CMSC433, Fall 2002 Programming Language Technology and Paradigms Basic Java

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Administrivia

- Project 1 posted today
- Java readings from *Thinking in Java*
  - we'll do parts of many chapters, but definitely read Chapter 1 for an overview
  - I'll add some suggestions on Web page, but use it as a refererence

Outline

- Object oriented programming principles
  - How Java realizes them
  - How Java differs from C++
- Useful information on Java
  - Using the compiler
  - I/O libraries
  - Container classes

Object Orientation

- Abstraction
  - focus on essential properties, ignore unimportant details
- Encapsulation
  - separate external, visible behavior from internal, hidden behavior

Object Orientation (cont'd)

- Combining data and behavior
  - objects, not developers, decide how to carry out operations
- Sharing
  - similar operations and structures are implemented once
- Emphasis on object-structure rather than procedure structure
  - behavior more stable than implementation
  - … but procedure structure still useful

And one more …

- Security and Reliability
  - Write code that works, and is not insecure

Java

- Similar to C++, but with "unsafe" features removed, and others added
- Fully specified, compiles to virtual machine
  - machine-independent
- Secure
  - bytecode verification ("type-safe")
  - security manager

Java design

- Everything is an **Object**
  - Allows sharing, generics, and more
  - There are primitive int, long, float values, etc.
- *Interfaces* and *Inheritance*
  - Allows role sharing and code sharing
  - Simulates multiple inheritance
- Security and reliability-conscious
  - Strong type system
  - Garbage collection
  - Exceptions

Wrapper classes

- To create **Integer**, **Boolean**, **Double**, …
  - that is a subclass of **Object**
  - useful/required for polymorphic methods
    - HashTable, LinkedList, …
  - used in reflection classes
- Include many utility functions
  - e.g., convert to/from String
- **Number**: superclass of **Byte**, **Short**, **Integer**, **Long**, **Float**, **Double**
  - allows conversion to any other numeric primitive type

Java libraries and features

- Utilities
  - collection classes, Zip files, internationalization
- GUIs, graphics and media
- Networking
  - sockets, URLs, RMI, CORBA
- Threads
- Databases
- Cryptography/security

Some of what's missing from C++

- preprocessor (#include, #define, …)
- structs and unions
- enumerated types
- bit-fields
- variable-length argument lists
- multiple inheritance (of implementation)
- operator overloading
- templates/ parameterized types
  - GJ (generic Java)

Naming conventions

- Classes/Interfaces start with a capital letter
- packages/methods/variables start with a lowercase letter
- for names with multiple words, CapitalizeFirstLetterOfEachWord
- don't use underscores
- CONSTANTS all in uppercase

Object-oriented programming in Java

class Complex – a toy example

```
public class Complex {
  private double r, i;

  public Complex(double r,double i) {
    this.r = r;
    this.i = i;
  }
  public String toString() {
    return "(" + r + "," + i + ")";
  }

  public Complex plus(Complex that) {
    return new Complex(
                r + that.r,
                i + that.i);
  }
}
```


Using Complex

```
public static void main(String[] args) {
  Complex a = new Complex(5.5,9.2);
  Complex b = new Complex(2.3,-5.1);
  Complex c,d;
  c = a.plus(b);
  d = a.plus(b);
  System.out.println("a = " + a);
  System.out.println("b = " + b);
  System.out.println("c = " + c);
  System.out.println("c.equals(d): " + (c.equals(d)));
  System.out.println("c = d: "+(c==d));
}
```

prints:
a = (5.5,9.2)
b = (2.3,-5.1)
c = (7.8,4.1)
c.equals(d): false
c == d: false

Java Classes and Objects

- Each object is an instance of a class
  - an array is an object
- Each class extends *one* superclass
  - **Object** if not specified
  - class **Object** has no superclass

instance operations

- = assignment
  - for object references: copies reference, not object
- == equality test
  - for object references: true if references *to same object*

Some **Object** operations

- o.equals(bar)
  - intended to compare contents of objects
- o.toString()
  - returns String representation of the object, can/should be overridden

Adding equals to Complex

```
public class Complex {
  …
  public boolean equals(Object o) {
    if (o instanceof Complex) {
      Complex c = (Complex)o;
      return (c.r == this.r &&
              c.i == this.i);
    } else {
      return false;
    }
  }
```


