Objects and Classes
Lecture 2

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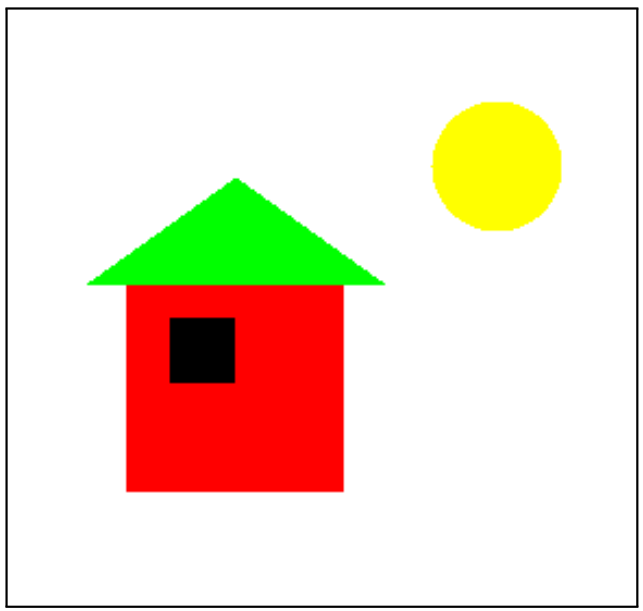
Object interaction

Could create Picture manually
Or could be created by program

- Picture Class instance creates
  - Two Square objects
  - One Triangle object
  - One Circle object
- Objects' states determine
  - Size of each object
  - Position of each object
  - Color or each object



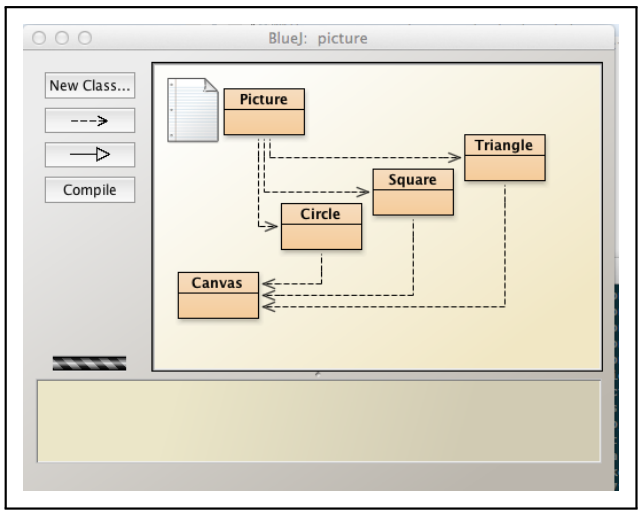
How Picture object created

Picture class contains

- Square class (wall)
- Square class (window)
- Triangle class (roof)
- Circle class (sun)

Picture has a method *draw* that

- Instantiates these classes
- Sets the state of each object



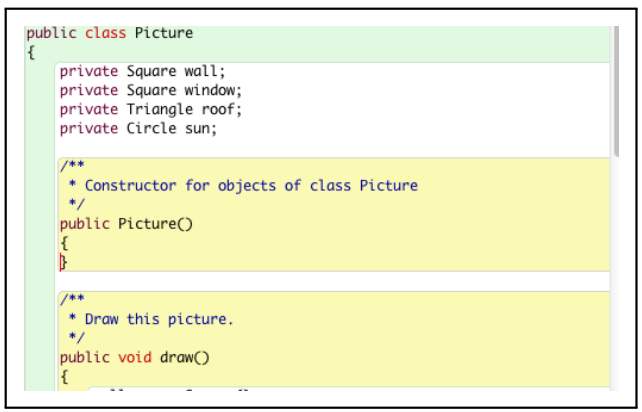
Picture object source code

Source code Java text
Defines fields and methods

- private `Square wall`;
- public void `draw`();

When source code compiled

- Object can be created
- State can be changed
- Object methods callable



```
public class Picture
{
    private Square wall;
    private Square window;
    private Triangle roof;
    private Circle sun;

    /**
     * Constructor for objects of class Picture
     */
    public Picture()
    {
    }

    /**
     * Draw this picture.
     */
    public void draw()
    {
```

Compilation

Source code is compiled

Computer processor requires binary (machine code)

- 00110001110101011

Difficult programming in binary

Hence human readable Java

Compiler: source code to machine code

Changed source requires recompilation

Bits and Bytes

Bit (**B**inary **D**igit): smallest unit of compilation

- Value range 0, 1

Byte: 8 bits

- 00000000
- 01001101

MegaByte (MB):

