Containers - Part I

Suggested Reading:
Bruce Eckel, Thinking in Java (Fourth Edition)
Holding Your Objects (Collection, Iterator, ArrayList)

Interface Collection

Method	Description (from docs API)
boolean add(Object o)	ensures that this collection contains the specified element
boolean addAll(Collection c)	adds all of the elements in the specified collection to this collection
void clear()	removes all of the elements from this collection
boolean contains(Object o)	returns true if this collection contains the specified element
boolean containsAll(Collection o)	returns true if this collection contains all of the elements in the specified collection
boolean equals(Object o)	compares the specified object with this collection for equality

Interface Collection

Method	Description (from docs API)
int hashCode()	returns the hash code value for this collection
boolean isEmpty()	returns true if this collection contains no elements
Iterator iterator()	returns an iterator over the elements in this collection
boolean remove(Object o)	removes a single instance of the specified element from this collection, if it is present
boolean removeAll(Collection c)	removes all of this collection's elements that are also contained in the specified collection
boolean retainAll(Collection c)	retains only the elements in this collection that are contained in the specified collection

Interface Collection

Method	Description (from docs API)
int size()	returns the number of elements in this collection
Object[] toArray()	returns an array containing all of the elements in this collection
Object[] toArray(Object[] a)	returns an array containing all of the elements in this collection