Using Complex again

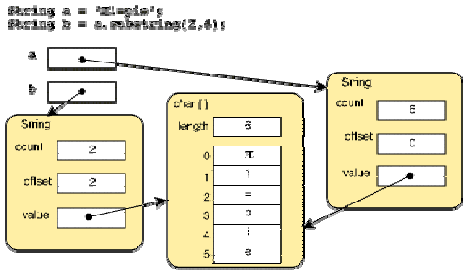
```
public static void main(String[] args) {
  Complex a = new Complex(5.5,9.2);
  Complex b = new Complex(2.3,-5.1);
  Complex c,d;
  c = a.plus(b);
  d = a.plus(b);
  System.out.println("a = " + a);
  System.out.println("b = " + b);
  System.out.println("c = " + c);
  System.out.println("c.equals(d): " + (c.equals(d)));
  System.out.println("c = d: "+(c==d));
}
```

prints:
a = (5.5,9.2)
b = (2.3,-5.1)
c = (7.8,4.1)
c.equals(d): true
c == d: false

Objects and references

- All objects allocated on the heap with *new()*
  - All variables of non-primitive type are references to an object or *null*
  - No object can "contain" another object
  - No objects stack-allocated (only references there)
- Reference is like a C++ pointer, except
  - can only point to start of heap-allocated object
  - no pointer arithmetic allowed
  - use . instead of -> to access fields/methods

String example



Different from C++

- No malloc()
  - Only new()
- No free()
  - Uses garbage collection
- No pointer operations: *, &, ->, +, ++, etc.
  - Simplifies usage and implementation
- Method parameters pass-by-value
  - but object parameters are references to heap objects that can be changed

More **Object** Obligations

- many operations have default implementations
  - which may not be the ones you want

```
public boolean equals (Object that) { … } // return this == that
public String toString() { … } // returns print representation
public int hashCode() { … } // key for accessing object
// important that a.equals(b) implies a.hashCode()==b.hashCode()
public void finalize() { … } // called before object garbage
    // collected, default is {}
public Object clone() { … } // default is shallow bit-copy if class
    // implements Cloneable, throw CloneNotSupportedException
    // otherwise
```

Class modifiers

- **public** – class visible outside package
- **final** – no other class can extend this class
- **abstract** – no instances of this class can be created
  - only instances of extensions of the class
- No modifier implies *package*-level scope

Variable / method visibility

- **public** – visible everywhere
- **private** – visible only within this class
- **protected** – visible within same package or in subclass
- **package** (default) – visible within same package

Instance vs. **static** variables

- **static** – the data is stored "with the class"
  - static variables allocated once, no matter how many objects created
  - static methods are not specific to any class instance, so can't refer to **this** or **super**
- Can reference class variables and methods through either class name or an object ref
  - Clearer to reference via the class name

Examples

- public **static** void main(String args[]) { … }
- public class Math {
  public final **static** PI = 3.14159…;
  }
- public class System {
  public **static** PrintStream out = …;
  }

Instance variable modifiers

- **final** – can't be changed; must be initialized in declaration or in constructor
- **transient, volatile**
  - will cover later

Method modifiers

- **final** – this method cannot be overridden
  - useful for security
  - allows compiler to inline method
- **abstract** – no implementation provided
  - class must be abstract
- **native, synchronized**
  - will cover later

Method invocation

- Method names can be overloaded
  - method invoked is determined by both its name and the types of the parameters
  - resolved at compile-time, based on compile-time types
- Methods can also be overridden
  - define a method also defined by a superclass
  - arguments and result types must be identical
  - resolved at run-time, based on type of object method is invoked on

Overriding

- Overriding
  - methods with same name and argument types in child class override method in parent class
  - you can override/hide instance variables
    - both variables will exist, but don't do it

```
class Parent {
  int cost;
  void add(int x) {
    cost += x;
  }
}
class Child extends Parent {
  void add(int x) {
    if (x > 0) cost += x;
  }
}
```


Overloading

- Methods with the same name, but different parameters (count or types) are overloaded

```
class Parent {
  int cost;
  void add (int x) {
    cost += x;
  }
}
```

```
class Child extends Parent {
  void add (String s)
    throws NumberFormatException {
      cost += Integer.parseInt(s);
  }
}
```


Dynamic Method Dispatch

- If you have a ref **a** of type **A** to an object that is actually of type **B** (a subclass of **A**)
  - instance methods invoked on **a** will get the methods for class **B** (like C++ virtual functions)
  - class methods invoked on **a** will get the methods for class **A**
    - invoking class methods on objects strongly discouraged

