Wrapper Classes

Objectives

- At the end of this session, you will be able to:
  - Describe the need for wrapper classes
  - Define wrapper classes
  - Understand Autoboxing & Unboxing
  - Understand cloning

Wrapper Classes

Wrapper Classes

- For all the primitive data types available in Java, there is a corresponding Object representation available which is known as Wrapper Classes

Need for Wrapper Classes

- All Collection classes in Java can store only Objects
- **Primitive data types cannot be stored directly in these classes** and hence the primitive values needs to be converted to objects
- We have to wrap the primitive data types in a corresponding object, and give them an object representation

Wrapper Classes (Contd.).

- Definition: The process of converting the primitive data types into objects is called *wrapping*

- To declare an integer ‘i’ holding the value 10, you write

  int i = 10;

- The object representation of integer ‘i’ holding the value 10 will be:

  Integer iref = new Integer(i);

- Here, class Integer is the wrapper class wrapping a primitive data type i

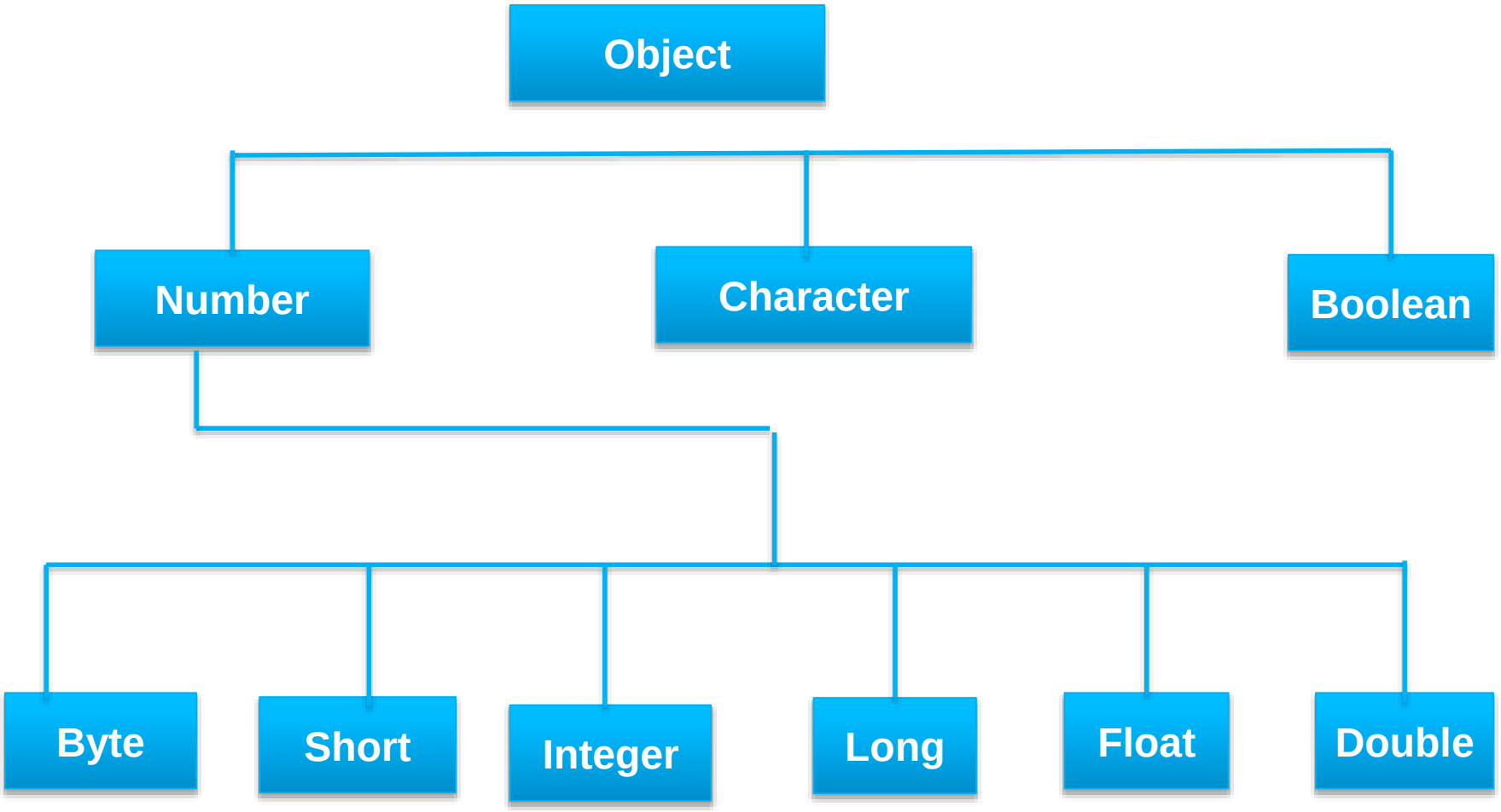
Wrapper Classes (Contd.).