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

Class ArrayList

Constructor	Description (from docs API)
ArrayList()	constructs an empty list with an initial capacity of ten
ArrayList(Collection c)	constructs a list containing the elements of the specified collection, in the order they are returned by the collection's iterator
ArrayList(int initialCapacity)	constructs an empty list with the specified initial capacity


```
import java.util.ArrayList;

class Test {
    public static void main(String[] args) {
        ArrayList stringList = new ArrayList(3);

        stringList.add("String1");
        stringList.add("String2");
        stringList.add(new String("String1"));
        stringList.add("String3");

        System.out.println("Collection size " + stringList.size());
        System.out.println("Collection content " + stringList);
    }
}
```

```
Collection size 4
Collection content [String1, String2, String1, String3]
```



```
import java.util.ArrayList;

class Test {
    public static void main(String[] args) {
        ArrayList stringList = new ArrayList(3);

        Collection size 4
        Collection content [String1, String2, String1, String3]

        stringList.addAll(stringList);
        System.out.println("Collection size " + stringList.size());
        System.out.println("Collection content " + stringList);
        System.out.println("Collection contains String2 "
                           + stringList.contains("String2"));
    }
}
```

```
Collection size 8
Collection content [String1, String2, String1, String3, String1, String2, String1, String3]
Collection contains String2 true
```



```
import java.util.ArrayList;

class Test {
    public static void main(String[] args) {
        ArrayList stringList = new ArrayList(3);

Collection size 8
Collection content [String1, String2, String1, String3, String1, String2, String1, String3]
Collection contains String2 true

        ArrayList stringList2 = new ArrayList(3);
        stringList2.retainAll(stringList);
        System.out.println("Collection2 content " + stringList2);
        System.out.println("Collection2 isEmpty " + stringList2.isEmpty());
    }
}
```

```
Collection2 content []
Collection2 isEmpty true
```

```
import java.util.ArrayList;

class Test {
    public static void main(String[] args) {
        ArrayList stringList = new ArrayList(3);

Collection size 8
Collection content [String1, String2, String1, String3, String1, String2, String1, String3]
Collection contains String2 true
Collection2 content []
Collection2 isEmpty true

            stringList2.addAll(stringList);
            System.out.println("Collection2 content " + stringList2);
            System.out.println("Collection2 isEmpty " + stringList2.isEmpty());
            stringList2.remove("String2");
            System.out.println("Collection2 content " + stringList2);
            stringList2.removeAll(stringList);
            System.out.println("Collection2 isEmpty " + stringList2.isEmpty());
        }
    }
Collection2 content [String1, String2, String1, String3, String1, String2, String1, String3]
Collection2 isEmpty false
Collection2 content [String1, String1, String3, String1, String2, String1, String3]
Collection2 isEmpty true
```



```
import java.util.ArrayList;

class Test {
    public static void main(String[] args) {
        ArrayList stringList2 = new ArrayList(3);

        stringList2.add("String4");
        System.out.println("Collection2 content " + stringList2);
        stringList2.clear();
        System.out.println("Collection2 isEmpty " + stringList2.isEmpty());
    }
}
```

```
Collection2 content [String4]
Collection2 isEmpty true
```



```
import java.util.ArrayList;

class Test {
    public static void main(String[] args) {
        ArrayList stringList2 = new ArrayList(3);

        stringList2.add("String1");
        stringList2.add("String2");
        stringList2.add("String3");
        stringList2.add("String4");

        Object[] o1 = stringList2.toArray();
        Object[] o2 = new Object[4];
        System.out.println("o2 " + o2);
        o2 = stringList2.toArray(o2);
        System.out.println("o2 " + o2);
    }
}
```

```
o2 [Ljava.lang.Object;@41675ec4
o2 [Ljava.lang.Object;@41675ec4
```



```
import java.util.ArrayList;

class Test {
    public static void main(String[] args) {
        ArrayList stringList2 = new ArrayList(3);

        stringList2.add("String1");
        stringList2.add("String2");
        stringList2.add("String3");
        stringList2.add("String4");

        Object[] o2 = new Object[3];
        System.out.println("o2 " + o2);
        o2 = stringList2.toArray(o2);
        System.out.println("o2 " + o2);
    }
}
```

```
o2 [Ljava.lang.Object;@41675ec4
o2 [Ljava.lang.Object;@697eb767
```

```
import java.util.ArrayList;

class Book{
    private int pages;

    public Book(int p) {
        pages = p;
    }
}

class Test {
    public static void main(String[] args) {
        Book b1 = new Book(1);
        Book b2 = new Book(2);
        ArrayList bookList = new ArrayList(3);

        bookList.add(b1);
        bookList.add(b2);

        System.out.println("Size " + bookList.size());
        System.out.println("Collection Contains " + bookList.contains(b1));
        System.out.println("Collection Contains " + bookList.contains(b2));
        System.out.println("Collection Contains " + bookList.contains(new Book(1)));
    }
}
```

```
Size 2
Collection Contains true
Collection Contains true
Collection Contains false
```



```
import java.util.ArrayList;

class Book{
    private int pages;

    public Book(int p) {
        pages = p;
    }

    public boolean equals(Book b) {
        return b.pages == pages;
    }
}

class Test {
    public static void main(String[] args) {
        Book b1 = new Book(1);
        Book b2 = new Book(2);
        ArrayList bookList = new ArrayList(3);

        bookList.add(b1);
        bookList.add(b2);

        System.out.println("Size " + bookList.size());
        System.out.println("Collection Contains " + bookList.contains(b1));
        System.out.println("Collection Contains " + bookList.contains(b2));
        System.out.println("Collection Contains " + bookList.contains(new Book(1)));
    }
}
```

```
Size 2
Collection Contains true
Collection Contains true
Collection Contains false
```

```
import java.util.ArrayList;

class Book{
    private int pages;

    public Book(int p) {
        pages = p;
    }

    public boolean equals(Object b) {
        return (b instanceof Book)
                && (((Book)b).pages == pages);
    }
}

class Test {
    public static void main(String[] args) {
        Book b1 = new Book(1);
        Book b2 = new Book(2);
        ArrayList bookList = new ArrayList(3);

        bookList.add(b1);
        bookList.add(b2);

        System.out.println("Size " + bookList.size());
        System.out.println("Collection Contains " + bookList.contains(b1));
        System.out.println("Collection Contains " + bookList.contains(b2));
        System.out.println("Collection Contains " + bookList.contains(new Book(1)));
    }
}
```

```
Size 2
Collection Contains true
Collection Contains true
Collection Contains true
```



```
import java.util.ArrayList;

class Book{
    private int pages;

    public Book(int p) {
        pages = p;
    }
}

class Test {
    public static void main(String[] args) {
        Book b1 = new Book(1);
        Book b2 = new Book(2);
        ArrayList bookList = new ArrayList(3);

        bookList.add(b1);
        bookList.add(b2);

        System.out.println("Size " + bookList.size());
        System.out.println(bookList);
    }
}
```

```
Size 2
[Book@19fa157c, Book@71988d36]
```

```
import java.util.ArrayList;

class Book{
    private int pages;

    public Book(int p) {
        pages = p;
    }

    public String toString() {
        return "Book " + pages;
    }
}

class Test {
    public static void main(String[] args) {
        Book b1 = new Book(1);
        Book b2 = new Book(2);
        ArrayList bookList = new ArrayList(3);

        bookList.add(b1);
        bookList.add(b2);

        System.out.println("Size " + bookList.size());
        System.out.println(bookList);
    }
}
```

```
Size 2
[Book 1, Book 2]
```


Do not forget to override equals and toString!!!