Simple Dynamic Dispatch Example

```
class A {
  String f() {return "A.f() "; }
  static String g() {return "A.g() "; }
}
public class B extends A {
  String f() {return "B.f() "; }
  static String g() {return "B.g() "; }
  public static void main(String args[]) {
    A a = new B();   B b = new B();
    System.out.println(a.f() + a.g() + b.f() + b.g());
  }
}
```

java B *generates*:

B.f() A.g() B.f() B.g()

Self reference

- **this** refers to the object the method is invoked on
- **super** refers to the same object as **this**
  - but used to access methods/variables in superclass
- Like C++

Constructors

- Declaration syntax same as C++
  - no return type specified
  - method name same as class
- First statement can be **this(args)** or **super(args**)
  - if those are omitted, **super()** is called
  - must be very first statement, even before variable declarations
- *not* used for type conversions or assignments
- void constructor generated if no constructors given

Garbage collection

- Objects that are no longer accessible can be garbage collected
- Method **void finalize()** called when an object is collected
  - best to avoid using it, since no way to tell when it will get called
- Garbage collection not a major performance bottleneck
  - **new/delete** in C++ can be expensive too

Detailed Example

- Shows
  - polymorphism for both method receiver and arguments
  - static vs. instance methods
  - overriding instance variables

Source code for classes

```
class A {
        String f(A x) { return "A.f(A) "; }
        String f(B x) { return "A.f(B) "; }
  static String g(A x) { return "A.g(A) "; }
  static String g(B x) { return "A.g(B) "; }
        String h = "A.h";
        String getH() {return "A.getH(): " + h; }
}
class B extends A {
        String f(A x) { return "B.f(A)/ " + super.f(x); }
        String f(B x) { return "B.f(B)/ " + super.f(x); }
  static String g(A x) { return "B.g(A) "; }
  static String g(B x) { return "B.g(B) "; }
        String h = "B.h";
        String getH() {return "B.getH(): " + h + "/" + super.h; }
}
```



```
A a = new A();  A ab = new B();  B b = new B();

System.out.println( a.f(a) + a.f(ab) + a.f(b) );
// A.f(A)  A.f(A)  A.f(B)
System.out.println( ab.f(a) + ab.f(ab) + ab.f(b) );
// B.f(A)/A.f(A)  B.f(A)/A.f(A)  B.f(B)/A.f(B)
System.out.println( b.f(a) + b.f(ab) + b.f(b) );
// B.f(A)/A.f(A)  B.f(A)/A.f(A)  B.f(B) A.f(B)

System.out.println( a.g(a) + a.g(ab) + a.g(b) );
// A.g(A)  A.g(A)  A.g(B)
System.out.println( ab.g(a) + ab.g(ab) + ab.g(b) );
// A.g(A)  A.g(A)  A.g(B)
System.out.println( b.g(a) + b.g(ab) + b.g(b) );
// B.g(A)  B.g(A)  B.g(B)

System.out.println( a.h + "  " + a.getH() );
// A.h  A.getH():A.h
System.out.println( ab.h + "  " + ab.getH() );
// A.h  B.getH():B.h/A.h
System.out.println( b.h + "  " + b.getH() );
// B.h  B.getH():B.h/A.h
```

Invocation and results

What to notice

- Invoking **ab.f(ab)** invokes **B.f(A)**
  - run-time type of object determines method invoked
  - compile-time type of arguments used
- **ab.h** gives the **A** version of **h**
- **ab.getH()**
  - **B.getH()** method invoked
  - in **B.getH()**, **h** gives **B** version of **h**
- Use of **super** in class **B** to reach **A** version of methods/variables
- **super** not allowed in static methods

Interfaces

- An interface lists supported methods
  - No constructors or implementations allowed
  - Can have final static variables
- A class can *implement* (be a subtype of) one or more interfaces
- Using the name of an interface as a type (i.e. to declare a variable) means
  - a reference to any instance of a class that implements the interface is a permitted value
  - **null** is also allowed

Interface example

```
public interface Comparable {
        public int compareTo(Object o)
}
public class Util {
        public static void sort(Comparable []) { … }
}
public class Choices implements Comparable {
        public int compareTo(Object o) {
                return … ;
        }
}
…
        Choices [] options = … ;
        Util.sort(options);
…
```


