Class Library
java.lang Package

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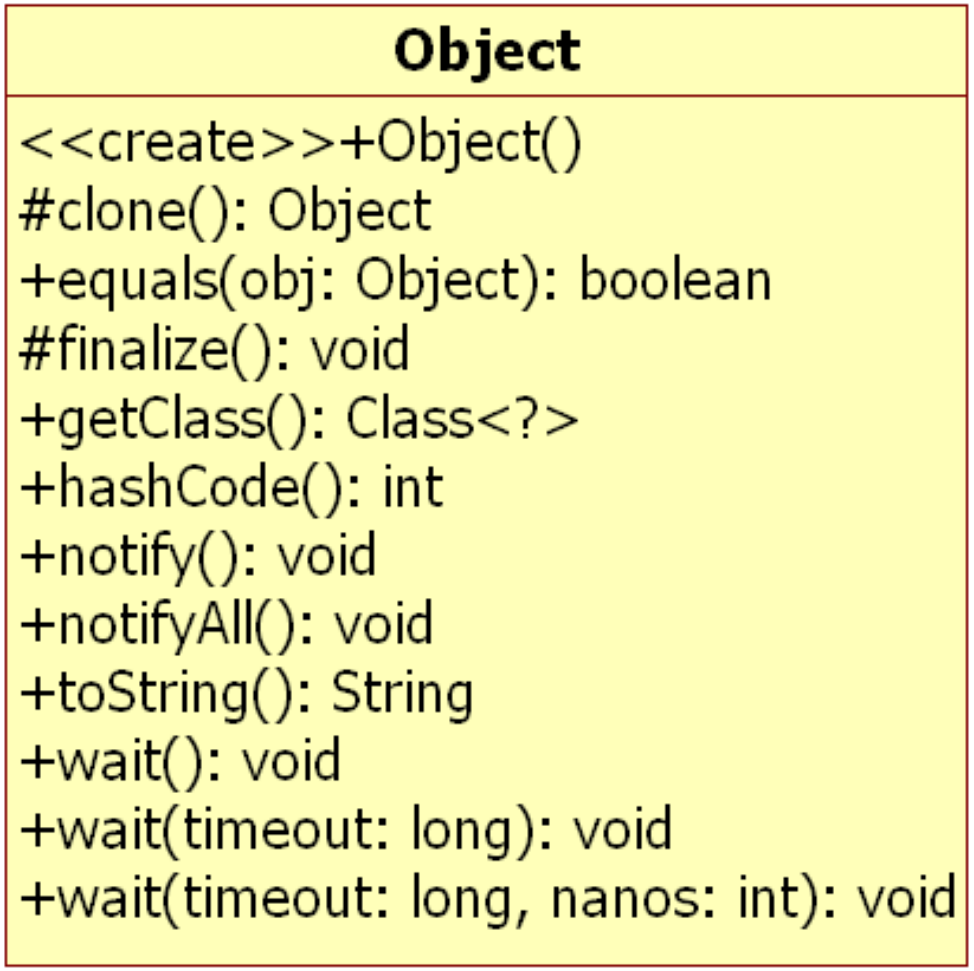
https://github.com/swacademy/JavaSE

`Object` class

- Is the root of the class hierarchy.
- Every class has `Object` as a superclass.
- If no inheritance is specified when a class is defined, the superclass of the class is `Object` by default.



Object class – clone()

- Performs a "shallow copy" of this object, not a "deep copy" operation.

```
1  public class CloneTest implements Cloneable{
2      private String name;
3      public CloneTest(String name) { this.name = name; }
4      public String getName() { return this.name; }
5      public void setName(String name) { this.name = name; }
6      public static void main(String[] args) {
7          CloneTest  t = new CloneTest("Duncan");
8          Object obj = null;
9          try{
10             obj = t.clone();
11         }catch(CloneNotSupportedException ex){
12             System.out.println("Cannot Copy");
13         }
14         CloneTest  t1 = (CloneTest)obj;
15         if(t == t1) System.out.println("Equals");
16         else System.out.println("Not Equals");
17         System.out.println(t1.getName());
18         t.setName("Michael");
19         System.out.println(t1.getName());
20     }
21 }
```

```
---------- Java Interpreter ----------
Not Equals
Duncan
Duncan
```

`Object` class – `clone()` (Cont.)