Towards Collection - equals(Object o)

```
class Test {
    public static void main(String[] args) {
        Book b11 = new Book(1);
        Book b12 = new Book(2);
        Book b21 = new Book(1);
        Book b22 = new Book(2);

        ArrayList bookList1 = new ArrayList();
        ArrayList bookList2 = new ArrayList();

        bookList1.add(b11); bookList1.add(b12);

        bookList2.add(b21); bookList2.add(b22);

        boolean areEquals = true;
        if(bookList1.size()!=bookList2.size())
            areEquals = false;
        else
            for(int i=0; i<bookList1.size(); i++)
                if(bookList1.get(i).equals(bookList2.get(i)) == false){
                    areEquals = false;
                    break;
                }
        System.out.println("Collections are equals " + areEquals);
    }
}
```


Towards Collection - equals(Object o)

```
class Test {
    public static void main(String[] args) {
        Book b11 = new Book(1);
        Book b12 = new Book(2);
        Book b21 = new Book(1);
        Book b22 = new Book(2);

        ArrayList bookList1 = new ArrayList();
        ArrayList bookList2 = new ArrayList();

        bookList1.add(b11); bookList1.add(b12);

        bookList2.add(b21); bookList2.add(b22);

        System.out.println("Collections are equals "
                           + bookList1.equals(bookList2));
    }
}
```

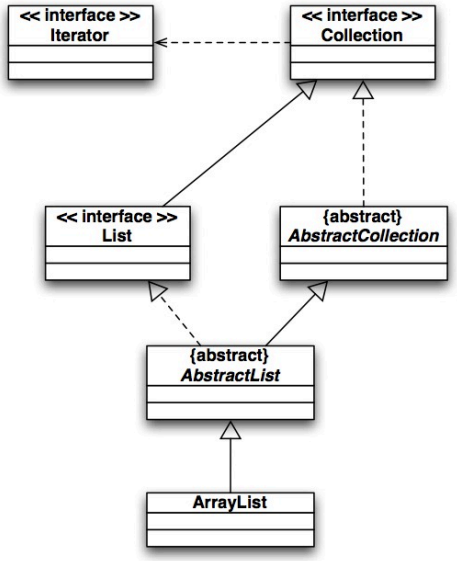
Fetching containers (a)

```
class Book{
    private int pages;

    public Book(int p) {
        pages = p;
    }

    public void setPages(int p){
        pages = p;
    }

    public String toString() {
        return "Book " + pages;
    }
}
```

```
class Test {
    public static void main(String[] args) {
        Book b1 = new Book(1);
        Book b2 = new Book(2);
        ArrayList bookList = new ArrayList(3);

        bookList.add(b1);
        bookList.add(b2);

        for(Object o:bookList)
            ((Book)o).setPages(10);

        System.out.println(bookList);
    }
}
```

```
[Book 10, Book 10]
```


A simplified view on ArrayList



Interface List

Method	Description (from docs API)
Object get(int index)	returns the element at the specified position in this list
Object set(int index, Object element)	replaces the element at the specified position in this list with the specified element
int lastIndexOf(Object o)	returns the index of the last occurrence of the specified element in this list, or -1 if this list does not contain the element
boolean remove(Object o)	removes the first occurrence of the specified element from this list, if it is present

Fetching (ArrayList) containers (b)

```
class Book{
    private int pages;

    public Book(int p) {
        pages = p;
    }

    public void setPages(int p){
        pages = p;
    }

    public String toString() {
        return "Book " + pages;
    }
}
```

```
class Test {
    public static void main(String[] args) {
        Book b1 = new Book(1);
        Book b2 = new Book(2);
        ArrayList bookList = new ArrayList(3);

        bookList.add(b1);
        bookList.add(b2);

        for(int i=0; i<bookList.size(); i++)
            ((Book)bookList.get(i)).setPages(10);

        System.out.println(bookList);
    }
}
```

```
[Book 10, Book 10]
```

Fetching containers (c)

Interface Collection

Method	Description (from docs API)
.....	
Iterator iterator()	returns an iterator over the elements in this collection
.....	

Interface Iterator

Method	Description (from docs API)
boolean hasNext()	returns true if the iteration has more elements
Object next()	returns the next element in the iteration
void remove()	removes from the underlying collection the last element returned by this iterator

Fetching containers (c)

```
class Book{
    private int pages;

    public Book(int p) {
        pages = p;
    }

    public void setPages(int p){
        pages = p;
    }

    public String toString() {
        return "Book " + pages;
    }
}
```

```
class Test {
    public static void main(String[] args) {
        Book b1 = new Book(1);
        Book b2 = new Book(2);
        ArrayList bookList = new ArrayList(3);

        bookList.add(b1);
        bookList.add(b2);

        Iterator it = bookList.iterator();
        while(it.hasNext())
            ((Book)it.next()).setPages(10);

        System.out.println(bookList);
    }
}
```

```
[Book 10, Book 10]
```

import java.util.Iterator;