No multiple inheritance

- A class type can be a subtype of many other types (**implements**)
- But can only inherit method implementations from one superclass (**extends**)
- Not a big deal
  - multiple inheritance rarely, if ever, necessary and often badly used
- And it's complicated to implement well

Poor man's polymorphism

- Every object is an **Object**
- An **Object[]** can hold references to any objects
- E.g., for a data structure **Set** that holds a set of **Object**
  - can use it for a set of **String**
  - or a set of images
  - or a set of anything
- Java's container classes are all containers of **Object**
  - when you get a value out, have to downcast it

Downcasting

- **(Bar) foo**
  - run-time exception if object reference by **foo** is not a subclass of **Bar**
  - compile-time error if **Bar** is not a subtype of **foo** (i.e. it always throws an exception)
  - doesn't transform anything, just allows treating the result as if it were of type **Bar**
- **o instanceof Foo** returns true iff **o** is an instance of a subclass of **Foo**

Array types

- If **S** is a subtype of **T**
  - **S[]** is a subtype of **T[]**
- **Object[]** is a supertype of all arrays of reference types
- Storing into an array generates a run-time check that the type stored is a subtype of the *declared* type of the array elements

Example: Object[]

```
public class TestArrayTypes {
        public static void reverseArray(Object [] A) {
                for(int i=0, j=A.length-1; i<j; i++,j--) {
                        Object tmp = A[i];
                        A[i] = A[j];
                        A[j] = tmp;
                }
        }
        public static void main(String [] args) {
                reverseArray(args);
                for(int i=0; i < A.length; i++)
                        System.out.println(args[i]);
        }
}
```


Class Objects

- For each class, there is an object of type **Class**
- Describes the class as a whole
  - used extensively in Reflection package
- **Class.forName("MyClass")**
  - returns class object for **MyClass**
  - will load **MyClass** if needed
- **Class.forName("MyClass").newInstance()**
  - creates a new instance of **MyClass**
- **MyClass.class** gives the **Class** object for **MyClass**

Exceptions

- On an error condition, we *throw* an exception
- At some point up the call chain, the exception is *caught* and the error is handled
- Separates normal from error-handling code
- A form of non-local control-flow
  - Like goto, but structured

Throwing an Exception

- Create a new object of the class Exception, and **throw** it
- Exceptions thrown are part of return type
  - when overriding a method in a superclass
  - can't throw anything that would surprise a superclass object

Method throws declarations

- A method declares the exceptions it might throw
  - **public void openNext() throws UnknownHostException, EmptyStackException { … }**
- Must declare any exception the method *might* throw
  - unless it is caught in the method
  - includes exceptions thrown by called methods

Exception Handling

- All exceptions eventually get caught
- First **catch** with supertype of the throwable catches it
- **finally** is always executed

```
try { if (i == 0) return; myMethod(a[i]); }
catch (ArrayIndexOutOfBounds e) {
        System.out.println("a[] out of bounds"); }
catch (MyOwnException e) {
        System.out.println("Caught my error"); }
catch (Exception e) {
        System.out.println("Caught" + e.toString());  throw e;  }
finally { /* stuff to do regardless of whether an exception */
        /* was thrown or a return taken */  }
```

java.lang.Throwable

- Exception is a subclass of **Throwable**
- Many objects of class **Throwable** have a message
  - specified when constructed, as **String**
  - **String getMessage()** returns the message
- **String toString()**
- **void printStackTrace()**
- **void printStackTrace(PrintWriter s)**

Example Application

```
Public class BufferedReader {
  public String readLine() throws IOException { … } …
}
public class Echo {
  BufferedReader in = …
  try {
        while((s = in.readLine()) != null)
          System.out.println(s);
  } catch(IOException e) {
    System.out.println(e.stackTrace()); }
  }
}
```


Creating New Exceptions

- User-defined exception is just a class that is a subclass of **Exception**

```
class MyOwnException extends Exception {}
class MyClass {
        void oops() throws MyOwnException {
                if (some_error_occurred) {
                        throw new MyOwnException();
                }
        }
}
```


Interacting with External Environment

Applications and I/O

- Java external interface is a public class
- via **public static void main(String [] args)**
- **args[0]** is first argument
  - unlike C/C++
- **System.out** and **System.err** are **PrintStreams**'s
  - should be **PrintWriter**'s, but would break 1.0 code
  - **System.out.print(…)** prints a string
  - **System.out.println(…)** prints a string with a newline
- **System.in** is an **InputStream**
  - not quite so easy to use