- To doing “deep copy” using method’s *override*.

```
2  public class CloneTest {
3      public static void main(String[] args) {
4          // TODO Auto-generated method stub
5          Product  original = new Product(10);
6          Object obj = original.clone();
7          if(obj instanceof Product){
8              Product  other = (Product)obj;
9              System.out.println(other.getSu());
10         }
11     }
12 }
13 class Product  {
14     private int su;
15     public Product(int su){
16         this.su = su;
17     }
18     protected Object clone(){ return this; }
19     public int getSu() { return this.su; }
20 }
```

Object class – equals()

```
2  public class EqualsTest {
3      public static void main(String[] args) {
4          // TODO Auto-generated method stub
5          Person original = new Person("Michael");
6          Person other = new Person("Sujan");
7          if(original.equals(other))
8              System.out.println("Name is same.");
9          else
10             System.out.println("Name is different.");
11     }
12 }
13 class Person{
14     private String name;
15     public Person(String name) { this.name = name; }
16     public boolean equals(Object obj){  //Object's equals() override
17         Person other = (Person)obj;
18         if(other.name == this.name) return true;
19         else return false;
20     }
21 }
```

`Object` class – `finalize()`

- Called by the garbage collector on an object when garbage collection determines that there are no more references to the object.
- A subclass overrides the `finalize` method to dispose of System resources or to perform other cleanup.
- Is never invoked more than once by a Java virtual machine.

`Object` class – `finalize()` (Cont.)

```
1  //finalize()
2  public class ObjectDemo {
3      public static void main(String[] args) {
4          Demo d = new Demo();
5          d = null;
6          System.gc();
7      }
8  }
9  class Demo{
10     public Demo(){
11         System.out.println("Demo class's Constructor");
12     }
13     @Override
14     protected void finalize(){
15         System.out.println("Demo class's Deconstructor");
16     }
17 }
```

```
Demo class's Constructor
Demo class's Deconstructor
```

`Object` class – `getClass()`

- Returns the runtime class of an object.

```
2  public class GetClassTest {
3      public static void main(String[] args) {
4          // TODO Auto-generated method stub
5          Cat c = new Cat();
6          System.out.println(c.getClass());
7      }
8  }
9  class Cat{}
10 /*
11 class Cat
12  */
```

Object class – toString()

```
2  public class ToStringTest {
3      public static void main(String[] args) {
4          // TODO Auto-generated method stub
5          Dog d = new Dog();
6          d.display();
7          System.out.println(d.toString());
8      }
9  }
10 class Dog{
11     public void display(){
12         System.out.println(this);
13     }
14 }
15 /*
16  * Dog@757aef
17  * Dog@757aef
18  */
```

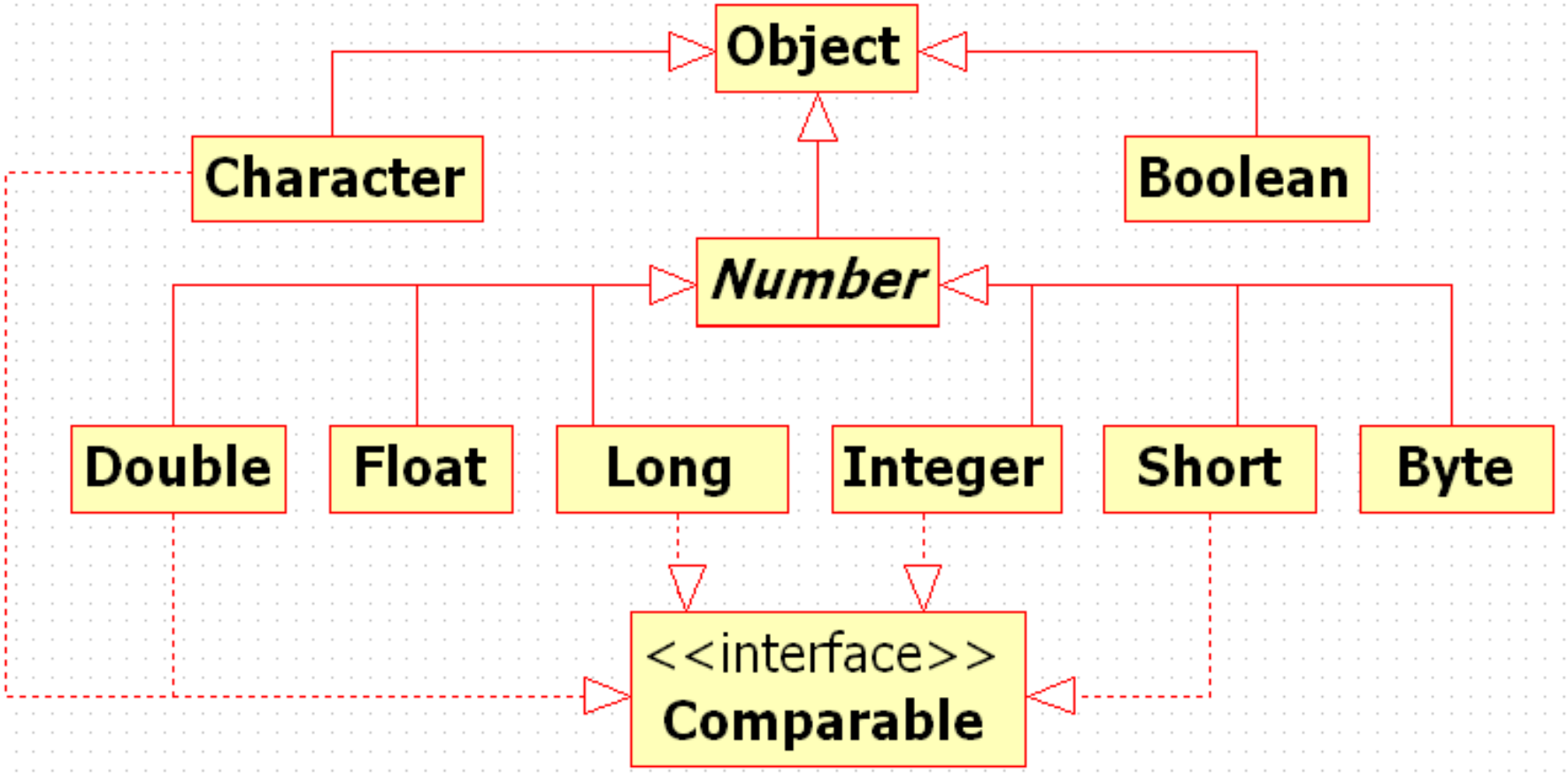
```
2  public class ToStringTest {
3      public static void main(String[] args) {
4          // TODO Auto-generated method stub
5          Dog d = new Dog("Michael");
6          System.out.println(d.toString());
7      }
8  }
9  class Dog{
10     private String name;
11     public Dog(String name){ this.name = name; }
12     public String toString(){
13         return String.format("This Dog's name is %s...", this.name);
14     }
15 }
16 /*
17  * This Dog's name is Michael...
18  */
```

