CSS 142 C

Lecture 9

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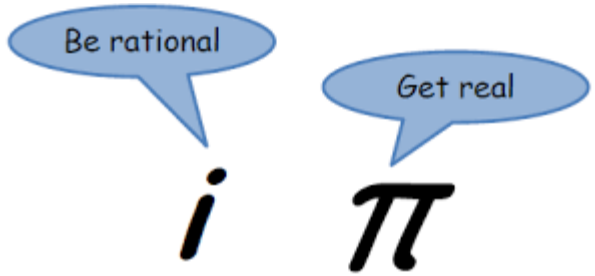
TODAY'S CONTENT



TODAY'S CONTENT

1. **Results | Solutions | Feedback**
   - **Midterm**
   - **Ethics Essay**
   - **General comments on coding style**
2. **Debugging Loops**
3. **File I/O**

NEXT:

- **HW4: due end of Thur**
- **Reading 4.1 Classes**

java.io

Software Engineering Ethics

Read Parts 1–5 in the file *An Introduction to Software Engineering Ethics,* by Shannon Vallor and Arvind Narayanan (**Students.pdf** file).

Answer all the questions in these sections.

Type in your answers in a separate file; do not write it in Students.pdf. Write it in Word or similar. Clearly label your answers with the exercise and/or question numbers; I cannot give credit if I do not know what your answer applies to.

When you are done with your responses, save and upload the file that contains your responses to Canvas. Please **name your <yourLast-FirstName-Ethics1.docx (**or .pdf)

You will be graded on the effort and thoughtfulness you put into your answers.

EXAM:
review solutions

+ see last week document

Need to Traverse A String?

```
for(int r = 0; r < string.length(); r++)
{
        System.out.println( string.charAt(r));
}
```

Or, backwards…

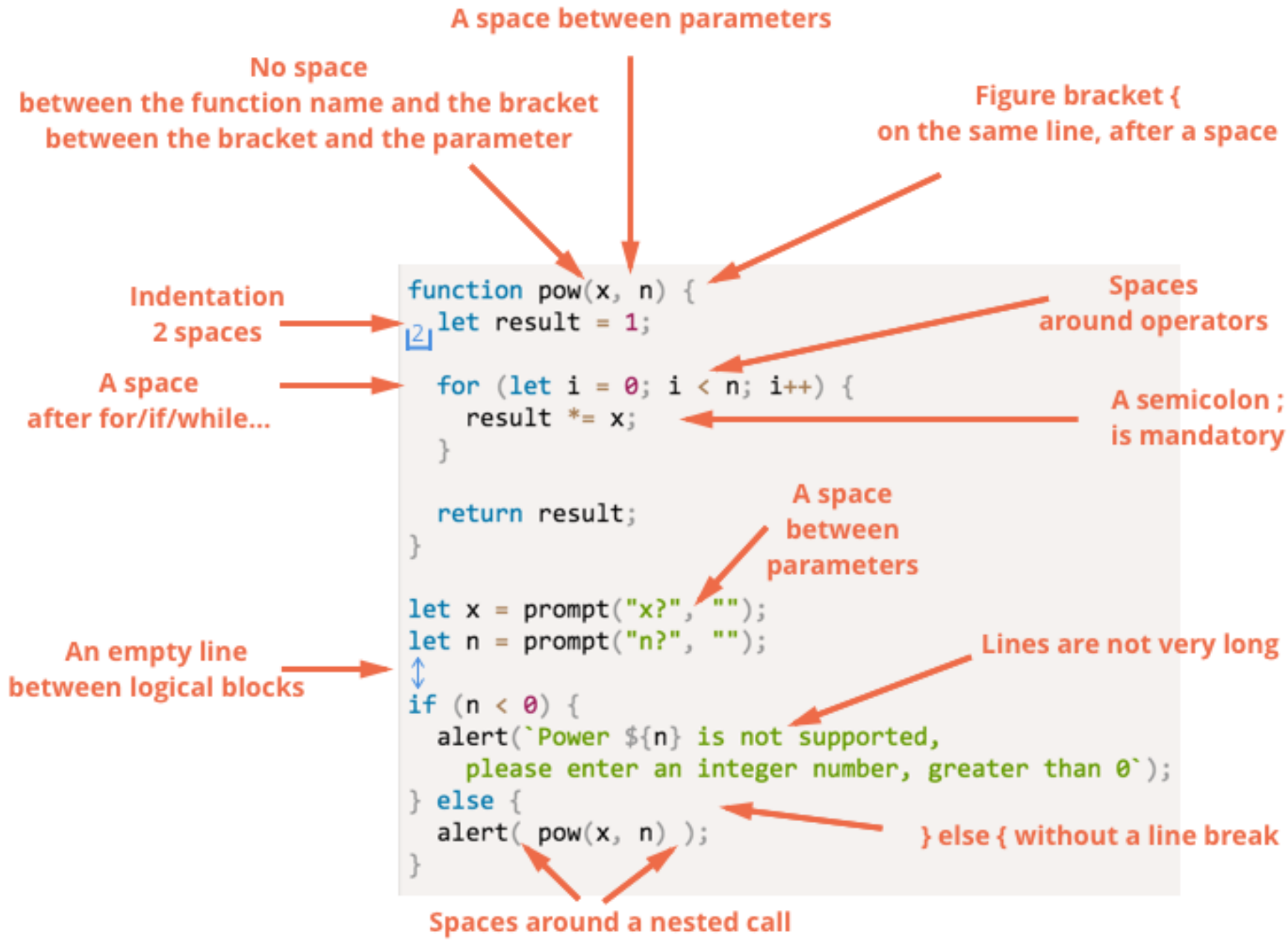
```
for(int r = string.length() – 1; r>=0; r--)
{
        System.out.println( string.charAt(r));
}
```

A Running Sum

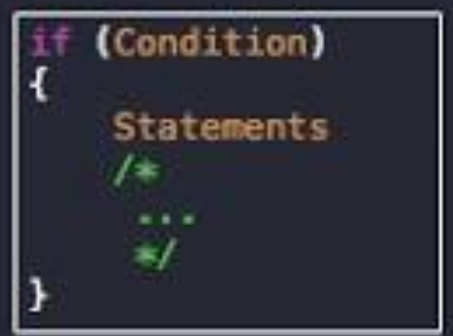
```
for( int j=0; j <=20; j++ )
{
      sum += j;   //same as sum = sum + j
}

for( int k =0; k <=30; k++ )
{
      if( k % 2 == 0 ) {
            sum = sum + k;
      }
}
```

Coding Style


A space between parameters
No space
between the function name and the bracket
between the bracket and the parameter
Figure bracket {
on the same line, after a space
Indentation
2 spaces
Spaces
around operators
A space
after for/if/while...
A semicolon ;
is mandatory
A space
between
parameters
An empty line
between logical blocks
Lines are not very long
} else { without a line break
Spaces around a nested call
function pow(x, n) {
let result = 1;
for (let i = 0; i < n; i++) {
result *= x;
}
return result;
}
let x = prompt("x?", "");
let n = prompt("n?", "");
if (n < 0) {
alert(`Power ${n} is not supported,
please enter an integer number, greater than 0`);
} else {
alert(pow(x, n));
}

There are two types of people.



Programmers will know.

```
public void RefreshCatalog()
{
    if (IsCacheValid)
    {
        ResetFilterToDefaults();
    }
    else
    {
        RepopulateCatalogFromService();
    }
}
```

```
public void RefreshCatalog() {
    if (IsCacheValid) {
        ResetFilterToDefaults();
    }
    else {
        RepopulateCatalogFromService();
    }
}
```

```
public void RefreshCatalog()
{
    if (IsCacheValid) {
        ResetFilterToDefaults();
    }
    else {
        RepopulateCatalogFromService();
    }
}
```

Brace placement	Styles

`while (x == y) {`
`  something();`
`  somethingelse();`
`}`
	K&R and variants:
	1TBS, Stroustrup, Linux kernel, BSD KNF

`while (x == y)`
`{`
`  something();`
`  somethingelse();`
`}`
	Allman

`while (x == y)`
`  {`
`  something ();`
`  somethingelse ();`
`  }`
	GNU

`while (x == y)`
`  {`
`  something();`
`  somethingelse();`
`  }`
	Whitesmiths

Four Key Styles

Four More….