Input (JDK 1.1 and higher)

- Wrap **System.in** in an **InputStreamReader**
  - converts from bytes to characters
- Wrap the result in a **BufferedReader**
  - makes input operations efficient
  - supports **readline()** interface
- **readline()** returns a string
  - returns **null** if at EOF

Example Echo Application

```
import java.io.*;
public class Echo {
   public static void main(String [] args) {
        String s;
        BufferedReader in = new BufferedReader(
                new InputStreamReader(System.in));
        int i = 1;
        try {
                while((s = in.readLine()) != null)
                        System.out.println((i++) + ": " + s); }
        catch(IOException e) {
                System.out.println(e); }
   }
}
```


Java Libraries

You should familiarize yourself

- Packages
  - java.lang
  - java.util
  - java.net
  - java.io
- Read the documentation on line

I/O and Utility Libraries

I/O Classes

- **OutputStream** – byte stream going out
- **Writer** – character stream going out
- **InputStream** – byte stream coming in
- **Reader** – character stream coming in

OutputStream - bytes

- base types
  - **ByteArrayOutputStream**
  - **FileOutputStream** – goes to file
  - **PipedOutputStream** – goes to **PipedInputStream**
  - **SocketOutputStream** (not public) – goes to TCP socket
- Filters – wrapped around an **OutputStream**
  - **BufferedOutputStream**
  - **ObjectOutputStream** (should implement **FilterOutputStream**) – serialization of object graph

Writer - characters

- **OutputStreamWriter**
  - wraps around **OutputStream** to get a **Writer**
  - takes characters, converts to bytes
  - can specify encoding used to convert
- **CharArrayWriter**
- **StringWriter**
- **Filters**
  - **PrintWriter** – supports **print**, **println**
  - **BufferedWriter**
- Convenience writers
  - wrap **OutputStreamWriter** around an **OutputStream**
  - **FileWriter** and **PipedWriter**

InputStream - bytes

- base types
  - **ByteArrayInputStream**
  - **FileInputStream**
  - **PipedInputStream**
  - **SocketInputStream** (not public) – comes from TCP socket
- Filters – wrapped around **InputStream**
  - **BufferedInputStream**
  - **PushedBackInputStream**
  - **ObjectInputStream**
- **SequenceInputStream** - concatenate

Reader - characters

- **InputStreamReader**
  - wrap around **InputStream** to get a **Reader**
  - takes bytes, converts to characters
  - can specify encoding used to convert
- **CharArrayReader**
- **StringReader**
- **Filters**
  - **BufferedReader** – efficient, supports **readLine()**
    - **LineNumberReader** – reports line numbers
  - **PushBackReader**
- Convenience Readers
  - wrap **InputStreamReader** around **InputStream**
  - **FileReader** and **PipedReader**

java.util

- Lots of stuff
  - Vector
  - Dictionaries
  - Enumerations and Bitsets
  - Collection classes
- We will focus on Collection classes

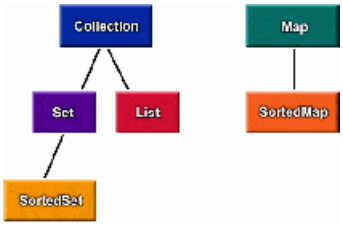
Other libraries

- java.lang.Math
  - abstract final class – only static members
  - includes constants *e* and π
  - includes static methods for trig, exponentiation, min, max, …
- java.text
  - text formatting tools
    - class **MessageFormat** provides printf/scanf functionality
  - lots of facilities for internationalization

Java Container Classes

- A unified architecture for representing and manipulating collections of objects
- Container classes contain three things:
  - Interfaces: abstract data types representing collections of objects
  - Implementations: concrete implementations of the collection interfaces
  - Algorithms: methods that perform computations on objects that implement collection interfaces

Container class hierarchy



Collection Classes

- Collections contain groups of objects (elements)
- Collection interface is not implemented in Java. Subinterfaces implemented
  - Set: unordered, can't contain duplicate elements
    - Hashset – unordered, no duplicates
    - TreeSet - ordered, no duplicates
  - List: ordered, can contain duplicate elements
    - LinkedList – unordered, dynamic size, add/delete quick
    - ArrayList – unordered, dynamic size, random access