Wrapper Classes

- Look at primitive data elements as objects.

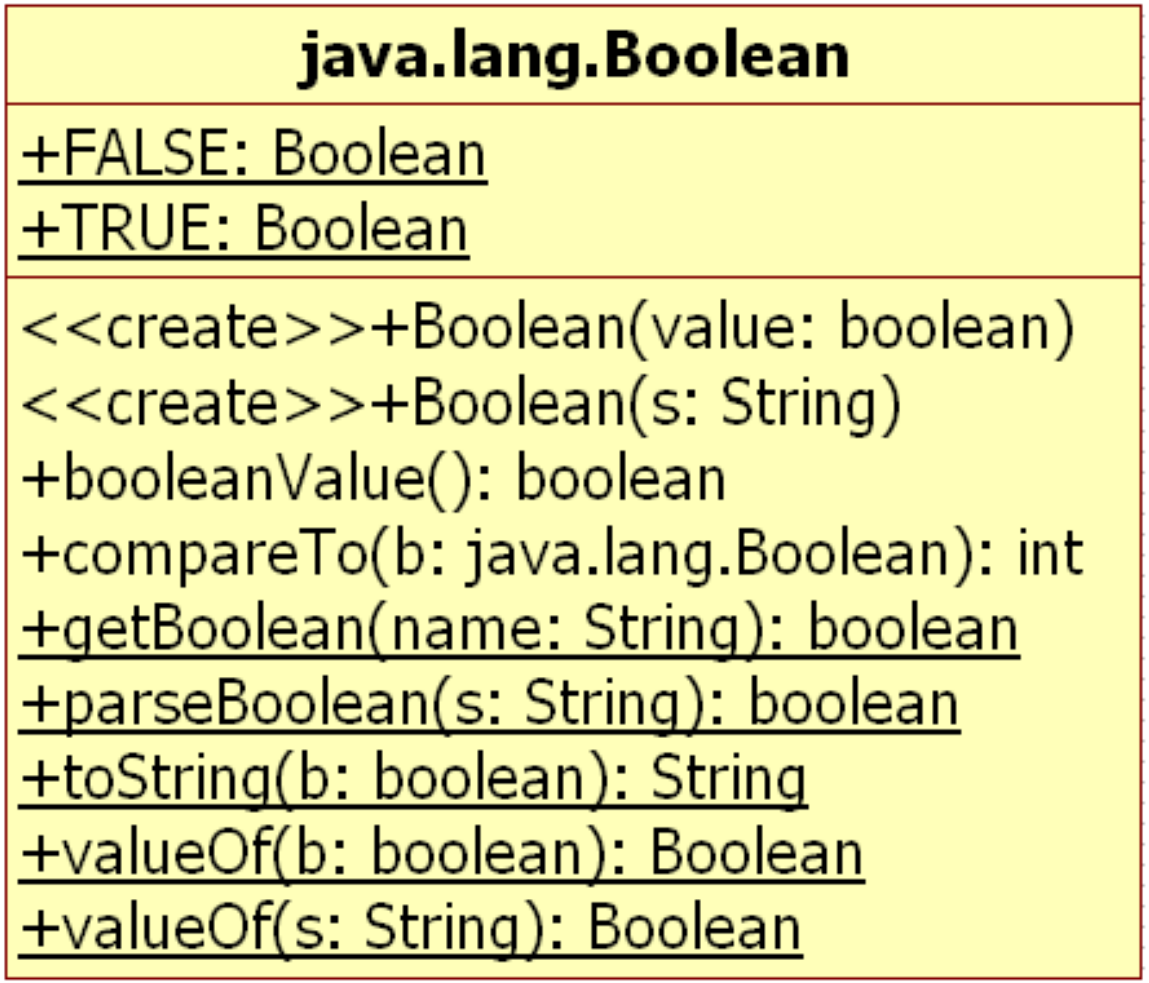
Primitive Data Type	Wrapper Class	Methods to get primitive values
`boolean`	`Boolean`	`booleanValue()`
`byte`	`Byte`	`charValue()`
`char`	`Character`	`byteValue()`
`short`	`Short`	`shortValue()`
`int`	`Integer`	`intValue()`
`long`	`Long`	`longValue()`
`float`	`Float`	`floatValue()`
`double`	`Double`	`doubleValue()`