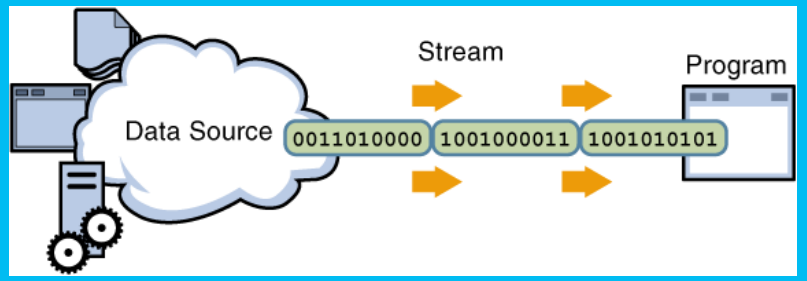
`while (x == y)`
`{  something();`
`  somethingelse();`
`}`
	Horstmann

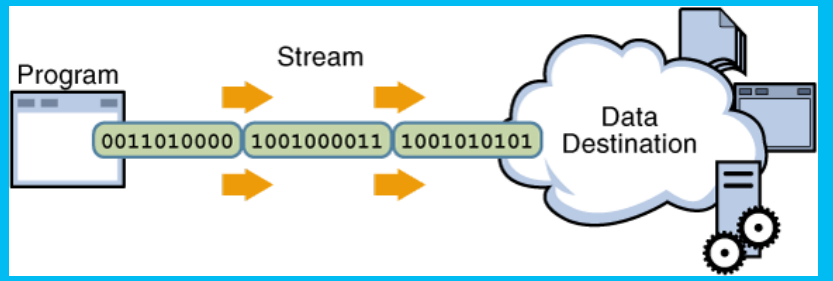
`while (x == y)`
`{  something();`
`  somethingelse(); }`
	Pico

`while (x == y) {`
`  something();`
`  somethingelse();`
`  }`
	Ratliff

`while (x == y) {`
`  something();`
`  somethingelse(); }`
	Lisp

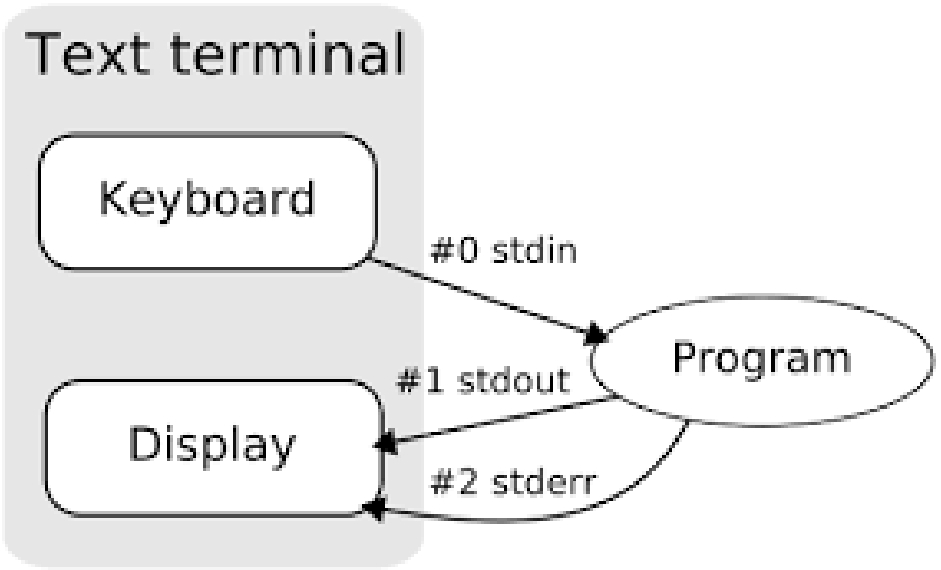
FILE I/O





Some slides and examples are from Absolute Java 6E:

So far: console I/O



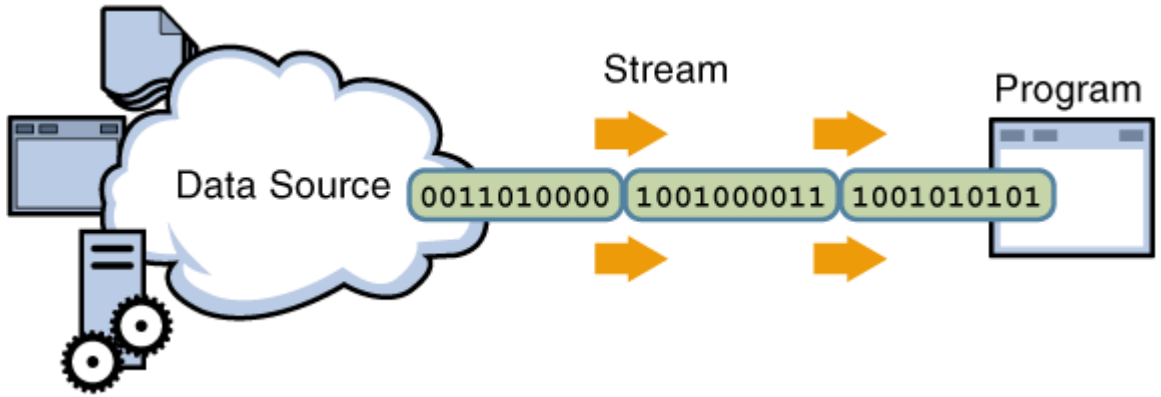
What's missing?

What's file?

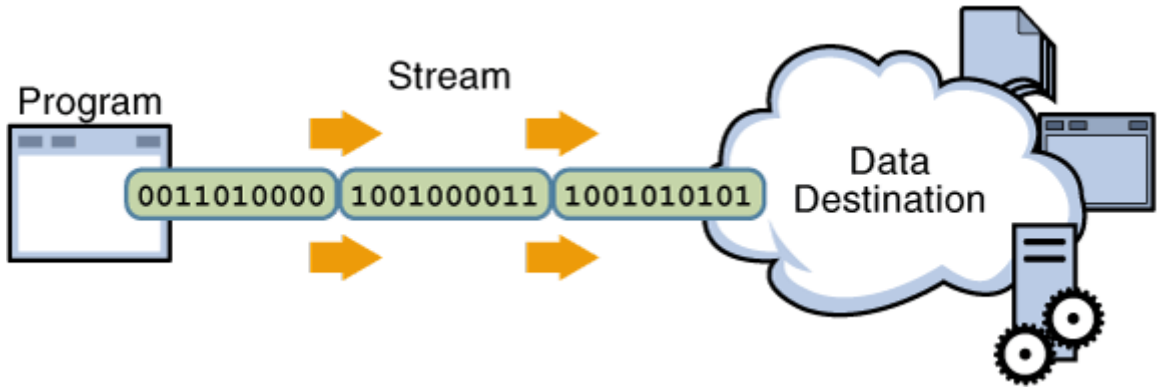
System.in

System.out

File I/O



Input stream



Output stream

Text Files vs Binary Files I/O

Which are text files?

This PC › Documents › AR-AA UWB › 00-CSSSKL161C-Aut2015 › Lab2

Search Lab2

- Lab1
- Lab2
- Lab3
- Lab4
- Lab5
- Lab6
- Lab7
- Lab8
- Lab9
- Lab10
- Syllabus
- Labs.zip

7 items

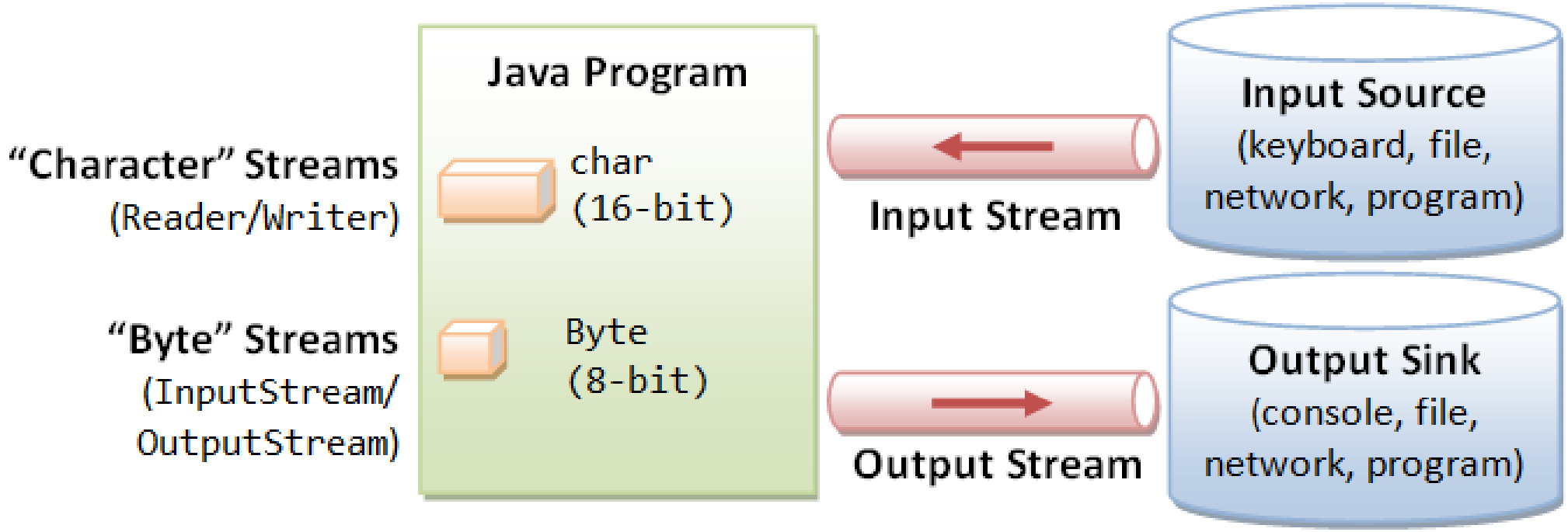
Name	Date modified	Type	Size
StudentSubmissions	10/22/2015 11:48 ...	File folder	
lab02.pdf	9/28/2015 7:02 PM	Adobe Acrobat D...	137 KB
Lab2 correctionsCommentByStudent.txt	10/22/2015 11:42 ...	Text Document	1 KB
Lab2a.java	10/8/2015 9:17 PM	JAVA File	3 KB
Lab2b.java	10/8/2015 9:18 PM	JAVA File	1 KB
Ricky-Lab2a-1.java	10/13/2015 5:04 PM	JAVA File	4 KB
Ricky-Lab2b-1.java	10/13/2015 5:05 PM	JAVA File	2 KB

Examples of binary files

DEMO: Path and Notepad ++

File Stream

TMI



Internal Data Formats:

- Text (char): UCS-2
- int, float, double, etc.