Map Classes

- A Map is an object that contains key:value pairs
- Maps cannot contain duplicate keys:
  - Each key can map to at most one value
- Map not implemented. Subinterfaces implemented
  - HashMap, entries stored in a hash table
  - TreeMap, entries maintained in sorted order
- Variants
  - Ordered/unordered (e.g., map vs. sorted map)

Object Ordering

- Two ways to order objects:
  - Comparable interface provides automatic *natural order* on classes that implement it
  - Comparator interface gives the programmer complete control over object ordering

compareTo Interface

- public int compareTo(Object o)
- The natural comparison method (i.e., default)
  - Returns a negative integer, zero, or a positive integer as this object is less than, equal to, or greater than o
  - sgn(x.compareTo(y)) == -sgn(y.compareTo(x))
    - implies that x.compareTo(y) must throw an exception iff y.compareTo(x) throws an exception.
  - (x.compareTo(y)>0 && y.compareTo(z)>0) => x.compareTo(z)>0.
  - x.compareTo(y)==0 => sgn(x.compareTo(z)) == sgn(y.compareTo(z))
  - Recommended that (x.compareTo(y)==0) == (x.equals(y))

Comparator Interface

- When natural order isn't acceptable
- public int compare(Object o1, Object o2)
  - Returns a negative integer, zero, or a positive integer as the first argument is less than, equal to, or greater than the second
  - sgn(compare(x, y)) == -sgn(compare(y, x))
    - (This implies that compare(x,y) must throw an exception if and only if compare(y, x) throws an exception.)
  - ((compare(x, y)>0) && (compare(y, z)>0)) => compare(x, z)>0.
  - compare(x, y)==0 => sgn(compare(x,z))==sgn(compare(y, z))
  - recommended (compare(x, y)==0) == (x.equals(y))
- public boolean equals(Object obj)
  - Indicates whether some other object is "equal to" this Comparator.

Example1

```
import java.util.*;
import java.awt.*;
class MyPoint extends java.awt.Point
   implements Comparable {
    MyPoint(int x, int y) {super(x,y);}
    public int compareTo(Object o) {
   MyPoint p = (MyPoint)o;
   double d1 = Math.sqrt(x*x + y*y);
   double d2 = Math.sqrt(p.x*p.x +
   p.y*p.y);
   if (d1 < d2) {return -1;}
   else if (d2 < d1) {return 1;}
   return 0;
    }
}
```

```
class Sort3 {
    public static void main(String[] args)
   {
   Random rnd = new Random();
   MyPoint[] points = new MyPoint[10];
   for (int i=0; i<points.length; i++) {
       points[i] = new MyPoint
   (rnd.nextInt(100),rnd.nextInt(100));
       System.out.println(points[i]);
   }
   System.out.println("----------");
   Arrays.sort(points);
   //Print the points
   for (int i=0; i<points.length; i++){
       System.out.println(points[i]);
   }
   }
}
```


Example2

```
import java.util.*;
import java.awt.*;

class MyPoint extends
   java.awt.Point implements
   Comparable {
    MyPoint(int x, int y) {
   super(x, y);
    }
    public int
   compareTo(Object o) {
   MyPoint p = (MyPoint)o;
   return x - p.x;
    }
}
```

```
class Sort2 {
    public static void main(String[]
   args) {
   Random rnd = new Random();
   MyPoint[] points = new MyPoint[10];
   for (int i=0; i<points.length; i++) {
       points[i] = new MyPoint
   (rnd.nextInt(100), rnd.nextInt(100));
       System.out.println(points[i]);
   }
   System.out.println("----------");
   Arrays.sort(points);
   //Print the points
   for (int i=0; i<points.length; i++){
       System.out.println(points[i]);
   }
  }
}
```


Output

Sort2 …….. // after sort
MyPoint[x=1,y=95]
MyPoint[x=2,y=16]
MyPoint[x=3,y=26]
MyPoint[x=12,y=95]
MyPoint[x=22,y=55]
MyPoint[x=30,y=73]
MyPoint[x=31,y=42]
MyPoint[x=66,y=33]
MyPoint[x=70,y=33]
MyPoint[x=80,y=31]

Sort3…….. // after sort
MyPoint[x=2,y=0]
MyPoint[x=0,y=15]
MyPoint[x=18,y=4]
MyPoint[x=39,y=13]
MyPoint[x=39,y=19]
MyPoint[x=42,y=23]
MyPoint[x=65,y=5]
MyPoint[x=38,y=74]
MyPoint[x=80,y=40]
MyPoint[x=87,y=62]