Wrapper Classes (Cont.)



`Boolean` Class

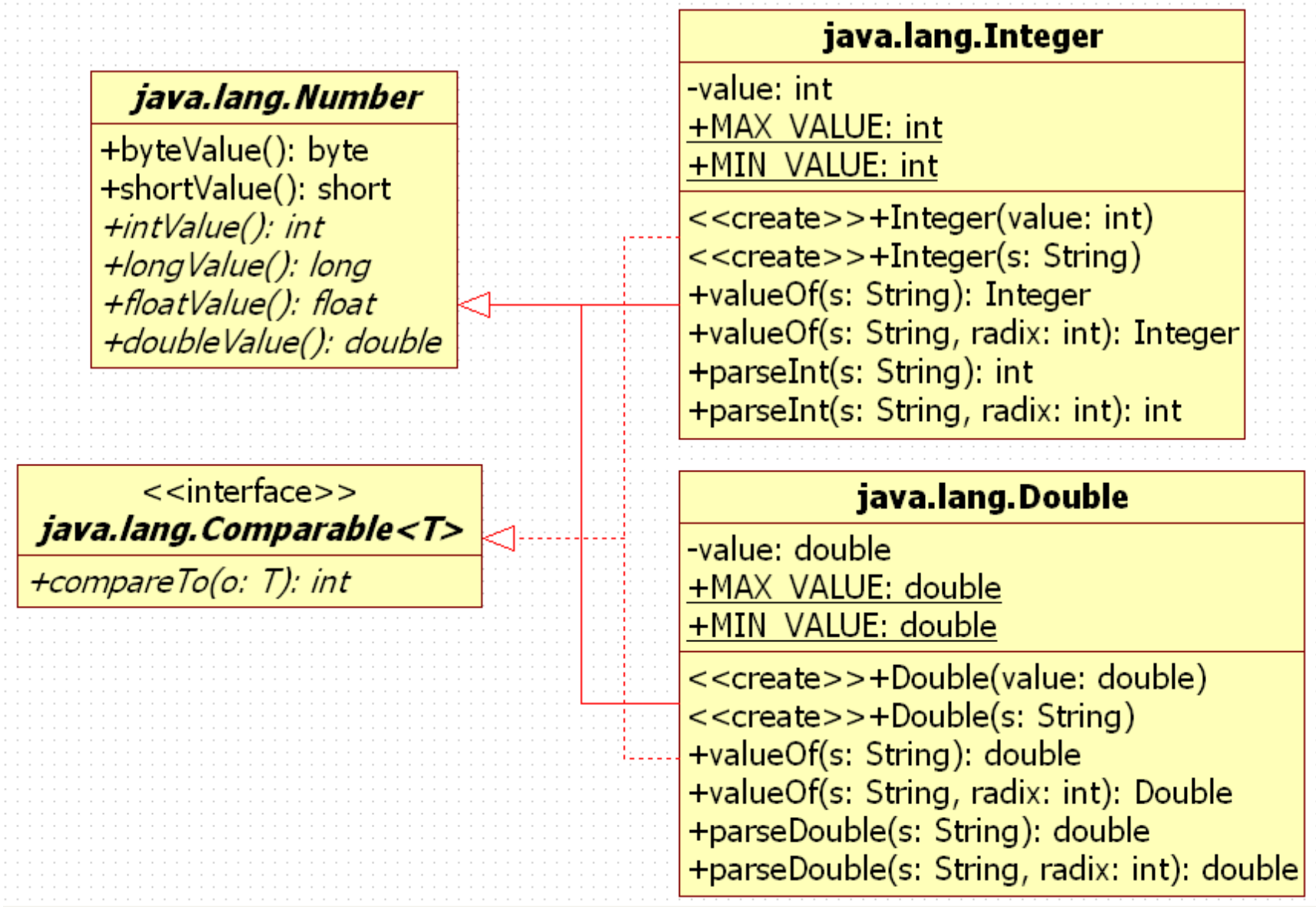
- Wraps a value of the primitive type **`boolean`** in an object.