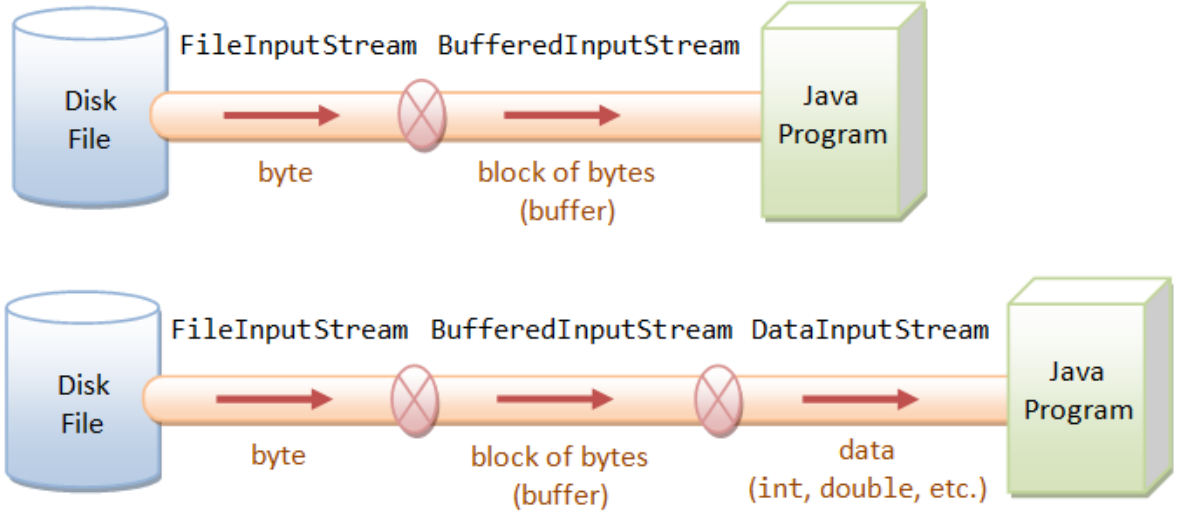
External Data Formats:

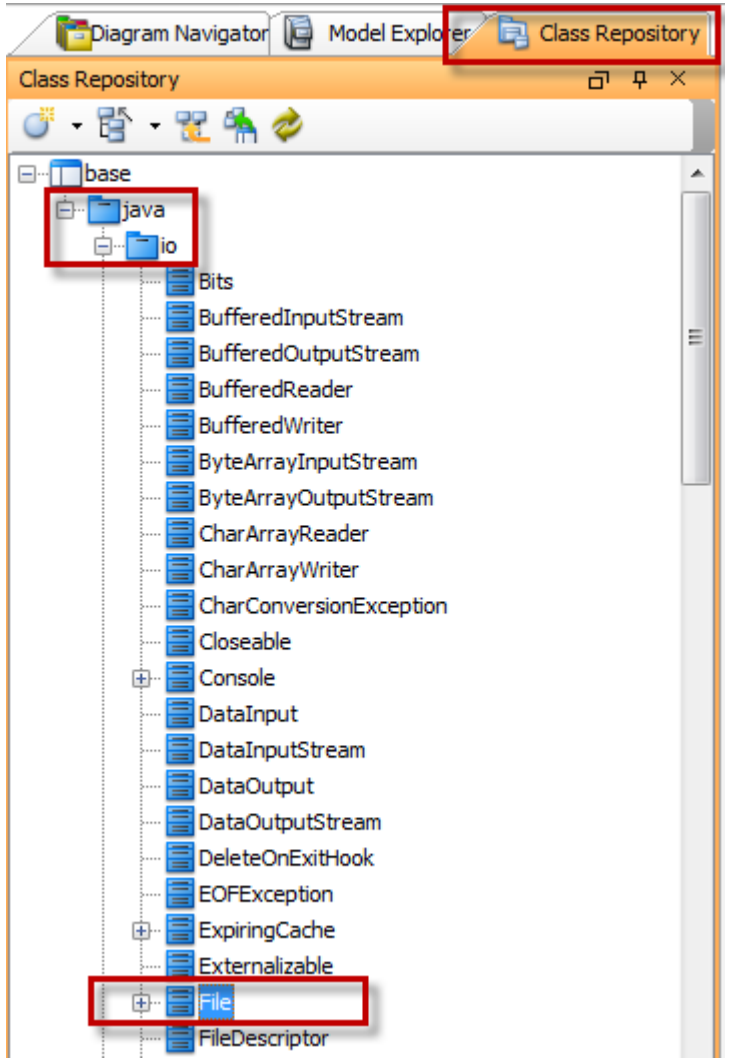
- Text in various encodings (US-ASCII, ISO-8859-1, UCS-2, UTF-8, UTF-16, UTF-16BE, UTF16-LE, etc.)
- Binary (raw bytes)

The File Class

TMI

Binary Files





Text Files and Binary Files

- Files that are designed to be read by human beings, and that can be read or written with an editor are called ***text files***
  - Text files can also be called **ASCII files** because the data they contain uses an ASCII encoding scheme
  - An advantage of text files is that the are usually the same on all computers, so that they can move from one computer to another

Text Files and Binary Files

- Files that are designed to be read by programs and that consist of a sequence of binary digits are called ***binary files (****or 'binaries'****)***
  - Binary files are designed to be read on the same type of computer and with the same programming language as the computer that created the file
  - An advantage of binary files is that they are *more efficient to process* than text files
  - Unlike most binary files, Java binary files have the advantage of being platform independent also

Writing to a Text File

- The class **`PrintWriter`** is a stream class that can be used to write to a text file
  - An object of the class **`PrintWriter`** has the methods **`print`** and **`println`**
  - These are similar to the **`System.out`** methods of the same names, but are used for text file output, not screen output

Writing to a Text File

- All the file I/O classes that follow are in the package **`java.io`**, so a program that uses **`PrintWriter`** will start with a set of **`import`** statements:

```
import java.io.PrintWriter;

import java.io.FileOutputStream;

import java.io.FileNotFoundException;
```

- The class **`PrintWriter`** has no constructor that takes a file name as its argument
  - It uses another class, **`FileOutputStream`**, to convert a file name to an object that can be used as the argument to its (the **`PrintWriter`**) constructor

Writing to a Text File

- A stream of the class **`PrintWriter`** is created and connected to a text file for writing as follows:

```
PrintWriter outputStreamName;

outputStreamName = new PrintWriter(new FileOutputStream(FileName));
```

  - The class **`FileOutputStream`** takes a string representing the file name as its argument
  - The class **`PrintWriter`** takes the anonymous **`FileOutputStream`** object as its argument

Writing to a Text File

- This produces an object of the class **`PrintWriter`** that is connected to the file ***`FileName`***
  - The process of connecting a stream to a file is called *opening the file*
  - If the file already exists, then doing this causes the old contents to be lost
  - If the file does not exist, then a new, empty file named ***`FileName`*** is created
- After doing this, the methods **`print`** and **`println`** can be used to write to the file

Writing to a Text File

- When a text file is opened in this way, a `FileNotFoundException` can be thrown
  - In this context it actually means that the file could not be created
  - This type of exception can also be thrown when a program attempts to open a file for reading and there is no such file
- It is therefore necessary to enclose this code in exception handling blocks
  - The file should be opened inside a `try` block
  - A `catch` block should catch and handle the possible exception
  - The variable that refers to the `PrintWriter` object should be declared outside the block (and initialized to `null`) so that it is not local to the block

Writing to a Text File

- When a program is finished writing to a file, it should always close the stream connected to that file

```
outputStreamName.close();
```

