

Writing Classes

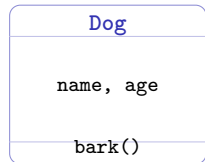
AP Computer Science A ■ Unit 3

AP Computer Science A

```
class Dog
```

What we will cover

- 1 Abstraction & program design
- 2 The anatomy of a class
- 3 Constructors & methods
- 4 References & static members
- 5 Scope & the this keyword



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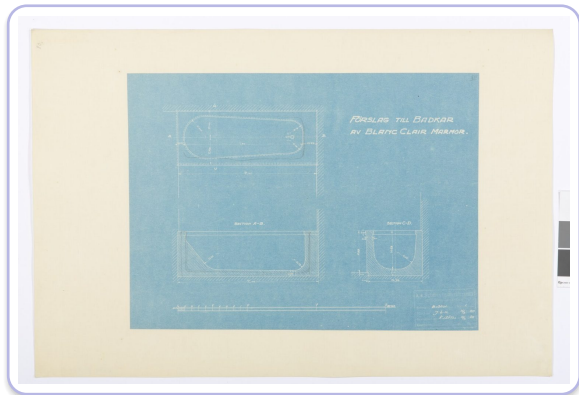
Design

Abstraction & program design

Abstraction 抽象 hides detail behind a simple interface, so we manage complexity one piece at a time.

Good **program design**

程序设计 breaks a problem into classes, each with one clear responsibility. A well-designed class is easier to test, reuse, and change without breaking the rest.



A class is the blueprint; objects are built from it

Encapsulation, and the responsibility that comes with design

encapsulation 封装

keep **instance variables** 实例变量 private and expose them only through methods

accessor
(getter) 访问器

returns a field's value without letting the caller change it

mutator
(setter) 修改器

changes a field, and is the one place a validity check can live

overloading 重载

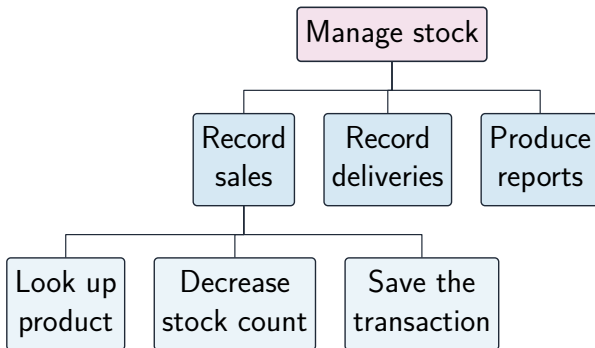
several methods with the **same name** and different parameter lists

system
reliability 系统可靠性

the program doing its job without failure – sometimes a **legal** requirement, not just a quality goal

Design also carries responsibility beyond the code: **intellectual property** 知识产权 in what you reuse, and **open source** 开源 licences that state the conditions of that reuse.

Decomposing a program into modules and sub-modules



Give each class or method one job, so it can be written, tested and reused on its own.

2

Anatomy

The anatomy of a class

class Dog

```
private String name;  
private int age;
```

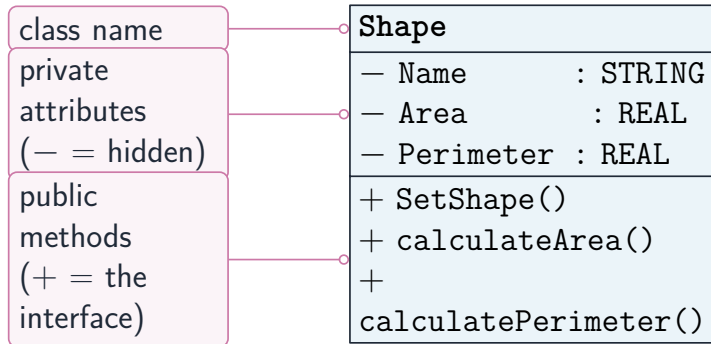
fields 字段 (the object's data)

```
public Dog(String n) ... constructor  
public void bark() ... methods
```

构造函数

方法

A class diagram



A class diagram: private attributes and public methods

Constructors & methods

Constructor 构造函数

runs once at new; sets the object's initial **fields** 字段

Method 方法

a named action; may take **parameters** 形参 and return a value

A method **returns** 返回 a value with return; a void method returns nothing.