Fetching containers (c)

```
class Book{
    private int pages;

    public Book(int p) {
        pages = p;
    }

    public void setPages(int p){
        pages = p;
    }

    public String toString() {
        return "Book " + pages;
    }
}
```

X Iterator it;
it = new Iterator();

```
class Test {
    public static void main(String[] args) {
        Book b1 = new Book(1);
        Book b2 = new Book(2);
        ArrayList bookList = new ArrayList(3);

        bookList.add(b1);
        bookList.add(b2);

        Iterator it = bookList.iterator();
        while(it.hasNext())
            ((Book)it.next()).setPages(10);

        System.out.println(bookList);
    }
}
```

A problem...

```
class Book{
    private int pages;

    public Book(int p) {
        pages = p;
    }

    public void setPages(int p){
        pages = p;
    }

    public String toString() {
        return "Book " + pages;
    }
}
```

```
Exception in thread "main" java.lang.ClassCastException:
java.lang.String cannot be cast to Book
```

```
class Test {
    public static void main(String[] args) {
        Book b1 = new Book(1);
        Book b2 = new Book(2);
        ArrayList bookList = new ArrayList(3);

        bookList.add(b1);
        bookList.add(b2);
        bookList.add("OOP");

        Iterator it = bookList.iterator();
        while(it.hasNext())
            ((Book)it.next()).setPages(10);

        System.out.println(bookList);
    }
}
```


Another (annoying) problem...

```
class Book{
    private int pages;

    public Book(int p) {
        pages = p;
    }

    public void setPages(int p){
        pages = p;
    }

    public String toString() {
        return "Book " + pages;
    }
}
```

```
class Test {
    public static void main(String[] args) {
        Book b1 = new Book(1);
        Book b2 = new Book(2);
        ArrayList bookList = new ArrayList(3);

        bookList.add(b1);
        bookList.add(b2);

        Iterator it = bookList.iterator();
        while(it.hasNext())
            ((Book)it.next()).setPages(10);

        System.out.println(bookList);
    }
}
```

Perform a cast

Generics and type-safe containers

```
class Book{
    private int pages;

    public Book(int p) {
        pages = p;
    }

    public void setPages(int p){
        pages = p;
    }

    public String toString() {
        return "Book " + pages;
    }
}
```

```
class Test {
    public static void main(String[] args) {
        Book b1 = new Book(1);
        Book b2 = new Book(2);
        ArrayList<Book> bookList = new ArrayList<Book>(3);

        bookList.add(b1);
        bookList.add(b2);
        bookList.add("OOP");
    }
}
```

Compilation Error!!!

Generics and type-safe containers

```
class Test {
    public static void main(String[] args) {
        Book b1 = new Book(1);
        Book b2 = new Book(2);
        ArrayList<Book> bookList = new ArrayList<Book>(3);

        bookList.add(b1);
        bookList.add(b2);

        for(Book b:bookList)
            b.setPages(20);

        for(int i=0; i<bookList.size(); i++)
            bookList.get(i).setPages(30);

        Iterator<Book> it = bookList.iterator();
        while(it.hasNext())
            it.next().setPages(10);
    }
}
```

Generics and type-safe containers

```
class Test {
    public static void main(String[] args) {
        Book[] books = new Book[3];
        books[0] = new Book(1);
        books[1] = new Book(2);

        Object[] objects = books;
        objects[2] = "OOP";

        books[2].setPages(25);
    }
}
```

Runtime Error!!!

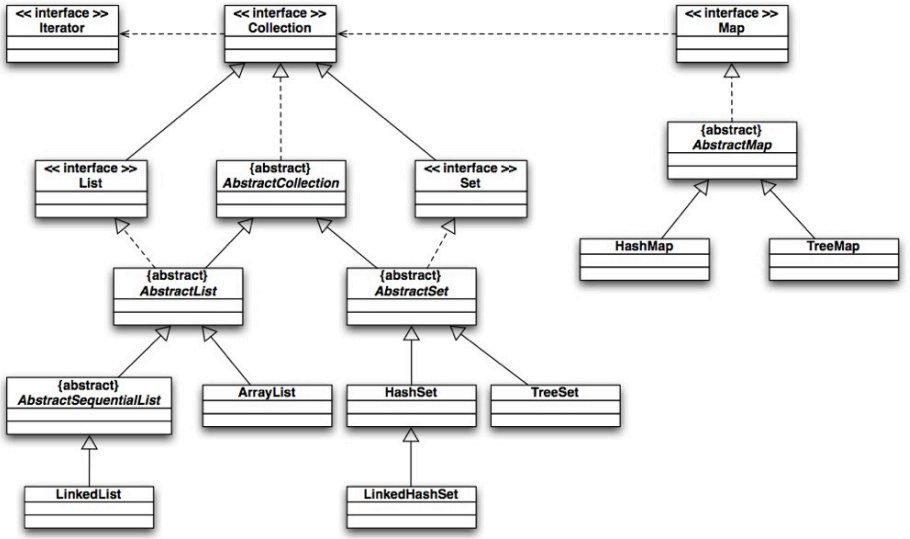
Generics and type-safe containers

```
class Test {
    public static void main(String[] args) {
        ArrayList<Book> books = new ArrayList<Book>();
        books.add(new Book(1));
        books.add(new Book(2));

        ArrayList<Object> objects;
        objects = books;
    }
}
```