  - This allows the system to release any resources used to connect the stream to the file
  - If the program does not close the file before the program ends, Java will close it automatically, but it is safest to close it explicitly

Writing to a Text File

- Output streams connected to files are usually ***buffered***
  - Rather than physically writing to the file as soon as possible, the data is saved in a temporary location (***buffer***)
  - When enough data accumulates, or when the method `flush` is invoked, the buffered data is written to the file all at once
  - This is more efficient, since physical writes to a file can be slow

Writing to a Text File

- The method `close` invokes the method `flush`, thus insuring that all the data is written to the file
  - If a program relies on Java to close the file, and the program terminates abnormally, then **any output that was buffered may not get written to the file**
  - Also, if a program writes to a file and later reopens it to read from the same file, it will have to be closed first anyway
  - The sooner a file is closed after writing to it, the less likely it is that there will be a problem

File Names

- The rules for how file names should be formed depend on a given operating system, not Java
  - When a file name is given to a java constructor for a stream, it is just a string, not a Java identifier (e.g., `"fileName.txt"`)
  - Any suffix used, such as `.txt` has no special meaning to a Java program

A File Has Two Names

- Every input file and every output file used by a program has two names:
  - The **real file name** used by the operating system
  - The **name of the stream** that is connected to the file
- The actual file name is used to connect to the stream
- The stream name serves as a temporary name for the file, and is the name that is primarily used within the program

IOException

- When performing file I/O there are many situations in which an exception, such as **`FileNotFoundException`**, may be thrown
- Many of these exception classes are subclasses of the class **`IOException`**
  - The class **`IOException`** is the root class for a variety of exception classes having to do with input and/or output
- These exception classes are all **checked exceptions**
  - Therefore, they must be caught or declared in a throws clause

Unchecked Exceptions

Define | Examples

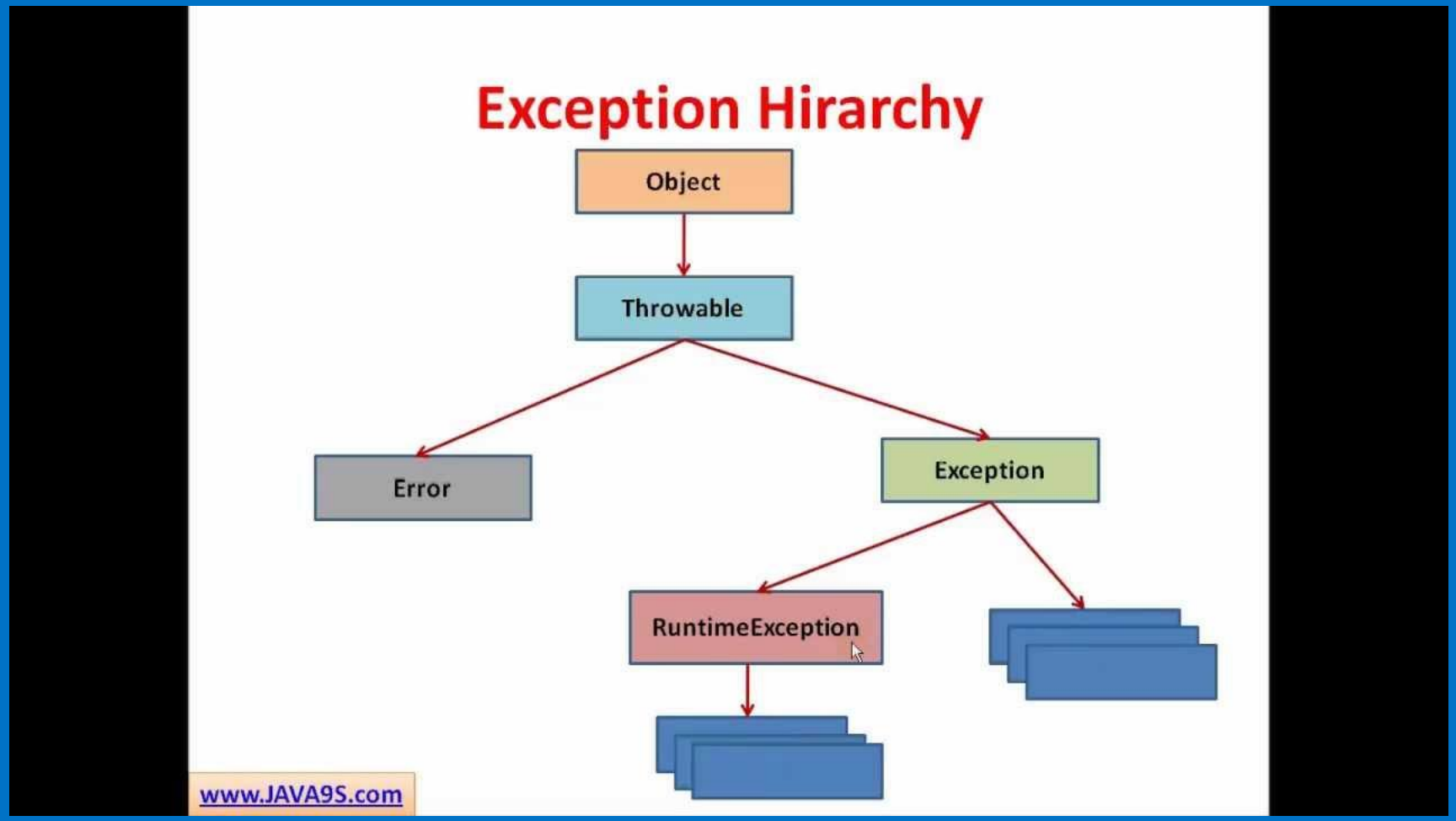
UNCHECKED: represent defects in the program (bugs)

CHECKED: represent invalid conditions in areas outside the immediate control of the program (invalid user input, database problems, network outages, absent files)

Unchecked Exceptions

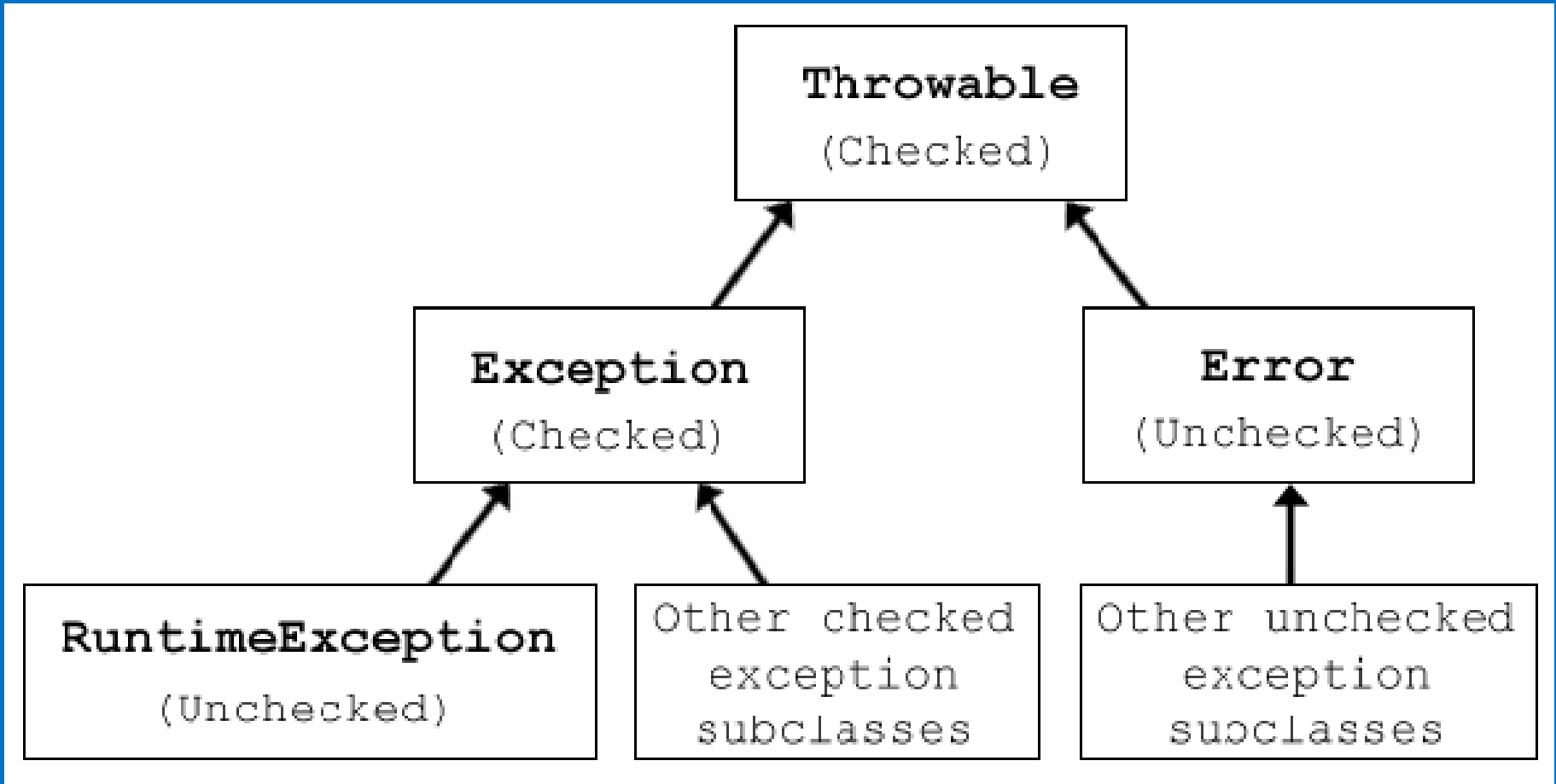
- In contrast, the exception classes **`NoSuchElementException`**, **`InputMismatchException`**, and **`IllegalStateException`** are all unchecked exceptions
  - Unchecked exceptions are not required to be caught or declared in a throws clause

