Classes for Object-Oriented Programming, Inheritance, Polymorphism

IST 256

Application Programming for Information Systems

Building a Class

- Simple employee class
- Two public fields

```
public class Employee
{       // employee fields (visible to subclasses)
        protected String name;
        protected double salary;

        // constructor with initial values
        public Employee(String n, double s)
        {       name = n;
                salary = s;
        }
        // can have multiple constructors
        public Employee( )  {  }

        // other methods
        public void raiseSalary(double percent)
        {   salary = … ;  }
        . . .
}
```

Using the Class

- Employee array with two people

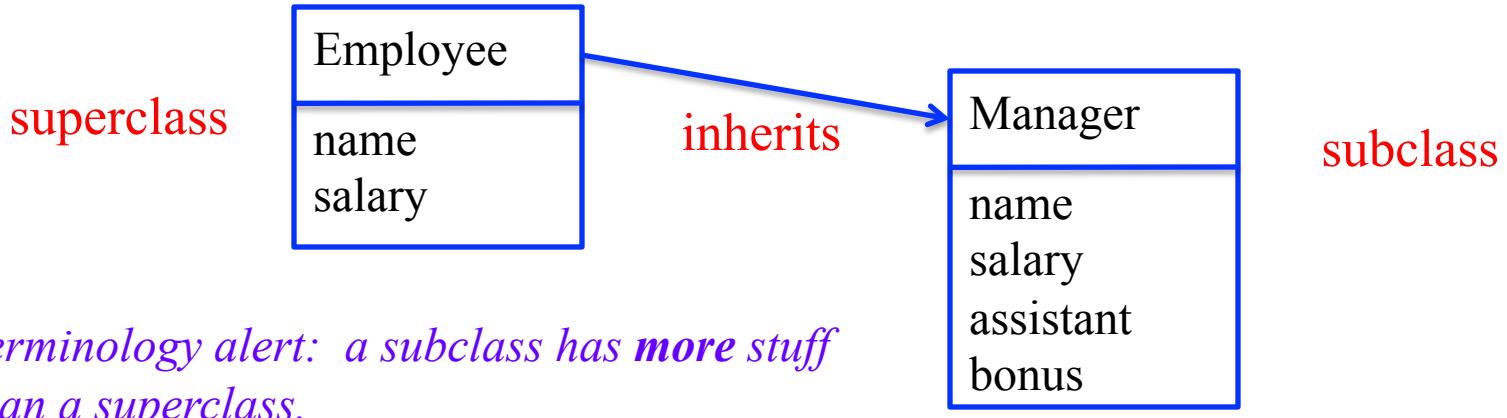
```
public class EmployeeTest
{   public void main(String[ ] args)
    {
        Employee [ ]  staff = new Employee[2];

        staff[0] = new Employee ("Hannah Hacker", 50000);
        staff[1] = new Employee ("Tony Tester", 40000);

        // give everyone a 3% raise
        for (int i = 0; i < staff.length; i++)
        {
            staff[i].raiseSalary(3.0);
        }
    }
}
```

Inheritance

- Another class can be defined that has all of the properties and operations as the previous class, and has additional ones
- Suppose that among our employees, some are managers. They may also have assistants and can have bonus amounts.
- We can make a Manager class that extends the Employee class
  - It will automatically have the fields and methods of the Employee class
  - It can have additional fields and methods
  - It can also redefine some of the methods (more on this later)



*Terminology alert: a subclass has **more** stuff than a superclass.*

Building a Subclass

- Manager class uses the extends keyword to inherit the two fields from the Employee class
- Adds two more fields

```
public class Manager extends Employee
{       // inherits name and salary fields
        // adds two more fields
        public String assistantname;
        public double bonus;

        // constructor with initial values
        public Manager(String n, double s,
                                        String a, double b)
        {       name = n;  salary = s;
                assistant = a; bonus = b;
        }

                . . .
}
```

Using the Subclass

- Employee array with three people
- One element of the array is a Manager, which counts as an Employee

```
public class EmployeeTest
{   public void main(String[ ] args)
    {
        Employee [ ]  staff = new Employee[3];

        staff[0] = new Employee ("Hannah Hacker", 50000);
        staff[1] = new Employee ("Tony Tester", 40000);
        staff[2] = new Manager ("Boss Boring", 90000,
                                "Tony Tester", 10000)

        // give everyone a 3% raise
        for (int i = 0; i < staff.length; i++)
        {
            staff[i].raiseSalary(3);
        }
    }
}
```

Polymorphism

- In the previous example, the subclass Manager used the same raiseSalary method as did all Employees
- But we can also redefine a method of the superclass by giving a new definition in the subclass

Subclass with a polymorphic method

- Manager class now adds its own definition of the raiseSalary method, which can do something special for managers

```
public class Manager extends Employee
{       // inherits name and salary fields
        // adds two more fields
        public String assistantname;
        public double bonus;

        // constructor with initial values
        public Manager(String n, double s,
                                        String a, double b)
        {       name = n;  salary = s;
                assistant = a; bonus = b;
        }
        // another version of raiseSalary
        public void raiseSalary(double percent)
        {   salary = …  ;
            bonus = …  ;  }
                . . .
}
```

Using a polymorphic method

- Same code as before
- Each call to raiseSalary will use the appropriate method, either from the Employee class or the Manager class

```
public class EmployeeTest
{   public void main(String[ ] args)
    {
        Employee [ ]  staff = new Employee[3];

        staff[0] = new Employee ("Hannah Hacker", 50000);
        staff[1] = new Employee ("Tony Tester", 40000);
        staff[2] = new Manager ("Boss Boring", 90000,
                                "Tony Tester", 10000)

        // give everyone a 3% raise
        for (int i = 0; i < staff.length; i++)
        {
            staff[i].raiseSalary(3);
        }
    }
}
```

Inheritance Hierarchies

- An application may create and use many extended classes.
- Information systems may use these hierarchies in the design of a system.