Numeric Wrapper Classes

- Each wrapper class overrides the `toString()`, `equals()`, and `hashCode()`.
- All the numeric wrapper classes and the `Character` class implement the `Comparable` interface → the `compareTo()` is implemented in these classes.

Numeric Wrapper Classes



Numeric Wrapper Classes

- Common Constructors
  - `Datatype (dataType value)`
  - `Datatype (String s) throws NumberFormatException`
- Common Fields
  - `static dataType MAX_VALUE`
  - `static dataType MIN_VALUE`

Numeric Wrapper Classes (Cont.)

- Common Methods
  - `dataType datatypeValue ()`
  - `dataType compareTo (Datatype anotherDataType)`
  - `static dataType parseDataType (String s)`
  - `boolean equals (Object obj)`
  - `String toString()`
  - `static Datatype valueOf (String s)`

Numeric Wrapper Classes (Cont.)

- Etc methods
  - `static String toBinaryString (int i)`
  - `static String toHexString (int i)`
  - `static String toOctalString (int i)`

`Character` Class

- Wraps a value of the primitive type char in an object.
- Character information is based on the Unicode Standard, version 4.0

`Character` Class

- Wraps a value of the primitive type char in an object.
- Character information is based on the Unicode Standard, version 4.0
- **`Character (char value)`**
- **`static boolean isXxx (char ch)`**
- **`static boolean isXxx (int codePoint)`**

Autoboxing and Autounboxing

```
 2 public class AutoboxingTest {
 3⊖    public static void main(String[] args) {
 4        // TODO Auto-generated method stub
 5        Integer in = new Integer(10);
 6        int su = 5;
 7        su += in;                //autounboxing
 8        in = su;                 //autoboxing
 9        System.out.println("in = " + in);
10    }
11 }
12 /*
13  * in = 15
14  */
```

Math Class

- Contains methods for performing basic numeric operations such as the elementary exponential, logarithm, square root, and trigonometric functions.
- Is final class. So, Cannot inherit.
- All field is final fields. So, Cannot assign literal.
- All method is final method. So, Cannot override it.

`Math` class (Cont.)

- `static type abs (type value)`
- `static type max (type a, type b)`
- `static type min (type a, type b)`
- `static double pow (double a, double b)`
- `static double sqrt (double a)`
- `static double random ()`
- `static double ceil (double a)`
- `static double floor (double a)`
- `static int round (float a)`
- `static long round (double a)`

`String` class

- Represents character strings.
- All string literals are implemented as instances of this class.
- Strings are ***constant***.
- Their values cannot be changed after they are created.
- Case mapping relies heavily on the information provided by the Unicode Consortium's Unicode 4.0 specification.

`String` class (Cont.)

- Provides special support for the string concatenation operator (`+`), and for conversion of other objects to strings.
- String concatenation is implemented through the `StringBuffer` class and its append method.

`String` class (Cont.)

- `String (byte [] bytes)`
- `String (byte [] bytes, int offset, int length)`
- `String (byte [] bytes, int offset, int length, String charsetName)`
- `String (byte [] bytes, String charsetName)`
- `String (char [] value)`
- `String (char [] value, int offset, int count)`
- `String (String original)`
- `String (StringBuffer buffer)`

`String` class (Cont.)