Exception Handling

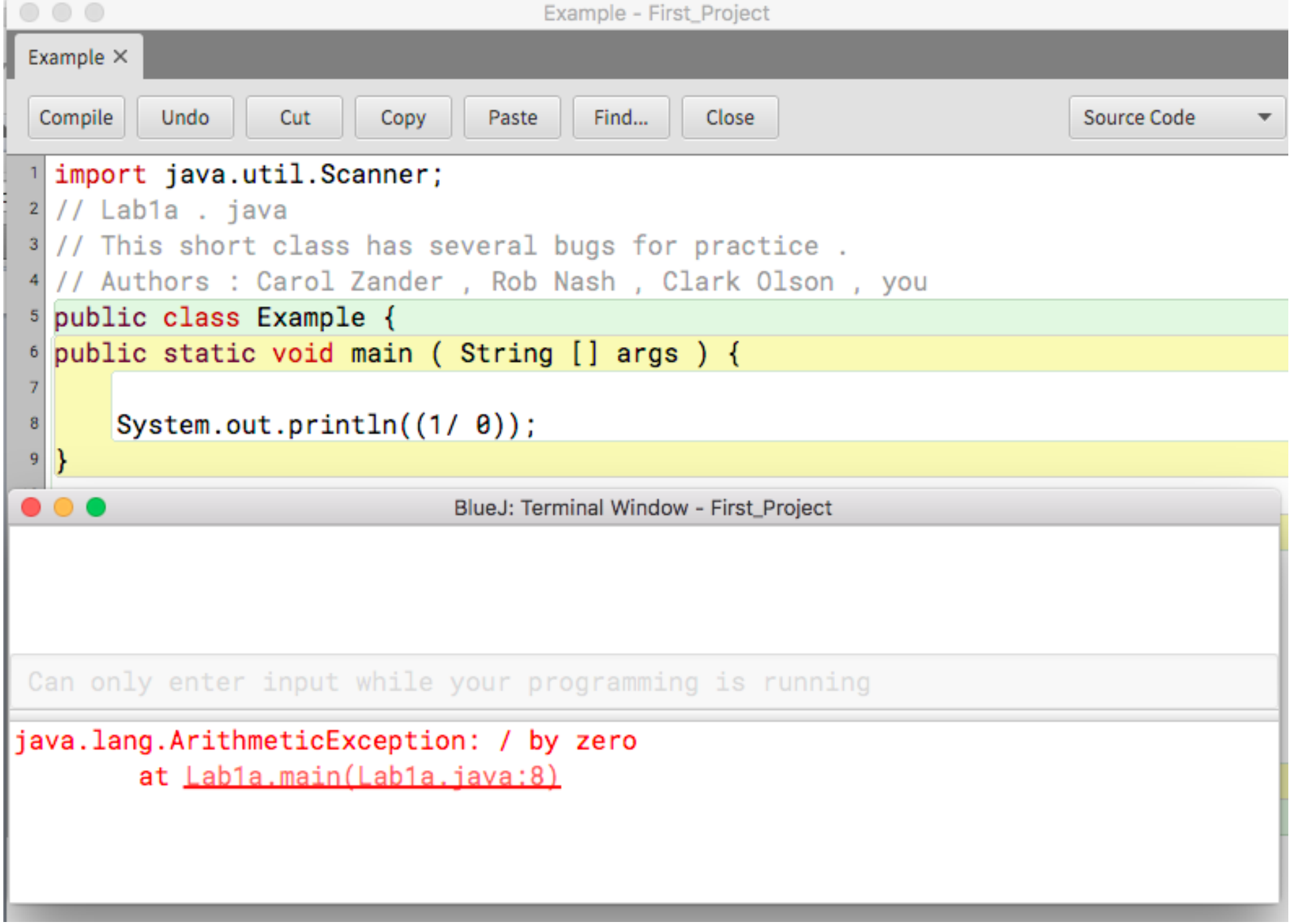


References:
Book citation and example code from Absolute Java by Walter Savitch, Kulsoom Mansoor and others

Exception Handling



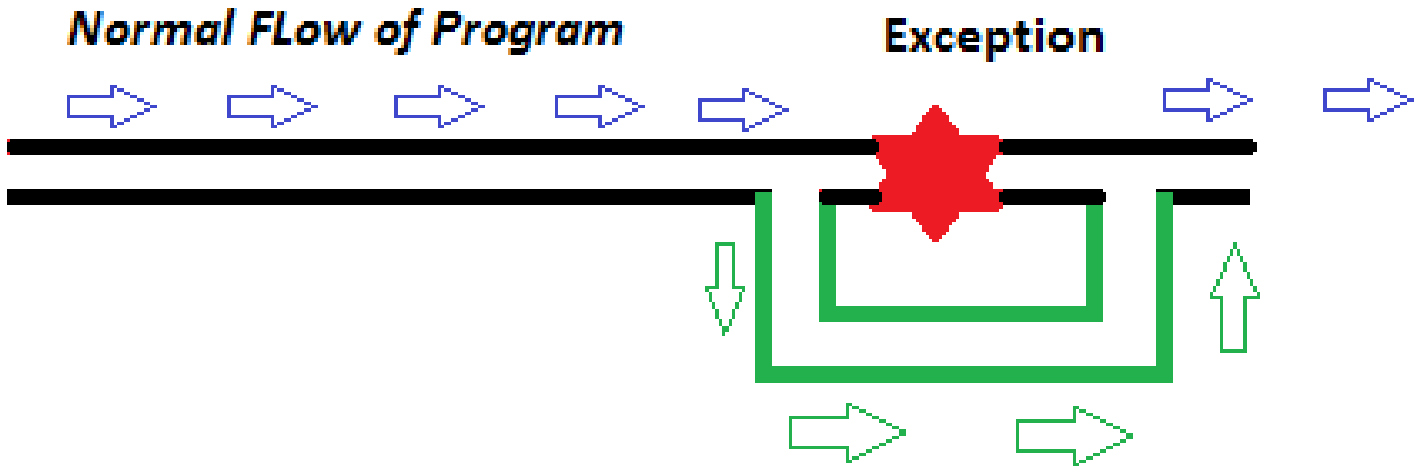
References:
Book citation and example code from Absolute Java by Walter Savitch, Kulsoom Mansoor and others


Example - First_Project
Example
Compile
Undo
Cut
Copy
Paste
Find...
Close
Source Code
1 import java.util.Scanner;
2 // Lab1a . java
3 // This short class has several bugs for practice .
4 // Authors : Carol Zander , Rob Nash , Clark Olson , you
5 public class Example {
6 public static void main (String [] args) {
7
8 System.out.println((1/ 0));
9 }
BlueJ: Terminal Window - First_Project
Can only enter input while your programming is running
java.lang.ArithmeticException: / by zero
at Lab1a.main(Lab1a.java:8)

Exceptions

- Used by Java to let the programmer know that a run-time error has occurred
- Most of the time, we don’t have to deal with exceptions
  - Such as the previous example
- But…
  - Sometime we have to take extra precautions
  - This is called **exception handling**