Compilation Error!!!

Containers - Part II

Suggested Reading:
Bruce Eckel, Thinking in Java (Fourth Edition)
Holding Your Objects (LinkedList, Set, Map)
Containers in Depth (Sets and storage order,
Understanding Maps, Hashing and hash codes)



Class LinkedList

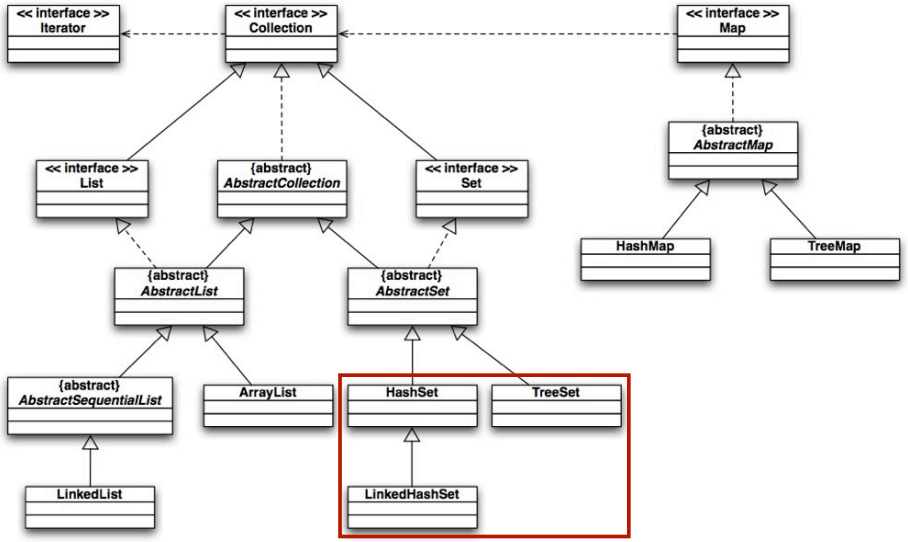
```
import java.util.LinkedList;
import java.util.Iterator;

class Test {
    public static void main(String[] args) {
        LinkedList<Book> books = new LinkedList<Book>();
        books.add(new Book(1));
        books.add(new Book(2));
        System.out.println(books);

        for(Book b: books)
            b.setPages(15);
        System.out.println(books);

        Iterator<Book> it = books.iterator();
        while(it.hasNext())
            it.next().setPages(20);
        System.out.println(books);

        for(int i = 0; i < books.size(); i++)
            books.get(i).setPages(25);
        System.out.println(books);
    }
}
```

```
class Book{
    private int pages;

    public Book(int p) {
        pages = p;
    }

    public void setPages(int p){
        pages = p;
    }

    public String toString() {
        return "Book " + pages;
    }
}
```


Class LinkedList

LinkedList inserts and removes elements in the middle of the list more efficiently than ArrayList.

LinkedList is less efficient for random-access operations than ArrayList.



Class HashSet

```
import java.util.HashSet;

class JavaElementsSetMain {
    public static void main(String[] args){
        HashSet<String> set = new HashSet<String>();

        String s1 = "string1";
        String s2 = "string1";
        String s3 = new String("string1");

        set.add(s1);
        set.add(s2);
        set.add(s3);

        System.out.println(set);
    }
}
```

prints [string1]

```
public class MyElementsSet {
    public static void main(String[] args){
        MyElement m1 = new MyElement(3);
        MyElement m2 = new MyElement(4);
        MyElement m3 = new MyElement(1);
        MyElement m4 = new MyElement(1);

        HashSet<MyElement> set = new HashSet<MyElement>();
        set.add(m1);
        set.add(m2);
        set.add(m3);
        set.add(m4);
        System.out.println(set);
    }
}
```