- `char charAt (int index)`
- `int compareTo (String anotherString)`
- `int compareToIgnoreCase (String str)`
- `String concat (String str)`
- `static String copyValueOf (char [] data)`
- `static String copyValueOf (char [] data, int offset, int count)`
- `boolean endsWith (String suffix)`
- `boolean equals (Object anObject)`
- `boolean equalsIgnoreCase (String anotherString)`

`String` class (Cont.)

- `byte [] getBytes ()`
- `byte [] getBytes (String charsetName)`
- `void getChars (int srcBegin, int srcEnd, char [] dst, int dstBegin)`
- `int hashCode ()`
- `int indexOf (int ch)`
- `int indexOf (int ch, int fromIndex)`
- `int indexOf (String str)`
- `int indexOf (String str, int fromIndex)`

`String` class (Cont.)

- `int lastIndexOf (int ch)`
- `int lastIndexOf (String str)`
- `int length ()`
- `boolean matches (String regex)`
- `boolean regionMatches (boolean ignoreCase, int toffset, String other, int ooffset, int len)`
- `String replace (char oldChar, char newChar)`
- `String replaceAll (String regex, String replacement)`
- `boolean startsWith (String prefix)`

`String` class (Cont.)

- `String substring (int beginIndex)`
- `String substring (int beginIndex, int endIndex)`
- `char [] toCharArray ()`
- `String toLowerCase ()`
- `String toString()`
- `String toUpperCase ()`
- `String trim ()`
- `static String valueOf (type t)`

Unicode Character Set(UCS)*

Charset	Description
US-ASCII	Seven-bit ASCII, ISO646-US, the Basic Latin block of the Unicode character set
ISO-8859-1	ISO Latin Alphabet No. 1, ISO-LATIN-1
UTF-8	Eight-bit UCS Transformation Format
UTF-16BE	Sixteen-bit UCS Transformation Format, big-endian byte order
UTF-16LE	Sixteen-bit UCS Transformation Format, little-endian byte order
UTF-16	Sixteen-bit UCS Transformation Format, byte order identified by an optional byte-order mark
EUC**-KR	Eight-bit, Unified Hangeul Code (통합완성형)
KS C 5601	KS_C_5601-1987, KSC_5601, KSC5601, KS X 1001, Korean Graphic Character Set for Information Interchange
MS949***	Code page 949, Windows Codepage 949, Microsoft's implementation that appears similar to EUC-KR

* **java.nio.charset.Charset**

* **Extended Unix Code (EUC) is a multibyte character encoding system used primarily for Korean, Japanese and simplified Chinese.**

** http://msdn.microsoft.com/ko-kr/goglobal/cc305154

`String` class (Cont.)

```
2  public class StringDemo1 {
3      public static void main(String[] args) {
4          // TODO Auto-generated method stub
5          char [] array = {'H','e','l','l','o'};
6          String str = new String(array);
7          String str1 = new String(str);
8          System.out.println("str = " + str);
9          System.out.println("str1 = " + str1);
10     }
11 }
12 /*
13 str = Hello
14 str1 = Hello
15 */
```

`String` class (Cont.)

```
byte [] array = "안녕하세요".getBytes();
for(byte b : array){
    System.out.print(b + ", ");
}
```

```
-20, -107, -120, -21, -123, -107, -19, -107, -104, -20, -124, -72, -20, -102, -108,
```

String class (Cont.)

```
byte [] array = {65, 66, 67, 68, 69, 70};
String str = new String(array);
System.out.println("str = " + str);

byte [] array1 = {-20, -107, -120, -21, -123, -107, -19, -107,
                  -104, -20, -124, -72, -20, -102, -108};
String str1 = new String(array1, "ISO8859_1");
String str2 = new String(array1, "KSC5601");
String str3 = new String(array1, "EUC-KR");
String str4 = new String(array1, "UTF-8");
String str5 = new String(array1, "UTF-16");

System.out.println("str1 = " + str1);
System.out.println("str2 = " + str2);
System.out.println("str3 = " + str3);
System.out.println("str4 = " + str4);
System.out.println("str5 = " + str5);
```

```
str = ABCDEF
str1 = ì ˆë í ˆì„¸ìš
str2 = □□□□□□
str3 = □□□□□□
str4 = 안녕하세요
str5 =    裨薰   養蒸   □
```

String class (Cont.)

```
2  public class StringDemo {
3      public static void main(String[] args) {
4          // TODO Auto-generated method stub
5          String str = "C";
6          String str1 = "A";
7          int su = str.compareTo(str1);
8          System.out.println("su = " + su);
9      }
10 }
11 /*
12 su = 2
13 */
```

```
2  public class StringDemo3 {
3      public static void main(String[] args) {
4          // TODO 자동 생성된 메소드 스텁
5          String str = "Hello, World";
6          String str1 = "안녕  하세요";
7          System.out.println(str.length());
8          System.out.println(str1.length());
9      }
10 }
11 /*
12 12
13 7
14 */
```

