

Lecture Notes (I/O Streams)

Course: Web Engineering
Instructor: Wasim Ahmad Khan

Input / Output in Java

Input/Output in Java can be done using the keyboard and screen, using files, or some combination of these methods. Input typed at the keyboard and output displayed on the screen are often referred to as **console** input/output.

Interactive input/output using the keyboard and screen is the default way of doing input/output in jGRASP. It is also possible to use a dialog box to get input from the user and to display a message. Java refers to these as an input dialog and message dialog respectively.

An object is always needed to perform an input/output operation in Java.

Display Output [standard output]

- Displaying screen output in Java is done using the System.out object. You do not need to create the System.out object. It is always available for you use in a Java program. There are 3 methods that can be used to display output: print(), printf(), and println().
 - The **print()** method is often used to display a prompt or a portion of a line. It does not move the cursor to the beginning of a new line automatically.
 - The **println()** method displays output exactly the same as the print() method except that it will always move the cursor to the beginning of a new line as the last action it performs.
 - The **printf()** method is used to output formatted text and numbers. Like the print() method, It does not move the cursor to the beginning of a new line automatically.

Keyboard Input [standard input]

- Accepting keyboard input in Java is done using a Scanner object. There is a System.in object in Java that can be used to get input in Java, but it is not very functional. Instead, Java programmers usually prefer to use a Scanner object that has been "mapped" to the System.in object. The System.in object (like the System.out object) already exists and is available for use. However, you must create a Scanner object.

Once you have created a Scanner object and "mapped" it to the System.in object you can use the following methods to test for and get input. Input always comes in to a Java program as a string of characters (Java String type). There are methods that can be used to convert the String to a character, an integer number, a floating-point number, etc. Here are commonly used Scanner methods:

```
hasNext()           //is something available to read? Returns true or false.

nextInt()           //get an int
nextFloat()         //get a float
nextDouble()        //get a double

nextBoolean()       //get a boolean value ( true or false )

next()              //get a String ( delimited by whitespace )
nextLine()          //get the rest of the line as a String
```

Note: There is no method to read in a character! Use a string variable instead.

Examples of Interactive input/output in Java

Use a Scanner object "mapped" to the **System.in** object for input and the standard output object **System.out** for output.

Input:

Lecture Notes (I/O Streams)

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1. Use the Scanner class to create an input object using the **standard input object** in the System class (**System.in**). The Scanner class is in the package `java.util`

```
Scanner input = new Scanner( System.in ); //input object is informally called "input"
```

2. Use **Scanner class methods** to get values the user enters using the keyboard.

```
int num1; double num2; String str;

num1 = input.nextInt(); //get an integer and assign it to num1
num2 = input.nextDouble(); //get a real number and assign it to num2
str = input.nextLine(); //get a String and assign it to str
```

Output:

1. Use the **standard output object** in the System class (**System.out**).
2. Use **PrintStream class methods** (`printf()`, `print()`, `println()`) to display the output to the screen using the System.out object. The System.out object is an object of type **PrintStream**.

```
System.out.print("What is your name? ");
String name = input.nextLine();
System.out.println("Hello there " + name + ", nice to meet you!");
```

```
double purchasePrice = 178.34;
System.out.printf("Your total is $%.2f\n", purchasePrice);
```

Input/Output Using a Dialog Box [include import javax.swing.JOptionPane;]

- When you use a dialog box in Java, it pops up in the middle of the screen and waits for you to enter input or displays a message and waits for you to click "OK".
- Input/output using a dialog box is done in Java using methods of the JOptionPane class. You do not have to create a JOptionPane object in Java to work with the dialog box methods `showInputDialog()` [used to get input] and `showMessageDialog()` [used to display output].
- If you are using an input dialog box, the input comes in as a String. You must then use a method to convert the input to the data type you need it to be. The method you would use to get the input is `showInputDialog()`. Once you have the input stored in a String variable, you can use a Java "wrapper" class method to convert the String.

Here are the most frequently used "wrapper" class methods: [all classes are in package `java.lang`]

```
Integer.parseInt( )      Double.parseDouble( )
Long.parseLong( )        Float.parseFloat( )
```

- To display a message using a dialog box you use the method `showMessageDialog()`.

Input using a dialog box [`JOptionPane.showInputDialog()`]

```
String name; //no conversion necessary
name = JOptionPane.showInputDialog("What is your name?");
```

```
String numberString; //accept input as a string, then convert it to a number
numberString = JOptionPane.showInputDialog( "Enter a number" );
```

```
int number;
number = Integer.parseInt( numberString );
```

Lecture Notes (I/O Streams)

Course: Web Engineering
Instructor: Wasim Ahmad Khan

Output using a dialog box [`JOptionPane.showMessageDialog()`]

```
JOptionPane.showMessageDialog(null, "Nice to meet you " + name + "!");
```

File Input/Output

Use a `Scanner` object for input and a `PrintWriter` object for output.

Note: Once we have created our objects, the input/output statements look virtually identical to the versions using the keyboard and screen.

Input:

1. Create an `input object` that is a `Scanner` class object “wrapped around” a `File` class object. Note this “wrapping” is similar in concept to wrapping a `Scanner` class object around the `System.in` object for input from the keyboard.

```
Scanner inFile = new Scanner( new File("MyData.txt") );  
//replace "MyData.txt" with the actual name of your data file.
```

The data file can be created using a simple editor such as Notepad. If the input file can not be found at runtime, an exception will occur and your program will stop execution.

2. Use `Scanner` class methods to read values from the input file.

```
int num1, num2; double num3;  
...  
num1 = inFile.nextInt();    //get an integer  
num2 = inFile.nextInt();    //get an integer  
num3 = inFile.nextDouble(); //get a real number
```

Output:

1. Create a `PrintWriter` object. The `PrintWriter` class is a subclass of `PrintStream`. The methods `print()`, `printf()`, `println()` will be available for use once the output object is created and will work exactly the same way as for the `System.out` object.

```
PrintWriter outFile = new PrintWriter("MyReport.txt");
```

The output file will automatically be created by your program. If a file exists with that name, it will be overwritten.

2. Use `PrintWriter` class methods (`print()`, `printf()`, `println()`) to write the output to the file using the `PrintWriter` object. Note: the textbook uses the `Formatter` class rather than the `PrintWriter` class.

```
int sum = num1 + num2 + num3;  
outFile.printf("The sum of the numbers is %5d\n", sum);
```

Note for File Input/Output, you need to close the files when you are finished doing your input and/or output operations. The `close()` method is used to do this.

Lecture Notes (I/O Streams)

Course: Web Engineering

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Close the input file object: `inFile.close();`
Close the output file object: `outFile.close();`

Also, because an input file may not be found at runtime, you must include the **clause throws `FileNotFoundException`** in the header of the method in which you create your input file object. It may also be required in the method header of other methods when they contain input/output operations.

To get access to the file stream and exception classes necessary to do input/output, you must include an import statement that imports the classes in **`java.io`**.

Note, the names you choose for your objects is entirely up to you. An identifier is used in the declaration of an object. You must follow the same rules as for any identifier. Choose a name that is descriptive.

Here are some example input file object identifiers: **`inFile`, `inputFile`, `dataFile`**

Here are some example output file object identifiers: **`outFile`, `outputFile`, `reportFile`**