3

References & static

References & static members

An object variable holds a **reference** 引用 – a pointer to the object, not the object itself.
Passing it lets a method change the same object.

Instance member

belongs to **each object**: `d.bark()`

Static 静态 (class) member

belongs to the **class**:

`Math.sqrt(9)`

One more kind of variable, and one responsibility

Static (class) variable

A **static (class) variable** belongs to the class, not to any object: one copy shared by every instance – a counter of objects created, or a constant.

Instance variable

Each object has its own, so changing one object's copy changes nothing elsewhere.

How to spot it

Declared with `static`, and reached through the class name rather than an object reference.

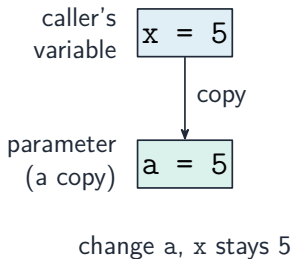
Responsibility

Legal and intellectual-property rules apply to code as to anything else: licences, attribution, and other people's data.

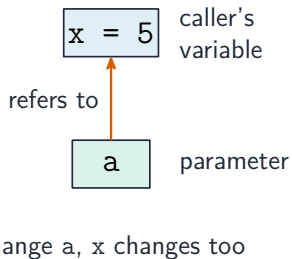
Ask whether the value describes *one object* or *the class*. That question decides static or instance every time.

References & static members, in detail

pass by value



pass by reference



Java always passes

Scope & the this keyword

Scope 作用域 is where a name is visible.

A local variable lives only inside its method; a field lives as long as the object.

`this` refers to the current object. Use it when a parameter name hides a field: `this.name = name;` sets the field from the parameter.

global scope (the whole program)

Total

global — visible everywhere

PROCEDURE Calc (local scope)

temp

local — exists only
while Calc runs

Key points

A class has **fields**, a **constructor** & **methods**

The constructor sets initial state at new

Object variables hold a **reference**; **static** belongs to the class

`this` names the current object

Worked example – passing a reference

**s is a Student with score 50; we call
tweak(s)**

Java passes the **reference by value**: tweak gets a **copy of the arrow**, pointing at the **same** object. So `s.setScore(90)` inside tweak **does** change the caller's object – but reassigning `s = new Student()` inside tweak **does not**.

You can change what the object **contains**; you cannot change which object the **caller's** variable points to.

Exam tips

- Design with methods and classes: encapsulate data as private fields and expose behaviour through public methods.
- Know the difference between an **object** and its **class**, and that objects are passed **by value** – the parameter gets a copy of the reference, so a method can change the object's state, but reassigning the parameter does not affect the caller (Java has no pass-by-reference).
- Traverse arrays and ArrayLists safely – size is `length` vs `.size()`, and removing during a loop shifts indices.
- **Trace** a **recursive** method to determine its result: find the base case first, then follow each recursive call to its return value (writing recursive code is outside the exam's scope).
- Recognise **inheritance** vocabulary – superclass, subclass, method overriding, and that every class is a subclass of `Object` (designing and implementing inheritance is outside the exam's scope).

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Recap

Unit 3 – key takeaways

1

Encapsulate

private fields, public methods

2

Reference

passed by value – reassigning the parameter is local

3

Lists

length vs `.size()`; removing shifts indices

4

Recursion

find the base case, then follow each return

Check yourself

- 1 Can a method change the caller's object through a reference?
- 2 Can it change which object the caller's variable points to?
- 3 What does `static` mean – per object, or per class?
- 4 What does `this` refer to?

Answers 1. yes 2. no 3. per class – shared by all objects 4. the current object