prints ???

```
[3, 1, 1, 4]
```

```
class MyElement {
    private int myValue;

    public MyElement(int v) {
        this.myValue = v;
    }

    public boolean equals(Object o){
        return ((o instanceof MyElement)
                && (myValue == ((MyElement)o).myValue));
    }

    public String toString() {
        return myValue + "";
    }
}
```



```
class JavaElementsSetMain {
    public static void main(String[] args){
        HashSet<String> set = new HashSet<String>();

        String s1 = "string1";
        String s2 = "string1";
        String s3 = new String("string1");

        set.add(s1);
        set.add(s2);
        set.add(s3);

        System.out.println(set);

        System.out.println(s1.hashCode());
        System.out.println(s2.hashCode());
        System.out.println(s3.hashCode());
    }
}
```

prints

```
-1881759168
-1881759168
-1881759168
```



```
package sets;

class MyElement {
    private int myValue;

    public MyElement(int v) {
        this.myValue = v;
    }

    public boolean equals(Object o){
        return ((o instanceof MyElement)
                && (myValue == ((MyElement)o).myValue));
    }
}

public class MyElementsSet {
    public static void main(String[] args){
        MyElement m1 = new MyElement(3);
        MyElement m2 = new MyElement(4);
        MyElement m3 = new MyElement(1);
        MyElement m4 = new MyElement(1);

        System.out.println(m1 + " " + m1.hashCode());
        System.out.println(m2 + " " + m2.hashCode());
        System.out.println(m3 + " " + m3.hashCode());
        System.out.println(m4 + " " + m4.hashCode());
    }
}
```

```
sets.MyElement@780324ff 2013471999
sets.MyElement@16721ee7 376577767
sets.MyElement@1e4adb34 508222260
sets.MyElement@447d4275 1149059701
```

prints

public int hashCode() from class Object

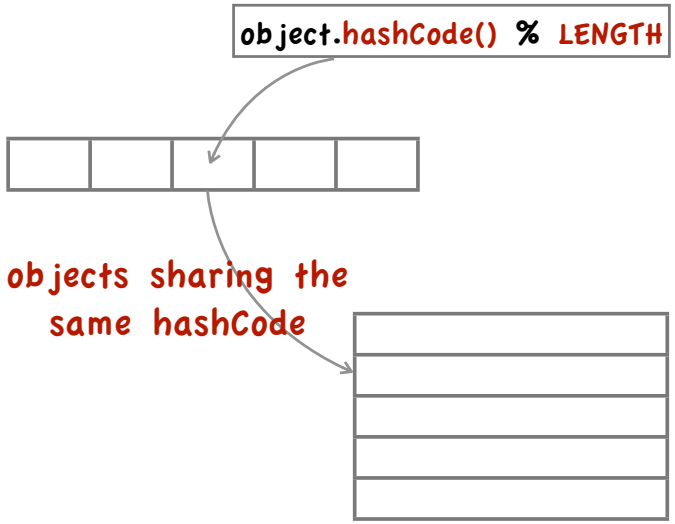
Returns a hash code value for the object. This method is supported for the benefit of hash tables such as those provided by HashMap.

The general contract of hashCode is:

- Whenever it is invoked on the same object more than once during an execution of a Java application, the hashCode method must consistently return the same integer, provided no information used in equals comparisons on the object is modified. This integer need not remain consistent from one execution of an application to another execution of the same application.
- If two objects are equal according to the equals(Object) method, then calling the hashCode method on each of the two objects must produce the same integer result.
- It is not required that if two objects are unequal according to the equals(java.lang.Object) method, then calling the hashCode method on each of the two objects must produce distinct integer results. However, the programmer should be aware that producing distinct integer results for unequal objects may improve the performance of hash tables. [from Java 1.7 API]

a recipe for generating hashCodes is available @page 614

Bruce Eckel, Thinking in Java (Fourth Edition)
Containers in Depth



Class HashSet

[no guarantee regarding the iteration order]

```
class MyElement {
    private int myValue;

    public MyElement(int v) {
        this.myValue = v;
    }

    public boolean equals(Object o){
        return ((o instanceof MyElement)
                && (myValue == ((MyElement)o).myValue));
    }

    public int hashCode() {
        return myValue;
    }

    public String toString() {
        return myValue + "";
    }
}
```

```
public class MyElementsSet {
    public static void main(String[] args){
        MyElement m1 = new MyElement(3);
        MyElement m2 = new MyElement(4);
        MyElement m3 = new MyElement(1);
        MyElement m4 = new MyElement(1);

        HashSet<MyElement> set = new HashSet<MyElement>();
        set.add(m1);
        set.add(m2);
        set.add(m3);
        set.add(m4);

        System.out.println(set);
    }
}
```

prints

```
[1, 3, 4]
```


protected Object clone() throws CloneNotSupportedException

from class Object

creates an object with a similar state as the object for which the clone() method was called.