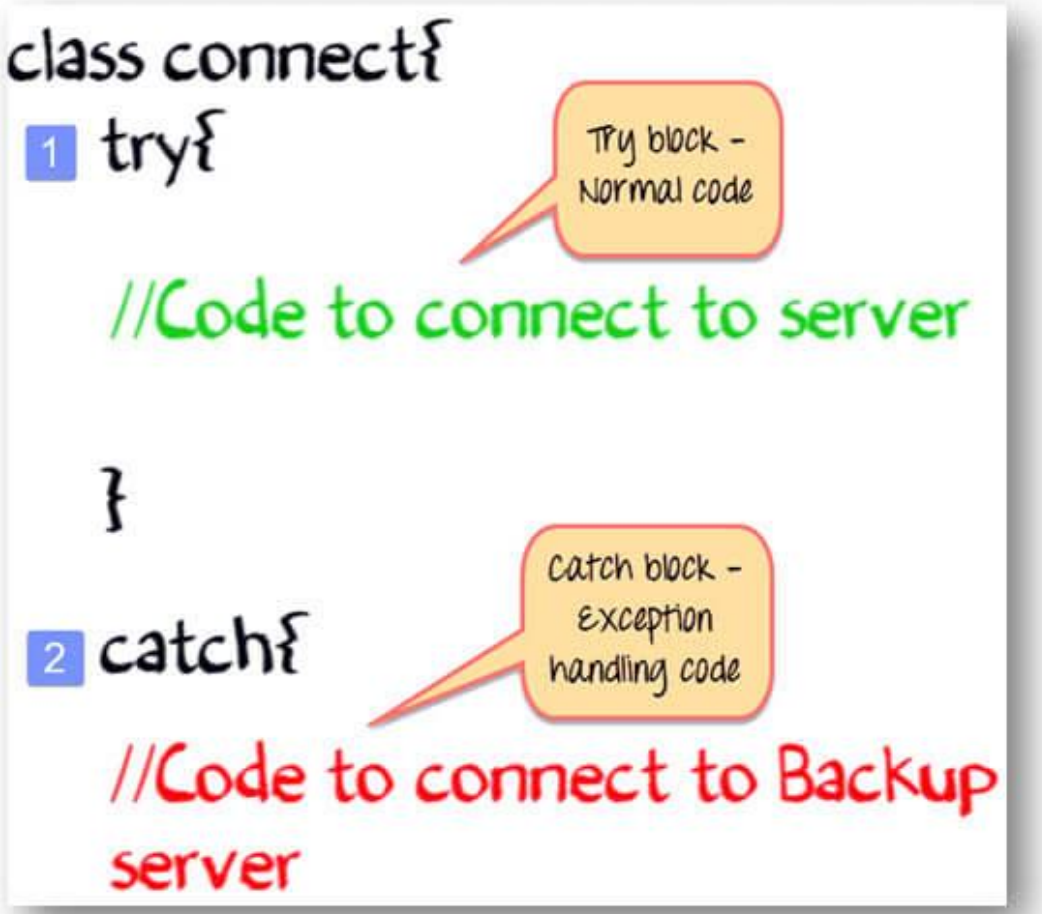
Exceptions



EXCEPTION HANDLING

Alternate way to continue flow of program

Exceptions

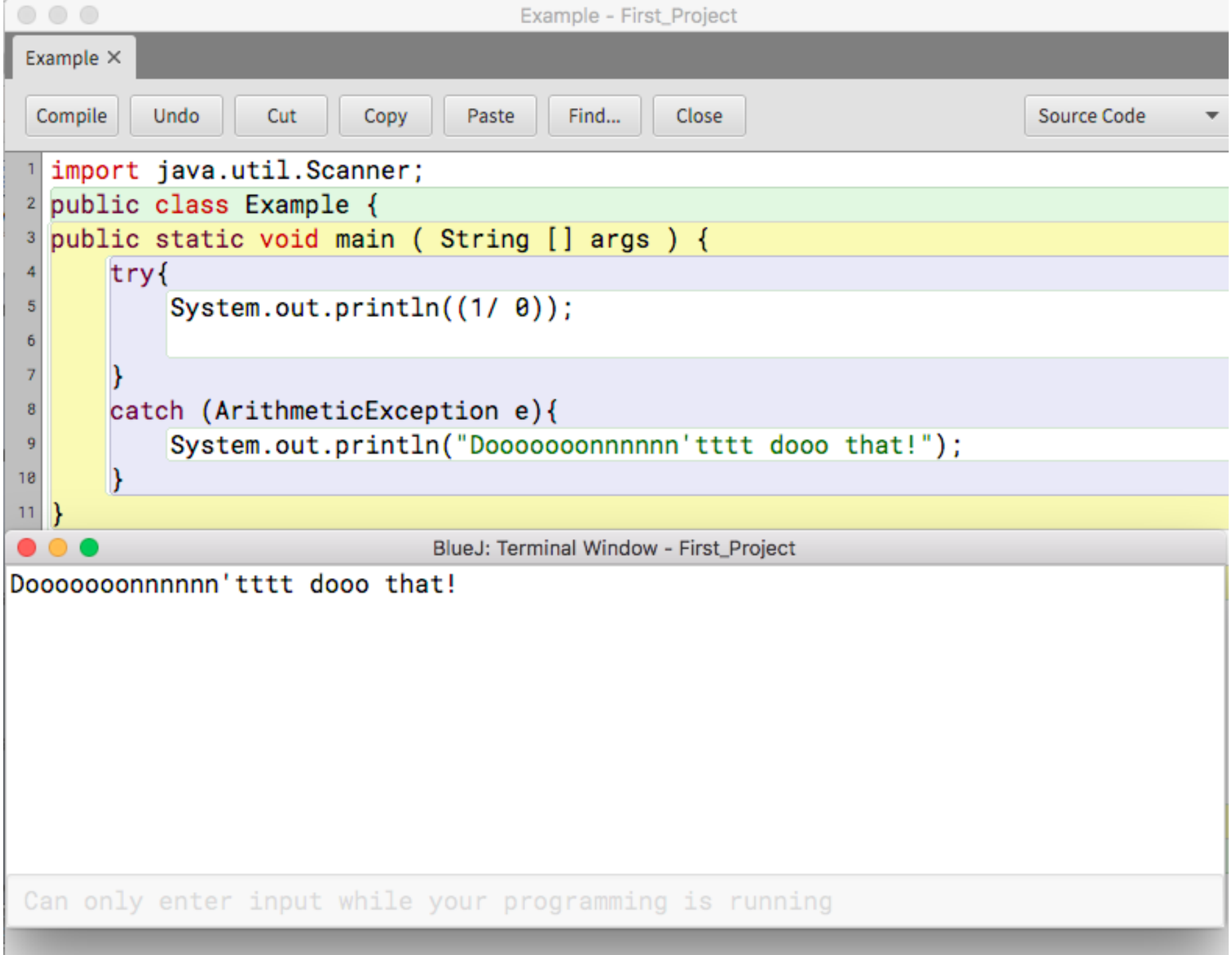

class connect{
1 try{
Try block - Normal code
//Code to connect to server
}
2 catch{
Catch block - Exception handling code
//Code to connect to Backup server

Exception Handling

How do we take extra precautions in case an exception occurs?

- By using a `try-catch` block

```
try{
    //statements that can cause an
    //exception
}
catch(ExceptionClass variableName){
    //statements responding to an
    //exception
}
```


Example - First_Project
Example
Compile
Undo
Cut
Copy
Paste
Find...
Close
Source Code
1 import java.util.Scanner;
2 public class Example {
3 public static void main (String [] args) {
4 try{
5 System.out.println((1/ 0));
6
7 }
8 catch (ArithmeticException e){
9 System.out.println("Doooooooonnnnnn'tttt dooo that!");
10 }
11 }
BlueJ: Terminal Window - First_Project
Doooooooonnnnnn'tttt dooo that!
Can only enter input while your programming is running

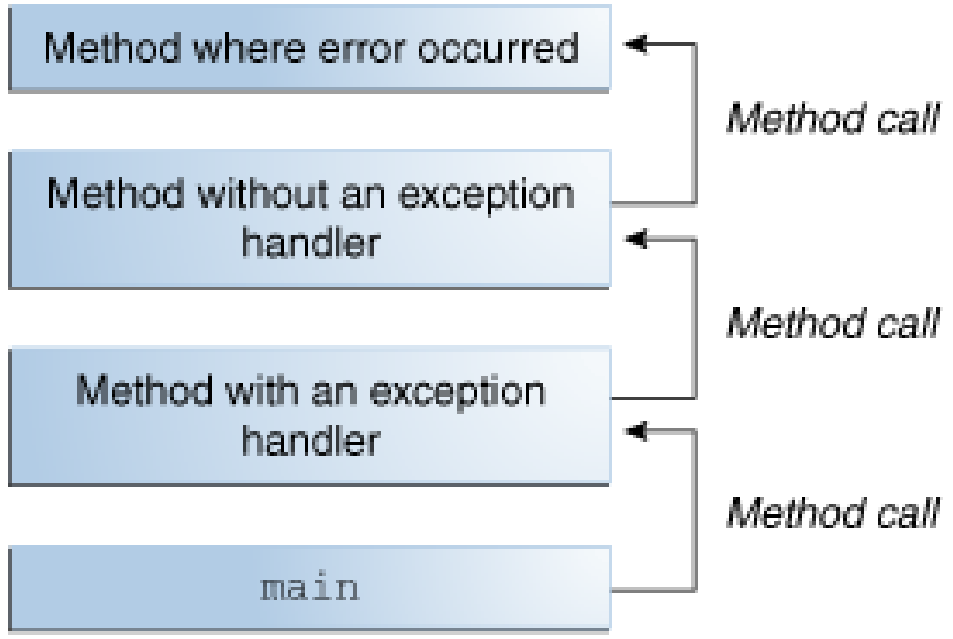
What Is an Exception?

