helps organize large projects e.g, `java.lang -> fundamental`

• Import a package member: `import package.member;`
• Import an entire package: `import package.*;`
Generics

- Enable classes and interfaces to be parameters when defining classes, interfaces, and methods.
  - `class Name<T1, T2, ..., Tn> {...}
  - T can be used anywhere within the class
  - T can be any non-primitive

- T → Type, E → Element, K → Key, V → Value, N → number

- See `Association` class in Bailey `structure5` library
  - `public class Association<K,V>`
  - `Association<String, Integer> phoneBook = new Association<>()`
Random Number Generator

• class Random in java.util package w/ method
  • int nextInt(int n) -- returns random k s.t. 0 ≤ k < n
  • See bottom of pg 30 in text.

• Create Random object once:
  • Random rng = new Random();

• send nextInt many times:
  • int r = rng.nextInt(10);
    • Repeat this step, not the creation of a new object

• See LottoHelper example.