`String` class (Cont.)

```
/*String str = "Hello";
String str1 = "Hello";*/

String str = new String("Hello");
String str1 = new String("Hello");

if(str.contentEquals(str1)) System.out.println("Equals");
else System.out.println("Different");

//cf. boolean equals(Object anObject), boolean equalsIgnoreCase(Object anotherString)
//cf. int compareTo(String anotherStr), int compareToIgnoreCase(String str)
```

String class (Cont.)

```
2  public class StringDemo3 {
3      public static void main(String[] args) {
4          // TODO 자동 생성된 메소드 스텁
5          String msg = "446-912 경기도 용인시 기흥구 마북동 431번지";
6          String zip1 = msg.substring(0, 3);
7          String zip2 = msg.substring(4, 7);
8          String address= msg.substring(8);
9          System.out.println("우편번호 = " + zip1+ "-" + zip2);
10         System.out.println("주소 = " + address);
11     }
12 }
13 /*
14 우편번호 = 446-912
15 주소 = 경기도 용인시 기흥구 마북동 431번지
16 */
```

`String` class (Cont.)

```
 2 public class StringDemo3 {
 3    public static void main(String[] args) {
 4       // TODO Auto-generated method stub
 5       String str = "Java is a Object Oriented Programming";
 6
 7       System.out.println(str.indexOf("Java"));
 8       System.out.println(str.lastIndexOf("a"));
 9       System.out.println(str.indexOf('a', 5));
10
11       String msg = "Hello";
12       //msg[0] = 'C';  //error
13       msg = msg.replace('H', 'C');
14       System.out.println("msg = " + msg);
15    }
16 }
17 /*
18 0
19 31
20 8
21 msg = Cello
22 */
```

`StringBuffer` class

- Is final class.
- A string buffer implements a ***mutable*** sequence of characters. A string buffer is like a String, but can be modified.
- String buffers are used by the compiler to implement the binary string concatenation operator **+**.
- Every string buffer has a capacity. As long as the length of the character sequence contained in the string buffer does not exceed the capacity, it is not necessary to allocate a new internal buffer array. If the internal buffer overflows, it is automatically made larger.

StringBuffer class (Cont.)

- StringBuffer (int length)
- StringBuffer (String str)
- StringBuffer append (type t)
- int capacity ()
- StringBuffer delete (int start, int end)
- StringBuffer deleteCharAt (int index)
- void getChars (int srcBegin, int srcEnd, char [] dst, int dstBegin)
- int indexOf(String str)

StringBuffer class (Cont.)

- StringBuffer insert (int offset, type t)
- int lastIndexOf (String str)
- int length ()
- StringBuffer replace (int start, int end, String str)
- StringBuffer reverse ()
- void setCharAt (int index, char ch)
- void setLength (int newLength)
- String substring (int start)
- String substring (int start, int end)

StringBuffer class (Cont.)

```
 2 public class StringBufferDemo {
 3    public static void main(String[] args) {
 4       // TODO Auto-generated method stub
 5       StringBuffer sb = new StringBuffer();
 6       System.out.println(sb.capacity());
 7       StringBuffer sb1 = new StringBuffer(30);
 8       System.out.println(sb1.capacity());
 9       StringBuffer sb2 = new StringBuffer("Hello");
10       System.out.println("buffer = " + sb2);
11       System.out.println("length = " + sb2.length());
12       System.out.println("capacity = " + sb2.capacity());
13    }
14 }
15 /*
16 16
17 30
18 buffer = Hello
19 length = 5
20 capacity = 21
21 */
```

StringBuffer class (Cont.)

```
2  public class StringBufferDemo {
3      public static void main(String[] args) {
4          // TODO Auto-generated method stub
5          String str = new String("A");
6          long startString = System.currentTimeMillis();
7          for(int i = 0 ; i < 50000 ; i++){
8              str = str.concat("A");
9          }
10         long endString = System.currentTimeMillis();
11         StringBuffer sb = new StringBuffer("A");
12         long startStringBuffer = System.currentTimeMillis();
13         for(int i = 0 ; i < 50000 ; i++){
14             sb.append("A");
15         }
16         long endStringBuffer = System.currentTimeMillis();
17         System.out.println("String : " + (endString - startString) + "ms");
18         System.out.println("StringBuffer : " + (endStringBuffer - startStringBuffer) + "ms");
19     }
20 }
21 /*
22 String : 3985ms
23 StringBuffer : 15ms
24 */
```