The term *exception* is shorthand for the phrase "exceptional event."

> **Definition:** An ***exception*** is an **event**, which occurs during the execution of a program, that disrupts the normal flow of the program's instructions.

When an error occurs within a method, the **method creates an object and hands it off to the runtime system**. The object, called an ***exception object***, contains information about the error, including its type and the state of the program when the error occurred. Creating an exception object and handing it to the runtime system is called ***throwing an exception*****.**

After a method throws an exception, the runtime system attempts to find something to handle it. The set of possible "somethings" to handle the exception is the ordered list of methods that had been called to get to the method where the error occurred. The list of methods is known as the ***call stack*****.**



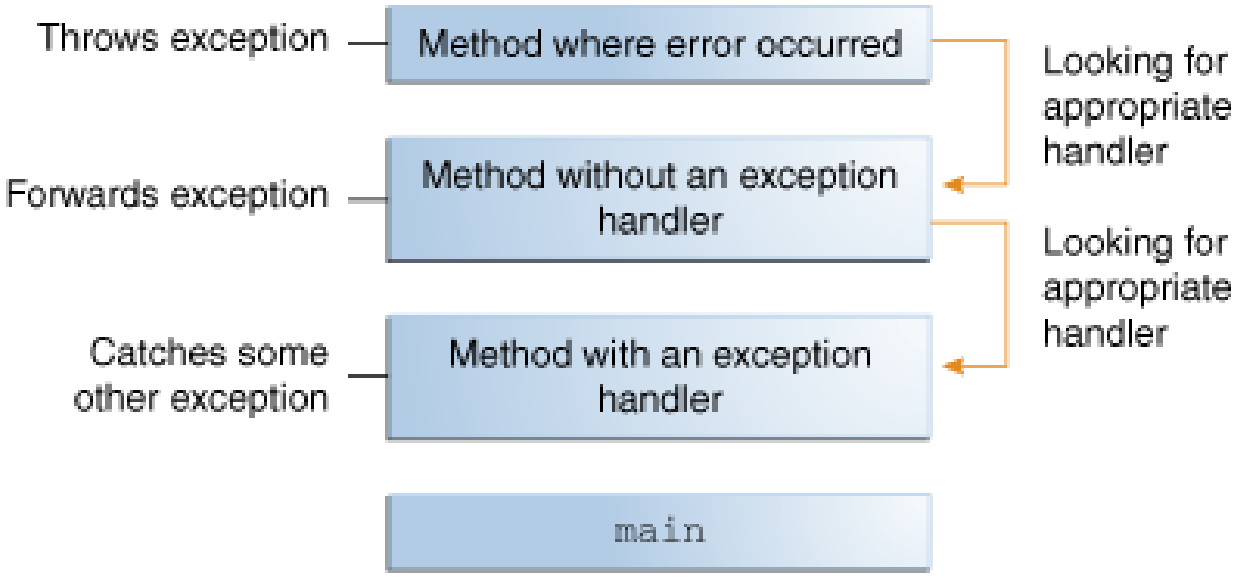
Call Stack

Exception Handling

The runtime system searches the call stack for a method that contains a block of code that can handle the exception. This block of code is called an ***exception handler***.

The search begins with the method in which the error occurred and proceeds through the call stack **in the reverse order** in which the methods were called. When an appropriate handler is found, the runtime system passes the exception to the handler. An exception handler is considered appropriate if the type of the exception object thrown matches the type that can be handled by the handler.

The exception handler chosen is said to ***catch the exception***. If the runtime system exhaustively searches all the methods on the call stack without finding an appropriate exception handler, the runtime system (and, consequently, the program) terminates.



Searching the call stack for the exception handler.

Pitfall: a `try` Block is a Block

- Since opening a file can result in an exception, it should be placed inside a `try` block
- If the variable for a `PrintWriter` object needs to be used outside that block, then the variable must be declared outside the block
  - Otherwise it would be local to the block, and could not be used elsewhere
  - If it were declared in the block and referenced elsewhere, the compiler will generate a message indicating that it is an undefined identifier

Appending to a Text File

- To create a **`PrintWriter`** object and connect it to a text file for *appending*, a second argument, set to **`true`**, must be used in the constructor for the **`FileOutputStream`** object

```
outputStreamName = new PrintWriter(new FileOutputStream(FileName, true));
```

  - After this statement, the methods **`print`**, **`println`** and/or **`printf`** can be used to write to the file
  - The new text will be written *after the old text* in the file

`toString` Helps with Text File Output

- If a class has a suitable `toString()` method, and `anObject` is an object of that class, then `anObject` can be used as an argument to `System.out.println`, and it will produce sensible output
- The same thing applies to the methods `print` and `println` of the class `PrintWriter`

```
outputStreamName.println(anObject);
```

Some Methods of the Class `PrintWriter` (Part 1 of 3)

Display 10.2 Some Methods of the Class `PrintWriter`

`PrintWriter` and `FileOutputStream` are in the `java.io` package.

```
public PrintWriter(OutputStream streamObject)
```

This is the only constructor you are likely to need. There is no constructor that accepts a file name as an argument. If you want to create a stream using a file name, you use

```
new PrintWriter(new FileOutputStream(File_Name))
```

When the constructor is used in this way, a blank file is created. If there already was a file named *File_Name*, then the old contents of the file are lost. If you want instead to append new text to the end of the old file contents, use

```
new PrintWriter(new FileOutputStream(File_Name, true))
```

(For an explanation of the argument `true`, read the subsection "Appending to a Text File.")

When used in either of these ways, the `FileOutputStream` constructor, and so the `PrintWriter` constructor invocation, can throw a `FileNotFoundException`, which is a kind of `IOException`.

If you want to create a stream using an object of the class `File`, you can use a `File` object in place of the *File_Name*. (The `File` class will be covered in Section 10.3. We discuss it here so that you will have a more complete reference in this display, but you can ignore the reference to the class `File` until after you've read that section.)

(continued)

Some Methods of the Class `PrintWriter` (Part 2 of 3)

Display 10.2 Some Methods of the Class `PrintWriter`

`public void println(`*Argument*`)`

The *Argument* can be a string, character, integer, floating-point number, `boolean` value, or any combination of these, connected with + signs. The *Argument* can also be any object, although it will not work as desired unless the object has a properly defined `toString()` method. The *Argument* is output to the file connected to the stream. After the *Argument* has been output, the line ends, and so the next output is sent to the next line.

`public void print(`*Argument*`)`

This is the same as `println`, except that this method does not end the line, so the next output will be on the same line.

(continued)

Some Methods of the Class `PrintWriter` (Part 3 of 3)

Display 10.2 Some Methods of the Class `PrintWriter`

```
public PrintWriter printf(Arguments)
```

This is the same as `System.out.printf`, except that this method sends output to a text file rather than to the screen. It returns the calling object. However, we have always used `printf` as a `void` method.

```
public void close()
```

Closes the stream's connection to a file. This method calls `flush` before closing the file.

```
public void flush()
```

Flushes the output stream. This forces an actual physical write to the file of any data that has been buffered and not yet physically written to the file. Normally, you should not need to invoke `flush`.

Reading From a Text File Using `Scanner`

- The class **`Scanner`** can be used for reading from the keyboard as well as reading from a text file
  - Simply replace the argument **`System.in`** (to the **`Scanner`** constructor) with a suitable stream that is connected to the text file

```
Scanner StreamObject =
    new Scanner(new FileInputStream(FileName));
```

- Methods of the **`Scanner`** class for reading input behave the same whether reading from the keyboard or reading from a text file
  - For example, the **`nextInt`** and **`nextLine`** methods

Reading Input from a Text File Using `Scanner` (Part 1 of 3)

Display 10.3 Reading Input from a Text File Using Scanner

```
1  import java.util.Scanner;
2  import java.io.FileInputStream;
3  import java.io.FileNotFoundException;
4
5  public class TextFileScannerDemo
6  {
7      public static void main(String[] args)
8      {
9          System.out.println("I will read three numbers and a line");
10         System.out.println("of text from the file morestuff.txt.");
11
12         Scanner inputStream = null;
13
14         try
15         {
16             inputStream =
17                new Scanner(new FileInputStream("morestuff.txt"));
18         }
```

(continued)

Reading Input from a Text File Using **`Scanner`** (Part 2 of 3)

Display 10.3 Reading Input from a Text File Using Scanner

```
19          catch(FileNotFoundException e)
20          {
21              System.out.println("File morestuff.txt was not found");
22              System.out.println("or could not be opened.");
23              System.exit(0);
24          }
25              int n1 = inputStream.nextInt( );
26              int n2 = inputStream.nextInt( );
27              int n3 = inputStream.nextInt( );
28
29              inputStream.nextLine(); //To go to the next line
30
31              String line = inputStream.nextLine( );
32
```

(continued)

Reading Input from a Text File Using `Scanner` (Part 3 of 3)

Display 10.3 Reading Input from a Text File Using Scanner

```
33              System.out.println("The three numbers read from the file are:");
34              System.out.println(n1 + ", " + n2 + ", and " +  n3);
35
36              System.out.println("The line read from the file is:");
37              System.out.println(line);
38
39              inputStream.close( );
40          }
41      }
```

File morestuff.txt

```
1 2
3 4
Eat my shorts.
```

This file could have been made with a text editor or by another Java program.