- 1024 bytes

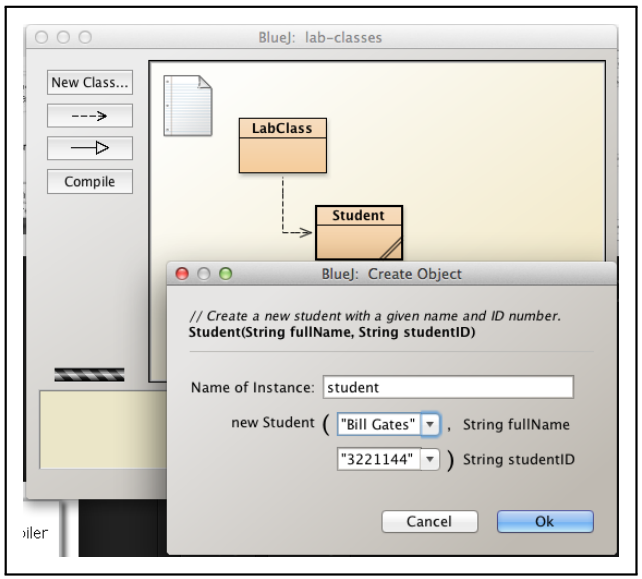
Megabit (Mb):

- 1024 bits
- 1 megabyte (MB)

Using parameters when creating objects

Student project example

- Create new student
- Object name required
- Parameters required
  - *String fullName*
  - *String studentID*



Object state

Student object state

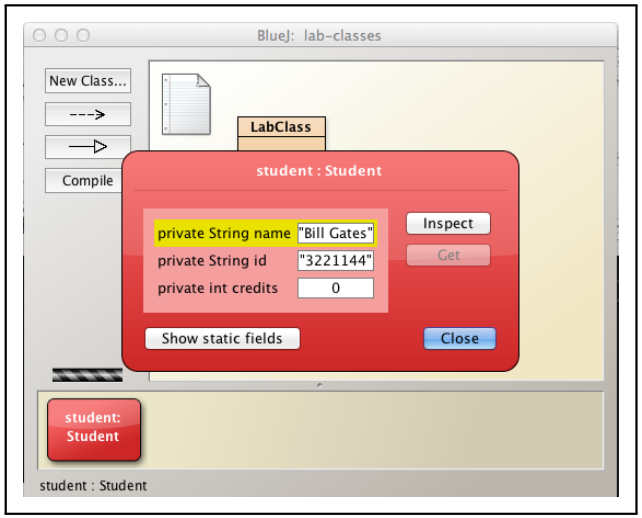
- private String name : "Bill Gates"
- private String id : "3221144"
- private int credits : 0

Notice double quotes

- These required for String objects

Notice third field undefined

- Assigning value here later task



Return values

Notice Student class methods
Some methods return data

- *String getName()*

Method *getName* when invoked

- Sends back String object
- String object contains student name

Signature of method informs return type

- *void* means no value returned
- *int* means an integer returned

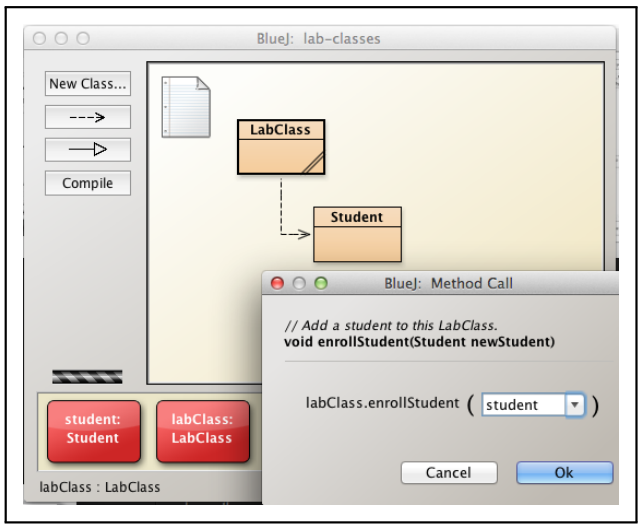
```
void addCredits(Int additionalPoints);
void changeName(String replacementName);
int getCredits();
String getLoginName();
String getName();
String getStudentID();
void print();
```

Objects as parameters

Parameters may be

- Primitive data types (example: int, float)
- Objects (example: String)

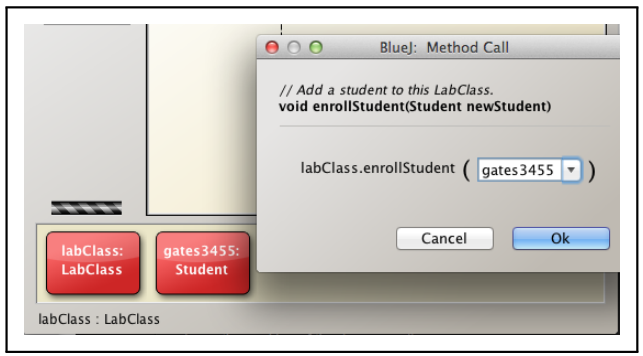
LabClass has students
Enrolling new student passes Student object as parameter