StringBuffer class (Cont.)

```
2  public class StringBufferDemo {
3      public static void main(String[] args) {
4          // TODO Auto-generated method stub
5          StringBuffer sb = new StringBuffer("I Java!");
6          sb.insert(2, "love "); System.out.println(sb);
7          sb.reverse(); System.out.println(sb);
8          sb.reverse();
9          sb.delete(7, 11); System.out.println(sb);
10         sb.deleteCharAt(0); System.out.println(sb);
11         sb.insert(6, "Java"); System.out.println(sb);
12         sb.replace(6, 10, "XML"); System.out.println(sb);
13     }
14 }
15 /*
16 I love Java!
17 !avaJ evol I
18 I love !
19  love !
20  love Java!
21  love XML!
22 */
```

`System` class

- Is final class.
- Contains several useful class fields and methods. It cannot be instantiated.
- Among the facilities provided by the System class are standard input, standard output, and error output streams; access to externally defined "properties“
- `static PrintStream err` : Standard error output
- `static InputStream in` : Standard input
- `static PrintStream out` : Standard output

`System` class (Cont.)

- `static void arraycopy (Object src, int srcPos, Object dest, int destPos, int length)`
- `static long currentTimeMillis ()`
- `static void exit (int status)`
- `static void gc ()`
- `static Properties getProperties ()`
- `static String getProperty (String key)`
- `static String getProperty (String key, String def)`

System class (Cont.)

```
Map<String, String> map = System.getenv();
Set<String> keys = map.keySet();
Object [] array = keys.toArray();
for(Object key : array){
    System.out.println(key + "=" + map.get(key));
}
```

```
PATHEXT=.COM;.EXE;.BAT;.CMD;.VBS;.VBE;.JS;.JSE;.WSF;.WSH;.PSC1
JAVA_HOME=C:\Program Files\Java\jdk1.7.0_25
TEMP=C:\DOCUME~1\Redmond\LOCALS~1\Temp
SystemDrive=C:
MOZ_PLUGIN_PATH=C:\Program Files\Foxit Software\Foxit Reader\plugins\
ProgramFiles=C:\Program Files
Path=C:/Program Files/Java/jdk1.7.0_25/bin/../jre/bin/client;C:/Program Fi
```

System class (Cont.)

```
long startMili = System.currentTimeMillis();
long startNano = System.nanoTime();
for(int i = 0 ; i < Integer.MAX_VALUE ; i++);
long endMili = System.currentTimeMillis();
long endNano = System.nanoTime();

System.out.println("Difference Milisec = " + (endMili - startMili) + "ms");
System.out.println("Difference Nanosec = " + (endNano - startNano) + "ns");
```

```
Difference Milisec = 2391ms
Difference Nanosec = 2379537064ns
```

`Runtime` class

- Every Java application has a single instance of class Runtime.
- Allows the application to interface with the environment in which the application is running.
- The current runtime can be obtained from the `getRuntime()` method.
- An application cannot create its own instance of this class.

Runtime class (Cont.)

```
5       Runtime r = Runtime.getRuntime();
6       long memory, memory1;
7       Integer [] array = new Integer[1000];
8       System.out.println("Total Memory : " + r.totalMemory());
9       memory = r.freeMemory();
10      System.out.println("Free Memory : " + memory);
11      r.gc();
12      memory = r.freeMemory();
13      System.out.println("After GC Free Memory : " + memory);
14      for(int i=0;i < array.length; i++)
15         array[i] = new Integer(i);
16      memory1 = r.freeMemory();
17      System.out.println("After fullfill Free Memory : " + memory1);
18      System.out.println("Memory that assigns data : " + (memory - memory1));
19      for(int i=0;i < array.length; i++)
20         array[i] = null;
21      r.gc();
22      memory1 = r.freeMemory();
23      System.out.println("After GC Free Memory : " + memory1);
24   }
25 }
26 /*
27 Total Memory : 2031616
28 Free Memory : 1836696
29 After GC Free Memory : 1892056
30 After fullfill Free Memory : 1875728
31 Memory that assigns data : 16328
32 After GC Free Memory : 1892056
33 */
```

Runtime class (Cont.)

```
2  public class RuntimeDemo {
3      public static void main(String[] args) {
4          // TODO Auto-generated method stub
5          Runtime r = Runtime.getRuntime();
6          Process p = null;
7          try{
8              p = r.exec("Notepad");
9          }catch(Exception e){
10             System.out.println("Error executing Notepad.");
11         }
12     }
13 }
```