protected Object clone() throws CloneNotSupportedException

from class Object

```
class MyClass implements Cloneable {
    private int myValue;
    private ArrayList<Integer> myValues = new ArrayList<Integer>();

    public void setValue(int myValue) { this.myValue = myValue; }

    public void addInteger(Integer...ints) {
        for(Integer i : ints) myValues.add(i); }

    public String toString() {
        return myValue + " " + myValues.toString();
    }

    public ArrayList<Integer> getValues() { return myValues; }

    public int getValue() { return myValue; }

    public Object clone() throws CloneNotSupportedException {
        return super.clone();
    }
}
```

Shallow Cloning

Shallow Cloning

```
public class CloningSample {
    public static void main(String[] args) throws CloneNotSupportedException {
        MyClass cls1 = new MyClass();
        cls1.setValue(12);
        cls1.addInteger(15, 17, 10);
        System.out.println(cls1);

        MyClass cls2 = (MyClass)cls1.clone();
        System.out.println(cls2);

        System.out.println(cls1==cls2);
        System.out.println(cls1.getValue() == cls2.getValue());
        System.out.println(cls1.getValues() == cls2.getValues());

        cls1.addInteger(25, 26, 27);
        System.out.println(cls1);
        System.out.println(cls2);

        cls1.setValue(37);
        System.out.println(cls1);
        System.out.println(cls2);
    }
}
```

prints

```
12 [15, 17, 10]
12 [15, 17, 10]
false
true
true
12 [15, 17, 10, 25, 26, 27]
12 [15, 17, 10, 25, 26, 27]
37 [15, 17, 10, 25, 26, 27]
12 [15, 17, 10, 25, 26, 27]
```


protected Object clone() throws CloneNotSupportedException

from class Object

```
class MyClass implements Cloneable {
    private int myValue;
    private ArrayList<Integer> myValues = new ArrayList<Integer>();

    public void setValue(int myValue) { this.myValue = myValue; }

    public void addInteger(Integer...ints) {
        for(Integer i : ints) myValues.add(i); }

    public String toString() {
        return myValue + " " + myValues.toString();
    }

    public ArrayList<Integer> getValues() { return myValues; }

    public int getValue() { return myValue; }

    protected Object clone() throws CloneNotSupportedException {
        MyClass myClone = (MyClass)super.clone();
        myClone.myValues = (ArrayList<Integer>)myValues.clone();
        return myClone;
    }
}
```

Deep Cloning

Deep Cloning

```
public class CloningSample {
    public static void main(String[] args) throws CloneNotSupportedException {
        MyClass cls1 = new MyClass();
        cls1.setValue(12);
        cls1.addInteger(15, 17, 10);
        System.out.println(cls1);

        MyClass cls2 = (MyClass)cls1.clone();
        System.out.println(cls2);

        System.out.println(cls1==cls2);
        System.out.println(cls1.getValue() == cls2.getValue());
        System.out.println(cls1.getValues() == cls2.getValues());

        cls1.addInteger(25, 26, 27);
        System.out.println(cls1);
        System.out.println(cls2);

        cls1.setValue(37);
        System.out.println(cls1);
        System.out.println(cls2);
    }
}
```

prints

```
12 [15, 17, 10]
12 [15, 17, 10]
false
true
false
12 [15, 17, 10, 25, 26, 27]
12 [15, 17, 10]
37 [15, 17, 10, 25, 26, 27]
12 [15, 17, 10]
```

Class LinkedHashSet

[defines the iteration ordering = the order in which the elements were inserted]

```
public class MyElementsLinkedSet {
    public static void main(String[] args) {
        MyElement m1 = new MyElement(3);
        MyElement m2 = new MyElement(4);
        MyElement m3 = new MyElement(1);

        HashSet<MyElement> set = new HashSet<MyElement>();
        set.add(m1);
        set.add(m2);
        set.add(m3);
        System.out.println(set);

        LinkedHashSet<MyElement> linkedSet = new LinkedHashSet<MyElement>();
        linkedSet.add(m1);
        linkedSet.add(m2);
        linkedSet.add(m3);
        System.out.println(linkedSet);

        MyElement m4 = new MyElement(2);
        set.add(m4); linkedSet.add(m4);
        System.out.println(set); System.out.println(linkedSet);
    }
}
```

```
[1, 3, 4]
[3, 4, 1]
[1, 2, 3, 4]
[3, 4, 1, 2]
```



```
class CompareExample {
    public static void main(String[] args){
        String s1 = new String("ABS");
        String s2 = new String("BSA");
        System.out.println(s1.compareTo(s2));
        System.out.println(s2.compareTo(s1));

        s1 = new String("ABS");
        s2 = new String("AB");
        System.out.println(s1.compareTo(s2));
        System.out.println(s2.compareTo(s1));

        s1 = new String("ABS");
        s2 = new String("AC");
        System.out.println(s1.compareTo(s2));
        System.out.println(s2.compareTo(s1));
    }
}
```

```
-1
1
1
-1
-1
1
```



```
public class MyStringElement implements Comparable<MyStringElement> {
    private String myString;

    public MyStringElement(String myString) {
        this.myString = myString;
    }

    public String getString() {
        return myString;
    }

    public String toString() {
        return myString;
    }

    public int compareTo(MyStringElement o) {
        return myString.compareTo(((MyStringElement)o).myString);
    }
}
```