Objects as parameters (continued)

Objects can be passed as parameters

- *Student gates3455*
- *labClass.enrollStudent(gates3455);*
- Notice no double quotes
- labClass is LabClass object
- gates3455 is Student object

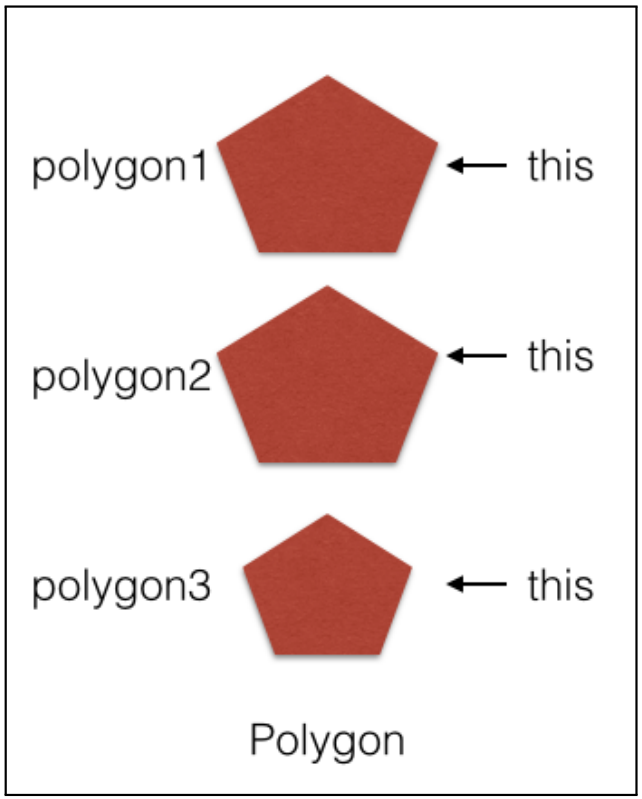


The *this* keyword

Object reference

- Memory address where object stored
- Address accessible by *this* keyword
- Common usage where field shadowed by parameter

```
public class BankAccount {
    int sum;
    public BankAccount(int sum) {
        this.sum = sum;
    }
}
```



The *this* keyword

Here is class Student constructor as written in the BlueJ example

```
/**
 * Create a new student with a given name and ID number.
 */
public Student(String fullName, String studentID)
{
    name = fullName;
    id = studentID;
    credits = 0;
}
```

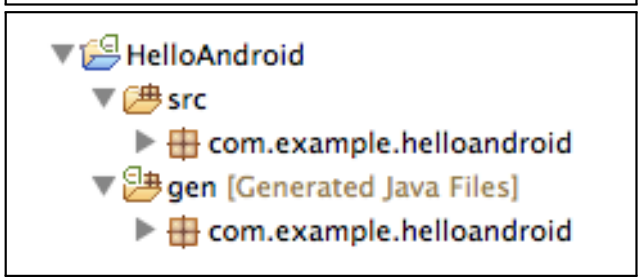
Here is an alternative approach using the *this* reference.

```
/**
 * Create a new student with a given name and ID number.
 */
public Student(String name, String id)
{
    this.name = name;
    this.id = id;
    credits = 0;
}
```

Package

Package definition

- A grouping of related types
- Example: a folder of class files
- One benefit to provide access protection



Controlling access

Access modifier

- Determines other class access to field or method

Fields may be declared thus:

- int value;
- public int value;
- private int value;
- protected int value;

Modifier	Class	Package	Subclass	World
public	Y	Y	Y	Y
protected	Y	Y	Y	N
no modifier	Y	Y	N	N
private	Y	N	N	N

Table 1 : Access Levels

Block

Block is code between curly braces.

```
public Tree(int val)
{
  this.val = val;
}
```

Blocks can be nested.

Example of method block enclosed by class block:

```
public class Student
{
  String name;
  public String getName()
  {
      return name;
  }
}
```

Scope

Scope refers to lifetime and accessibility of variable

```
public class Tree
{
    int val;
    ...
    public Tree(int val)
    {
        this.val = val;
    }
}
```

this.val

- Has class scope
- Visible (usable) throughout class

val

- Has local scope
- Visible (usable) only within constructor

Summary

Classes and Objects

- Class represents general concept
- Object is instance of class
- Class can have many objects
- Objects store data in fields
- Object state comprises all data values
- Objects have methods
- Methods can change objects
- Methods can retrieve information from objects

Summary continued

Classes and Objects

- Method : method invocation communicates with objects
- Return value : data sent to caller when method invoked
- Signature : header of method facilitating invocation
- Parameter : data passed to method
- Type : defines kind of data
- State : set of field values (attributes) in object
- Source code : Java language description of program
- Compiler : software program converts source code to bytecode