- The Java API has provided a set of classes that make the process of wrapping easier. Such classes are called wrapper classes.
- For all the primitive data types, there are corresponding wrapper classes. Storing primitive types in the form of objects affects the performance in terms of memory and speed.
- Representing an integer via a wrapper takes about 12-16 bytes, compared to 4 in an actual integer. Also, retrieving the value of an integer uses the method **`Integer.intValue()`**.
- The wrapper classes are very useful as they enable you to manipulate primitive data types.

Wrapper Classes (Contd.).

- For example, you can take the integer input from the user in the form of a **String**, and convert it into integer type using the following statements:
- **String str = "100";**
- **int j = Integer.parseInt(str);**
- There are many more methods in the wrapper classes that help you do several operations with the data types.
- The wrapper classes also have constants like :
- **MAX_VALUE, MIN_VALUE, NaN** (Not a Number), **POSITIVE_INFINITY**, and **NEGATIVE_INFINITY**.

Wrapper Classes (Contd.).



The Integer Class

- Class **Integer** is a wrapper for values of type **int**

- **Integer** objects can be constructed with a **int** value, or a string containing a int value

- The constructors for Integer are shown here:

  Integer(int num)

  Integer(String str) throws NumberFormatException

- Some methods of the **Integer** class:

  static int parseInt(String str) throws NumberFormatException

  int intValue( ) returns the value of the invoking object as a **int** value

Refer Java documentation for other important methods

The Integer Class

Integer i1=new Integer(100);

Integer i2=new Integer(“100”);

Few more method of Integer class (These methods also available in Long, Short, Byte, Float, Double wrapper class)

byteValue()

Returns the value of the invoking object as a byte.

doubleValue()

Returns the value of the invoking object as a double.

floatValue()

Returns the value of the invoking object as a float.

longValue()

Returns the value of the invoking object as a long.

shortValue()

Returns the value of the invoking object as a short.

E.g.

```
Integer i1=new Integer(20);
double d1=i1.doubleValue();
```

The Character Class

- Character class is a wrapper class for character data types.
- The constructor for Character is:
  - **Character(char c)**
  - Here, c specifies the character to be wrapped by the Character object
- After a Character object is created, you can retrieve the primitive character value from it using:
  - **char charValue( )**

Refer Java documentation for other important methods

The Character Class

The **Character** class contains the following constants:

MAX_VALUE - The largest character value.

MIN_VALUE - The smallest character value.

TYPE - The **Class** object for **char.**

Few more functions from Character class

static String toString(char c)

Returns a String object representing the specified char.

static char toLowerCase(char ch)

Converts the character argument to lowercase

static char toUpperCase(char ch)

Converts the character argument to uppercase .

The Boolean Class

- The Boolean class is a wrapper class for boolean values

- It has the following constructors:
  - **Boolean(boolean bValue)**
    - Here, bValue can be either true or false
  - **Boolean(String str)**
    - The object created by this constructor will have the value true or false depending upon the string value in str – “true” or “false”
    - The value of str can be in upper case or lower case

Refer Java documentation for other important methods

The Float Class

- Class **Float** is a wrapper for floating-point values of type float

- **Float** objects can be constructed with a **float** value, or a string containing a floating-point value

- The constructors for float are shown here:

  Float(float num)

  Float(String str) throws NumberFormatException

- Some methods of the **Float** class:

  static Float valueOf(String str) throws NumberFormatException

  float floatValue( ) returns the value of the invoking object as a **float** value

Refer Java documentation for other important methods

The Double Class

- Class **Double** is a wrapper for floating-point values of type **double**

- **Double** objects can be constructed with a **double** value, or a string containing a floating-point value

- The constructors for double are shown here:

  Double(double num)

  Double(String str) throws NumberFormatException

- Some methods of the **Double** class:

  static Double valueOf(String str) throws NumberFormatException

  double doubleValue( ) returns the value of the invoking object as a **double** value

Refer Java documentation for other important methods

The Long Class

- Class **Long** is a wrapper for values of type **long**
- **Long** objects can be constructed with a **long** value, or a string containing a long value
- The constructors for long are shown here:

  Long(long num)

  Long(String str) throws NumberFormatException
- Some methods of the **Long** class:

  static Long valueOf(String str) throws NumberFormatException

  long longValue( ) returns the value of the invoking object as a **long** value

Refer Java documentation for other important methods

Example

```
long ln=999;
Long lng=new Long(ln);
Long ls=new Long("666");
System.out.println("long value="+lng.longValue());
System.out.println("long value from string
version="+ls.longValue());
```

Output:

long value=999

long value from string version=666

The Short Class

- Class **Short** is a wrapper for values of type **short**

- **Short** objects can be constructed with a **short** value, or a string containing a long value

- The constructors for short are shown here:

  Short(short num)

  Short(String str) throws NumberFormatException

- Some methods of the **Short** class:

  static Short valueOf(String str) throws NumberFormatException

  short shortValue( ) returns the value of the invoking object as a **short** value