Class TreeSet

The elements are ordered using their natural ordering, or by a Comparator provided at set creation time, depending on which constructor is used.

```
public class MyElementsTreeSet1 {
    public static void main(String[] args){
        MyStringElement m1 = new MyStringElement("3");
        MyStringElement m2 = new MyStringElement("4");
        MyStringElement m3 = new MyStringElement("1");

        TreeSet<MyStringElement> tree = new TreeSet<MyStringElement>();
        tree.add(m1);
        tree.add(m2);
        tree.add(m3);
        tree.add(new MyStringElement("1"));
        System.out.println(tree);
    }
}
```

```
[1, 3, 4]
```

```
public class MyElementsTreeSet2 {
    public static void main(String[] args){
        MyStringElement m1 = new MyStringElement("3");
        MyStringElement m2 = new MyStringElement("4");
        MyStringElement m3 = new MyStringElement("1");

        TreeSet<MyStringElement> tree = new TreeSet<MyStringElement>(
            new Comparator<MyStringElement>() {
                public int compare(MyStringElement o1, MyStringElement o2)
                {
                    return o1.getString().compareTo(o2.getString())*(-1);
                }});

        tree.add(m1);
        tree.add(m2);
        tree.add(m3);
        System.out.println(tree);
    }
}
```

```
[4, 3, 1]
```


Variable number of arguments

```
import java.util.TreeSet;

public class MyElementsTreeSet3 {
    private TreeSet<MyStringElement> set = new TreeSet<MyStringElement>();

    public void add(MyStringElement...elements){
        for(MyStringElement e : elements)
            set.add(e);
    }

    public String toString() {
        return set.toString();
    }

    public static void main(String[] args) {
        MyElementsTreeSet3 set = new MyElementsTreeSet3();

        MyStringElement m1 = new MyStringElement("3");
        MyStringElement m2 = new MyStringElement("4");
        MyStringElement m3 = new MyStringElement("1");

        set.add();
        System.out.println(set);
        set.add(m1);
        System.out.println(set);
        set.add(m1, m2, m3);
        System.out.println(set);
    }
}
```


Class HashMap

[This class makes no guarantees as to the order of the map; in particular, it does not guarantee that the order will remain constant over time.]

```
import java.util.HashMap;

public class JavaHashMap {
    public static void main(String[] args) {
        HashMap<String, Integer> map = new HashMap<String, Integer>();
        Integer count;

        count = map.get("string1");
        map.put("string1", count == null ? 1 : count + 1);

        count = map.get("string1");
        map.put("string1", count == null ? 1 : count + 1);

        count = map.get("string7");
        map.put("string7", count == null ? 1 : count + 1);

        count = map.get("string2");
        map.put("string2", count == null ? 1 : count + 1);

        System.out.println(map);
    }
}
```

```
{string7=1, string2=1, string1=2}
```



```
for (String key: map.keySet())
  System.out.println(key);

for (Integer value: map.values())
  System.out.println(value);
```

fore more details please consult

http://docs.oracle.com/javase/7/docs/api/

Class TreeMap

[The map is sorted according to the natural ordering of its keys, or by a Comparator provided at map creation time, depending on which constructor is used.]

```
public class JavaTreeMap {
    public static void main(String[] args) {
        TreeMap<String, Integer> map = new TreeMap<String, Integer>();
        Integer count;

        count = map.get("string1");
        map.put("string1", count == null ? 1 : count + 1);

        count = map.get("string1");
        map.put("string1", count == null ? 1 : count + 1);

        count = map.get("string7");
        map.put("string7", count == null ? 1 : count + 1);

        count = map.get("string2");
        map.put("string2", count == null ? 1 : count + 1);

        System.out.println(map);
    }
}
```

```
{string1=2, string2=1, string7=1}
```