Refer Java documentation for other important methods

Example

```
short s=9;
    Short sh=new Short(ln);
    Short ls=new Short(“6");
    System.out.println("short value="+lng.shortValue());
    System.out.println("short value from string version="+ls.shortValue());
```

Output:

short value=999

short value from string version=666

The Byte Class

- Class **Byte** is a wrapper for values of type **byte**

- **Byte** objects can be constructed with a **byte** value, or a string containing a long value

- The constructors for byte are shown here:

  Byte(byte num)

  Byte(String str) throws NumberFormatException

- Some methods of the **Byte** class:

  static Byte valueOf(String str) throws NumberFormatException

  byte byteValue( ) returns the value of the invoking object as a **byte** value

Refer Java documentation for other important methods

AutoBoxing & UnBoxing

- Java 5.0 introduced automatic conversion between a primitive type and the corresponding wrapper class

- During assignment , the automatic transformation of primitive type to corresponding wrapper type is known as **autoboxing**

- Primitive types ----------→ wrapper type

  (autoboxing)

- E. g. `Integer i1=10;`

- During assignment , the automatic transformation of wrapper type into their primitive equivalent is known as **Unboxing**

- wrapper type ----------→ primitive type

  (unboxing)

- E. g.
```
int i=0;
i=new Integer(10);
```

AutoBoxing & UnBoxing (Contd.).

•Boxing conversion converts values of primitive type to corresponding values of reference type. But the primitive types can not be widened/ Narrowed to the Wrapper classes and vice versa.

Wrong!!!

```
byte  b   = 12;
Integer I1=b;
```

Wrong!!!

```
byte  b   = 12;
Integer I1=(Integer)b;
```

Right!!!

```
byte  b   = 12;
Integer I1=(int)b;
```

Quiz

What is the output of the following code?

```
class Test {
void m1(Integer i1) {
System.out.println("int value=" + i1);
}

public static void main(String a[]) {
Test t = new Test();
t.m1(10);
}
}
```

Quiz

What is the output of the following code?

```
class Test {
public void m1(Double x) {
System.out.println("Double");
}

public void m1(long x) {
System.out.println("long");
}

public static void main(String[] args) {
int x = 0;

Test t = new Test();
t.m1(x);
Long l1 = 10L;

t.m1(l1); }}
```

In Function Overloading Widening /Narrowing Beats Boxing/UnBoxing

Quiz

What is the output of the following code?

```
class Test {
static void fun(int i) {
System.out.println("int");
}

static void fun(Integer i) {
System.out.println("Integer");
}

public static void main(String args[]) {
byte b = 10;
fun(b);
}}
```

Quiz

What is the output of the following code?

```
class Test {
public static void main(String ar[]) {
        int x = 10;
        Integer y = new Integer(10);
        System.out.println(x == y);
}
}
```

Quiz

Which of the following is not a Wrapper Class?

1. Byte
2. Short
3. Integer
4. Long
5. String
6. Float
7. Double
8. Character
9. Boolean

The Cloneable Interface

- When you make a copy of an object reference:
  - The original and copy are references to the same object
  - This means a change to either variable also affect the other
- The clone( ) method:
  - is a protected member of Object,
  - can only be invoked on an object that implements Cloneable
- Object cloning performs a bit-by-bit copy

The Cloneable Interface

- Objects can be cloned only of those classes that implement the **Cloneable** interface.
- The **Cloneable** interface has no members. It is a marker interface and is used to indicate that a class allows a bitwise copy of an object.
- If you call **clone( )** on a class that does not implement **Cloneable**, a **CloneNotSupportedException** is thrown.
- **When a clone is made, the constructor for the object being cloned is not called**.
- A clone is simply an exact copy of the original.

Example on cloning

```
class XYZ implements Cloneable {
int a;
double b;

XYZ cloneTest() {
try {
      return (XYZ) super.clone();
} catch (CloneNotSupportedException e) {
      System.out.println("Cloning Not Allowed");
      return this;
}
}
}
```

Example on cloning (Contd.).

```
class CloneDemo1 {
    public static void main(String args[])  {
   XYZ x1 = new XYZ();
   XYZ x2;
   x1.a = 10;
   x1.b = 20;
   x2 = x1.cloneTest(); // cloning x1
   System.out.println("x1 : " + x1.a + " " + x1.b);
   System.out.println("x2 : " + x2.a + " " + x2.b);
   x1.a = 100;
   x1.b = 200;
   System.out.println("x1 : " + x1.a + " " + x1.b);
   System.out.println("x2 : " + x2.a + " " + x2.b);
    }
}
```

Output :

x1 : 10 20.0
x2 : 10 20.0
x1 : 100 200.0
x2 : 10 20.0

Summary

- In this module, you were able to:
  - Describe the need for wrapper classes
  - Define wrapper classes
  - Understand Autoboxing & Unboxing
  - Understand cloning

Thank you