Display 10.3 Reading Input from a Text File Using Scanner

SCREEN OUTPUT

```
I will read three numbers and a line
of text from the file morestuff.txt.
The three numbers read from the file are:
1, 2, and 3
The line read from the file is:
Eat my shorts.
```

Testing for the End of a Text File with `Scanner`

- A program that tries to read beyond the end of a file using methods of the `Scanner` class will cause an exception to be thrown
- However, instead of having to rely on an exception to signal the end of a file, the `Scanner` class provides methods such as `hasNextInt` and `hasNextLine`
  - These methods can also be used to check that the next token to be input is a suitable element of the appropriate type

Checking for the End of a Text File with **`hasNextLine`** (Part 1 of 4)

Display 10.4 Checking for the End of a Text File with `hasNextLine`

```
1   import java.util.Scanner;
2   import java.io.FileInputStream;
3   import java.io.FileNotFoundException;
4   import java.io.PrintWriter;
5   import java.io.FileOutputStream;
6
7   public class HasNextLineDemo
8   {
9       public static void main(String[] args)
10      {
11          Scanner inputStream = null;
12          PrintWriter outputStream = null;
```

(continued)

Checking for the End of a Text File with **`hasNextLine`** (Part 2 of 4)

Display 10.4 Checking for the End of a Text File with `hasNextLine`

```
13          try
14          {
15             inputStream =
16                new Scanner(new FileInputStream("original.txt"));
17             outputStream = new PrintWriter(
18                             new FileOutputStream("numbered.txt"));
19          }
20          catch(FileNotFoundException e)
21          {
22             System.out.println("Problem opening files.");
23             System.exit(0);
24          }

25          String line = null;
26          int count = 0;
```

(continued)

Checking for the End of a Text File with **`hasNextLine`** (Part 3 of 4)

Display 10.4 Checking for the End of a Text File with `hasNextLine`

```
27          while (inputStream.hasNextLine( ))
28          {
29              line = inputStream.nextLine( );
30              count++;
31              outputStream.println(count + " " + line);
32          }

33          inputStream.close( );
34          outputStream.close( );
35      }

36  }
```

(continued)

Checking for the End of a Text File with `hasNextLine` (Part 4 of 4)

Display 10.4 Checking for the End of a Text File with `hasNextLine`

File original.txt

```
Little Miss Muffet
sat on a tuffet
eating her curves away.
Along came a spider
who sat down beside her
and said "Will you marry me?"
```

File numbered.txt (after the program is run)

```
1 Little Miss Muffet
2 sat on a tuffet
3 eating her curves away.
4 Along came a spider
5 who sat down beside her
6 and said "Will you marry me?"
```

Checking for the End of a Text File with **`hasNextInt`** (Part 1 of 2)

Display 10.5 Checking for the End of a Text File with `hasNextInt`

```
1   import java.util.Scanner;
2   import java.io.FileInputStream;
3   import java.io.FileNotFoundException;

4   public class HasNextIntDemo
5   {
6       public static void main(String[] args)
7       {
8           Scanner inputStream = null;

9           try
10          {
11             inputStream =
12                new Scanner(new FileInputStream("data.txt"));
13          }
14          catch(FileNotFoundException e)
15          {
16             System.out.println("File data.txt was not found");
17             System.out.println("or could not be opened.");
18             System.exit(0);
19          }
```

(continued)

Checking for the End of a Text File with `hasNextInt` (Part 2 of 2)

Display 10.5 Checking for the End of a Text File with `hasNextInt`

```
20          int next, sum = 0;
21          while (inputStream.hasNextInt( ))
22          {
23              next = inputStream.nextInt( );
24              sum = sum + next;
25          }

26          inputStream.close( );

27          System.out.println("The sum of the numbers is " + sum);
28      }
29  }
```

File data.txt

```
1  2
3  4 hi 5
```

Reading ends when either the end of the file is reach or a token that is not an `int` is reached. So, the 5 is never read.

SCREEN OUTPUT

```
The sum of the numbers is 10
```

Methods in the Class **`Scanner`** (Part 1 of 11)

Display 10.6 Methods in the Class Scanner

`Scanner` is in the `java.util` package.

```
public Scanner(InputStream streamObject)
```

There is no constructor that accepts a file name as an argument. If you want to create a stream using a file name, you can use

```
new Scanner(new FileInputStream(File_Name))
```

When used in this way, the `FileInputStream` constructor, and thus the `Scanner` constructor invocation, can throw a `FileNotFoundException`, which is a kind of `IOException`.
To create a stream connected to the keyboard, use

```
new Scanner(System.in)
```

(continued)

Methods in the Class `Scanner` (Part 2 of 11)

Display 10.6 Methods in the Class Scanner

```
public Scanner(File fileObject)
```

The `File` class will be covered in the section entitled "The `File` Class," later in this chapter. We discuss it here so that you will have a more complete reference in this display, but you can ignore this entry until after you've read that section.
If you want to create a stream using a file name, you can use

```
new Scanner(new File(File_Name))
```

```
public int nextInt()
```

Returns the next token as an `int`, provided the next token is a well-formed string representation of an `int`.

Throws a `NoSuchElementException` if there are no more tokens.

Throws an `InputMismatchException` if the next token is not a well-formed string representation of an `int`.

Throws an `IllegalStateException` if the `Scanner` stream is closed.

(continued)

Methods in the Class `Scanner` (Part 3 of 11)

Display 10.6 Methods in the Class Scanner

```
public boolean hasNextInt()
```

Returns `true` if the next token is a well-formed string representation of an `int`; otherwise returns `false`.

Throws an `IllegalStateException` if the `Scanner` stream is closed.

```
public long nextLong()
```

Returns the next token as a `long`, provided the next token is a well-formed string representation of a `long`.

Throws a `NoSuchElementException` if there are no more tokens.

Throws an `InputMismatchException` if the next token is not a well-formed string representation of a `long`.

Throws an `IllegalStateException` if the `Scanner` stream is closed.

(continued)

Methods in the Class `Scanner` (Part 4 of 11)

Display 10.6 Methods in the Class Scanner

```
public boolean hasNextLong()
```

Returns `true` if the next token is a well-formed string representation of a `long`; otherwise returns `false`.

Throws an `IllegalStateException` if the `Scanner` stream is closed.

```
public byte nextByte()
```

Returns the next token as a `byte`, provided the next token is a well-formed string representation of a `byte`.

Throws a `NoSuchElementException` if there are no more tokens.

Throws an `InputMismatchException` if the next token is not a well-formed string representation of a `byte`.

Throws an `IllegalStateException` if the `Scanner` stream is closed.

(continued)

Methods in the Class `Scanner` (Part 5 of 11)

Display 10.6 Methods in the Class Scanner

```
public boolean hasNextByte()
```

Returns `true` if the next token is a well-formed string representation of a `byte`; otherwise returns `false`.

Throws an `IllegalStateException` if the `Scanner` stream is closed.

```
public short nextShort()
```

Returns the next token as a `short`, provided the next token is a well-formed string representation of a `short`.

Throws a `NoSuchElementException` if there are no more tokens.

Throws an `InputMismatchException` if the next token is not a well-formed string representation of a `short`.

Throws an `IllegalStateException` if the `Scanner` stream is closed.

(continued)

Methods in the Class **`Scanner`** (Part 6 of 11)

Display 10.6 Methods in the Class Scanner

```
public boolean hasNextShort()
```

Returns `true` if the next token is a well-formed string representation of a `short`; otherwise returns `false`.

Throws an `IllegalStateException` if the `Scanner` stream is closed.

```
public double nextDouble()
```

Returns the next token as a `double`, provided the next token is a well-formed string representation of a `double`.

Throws a `NoSuchElementException` if there are no more tokens.

Throws an `InputMismatchException` if the next token is not a well-formed string representation of a `double`.

Throws an `IllegalStateException` if the `Scanner` stream is closed.

(continued)

Methods in the Class `Scanner` (Part 7 of 11)

Display 10.6 Methods in the Class Scanner

```
public boolean hasNextDouble()
```

Returns `true` if the next token is a well-formed string representation of an `double`; otherwise returns `false`.

Throws an `IllegalStateException` if the `Scanner` stream is closed.

```
public float nextFloat()
```

Returns the next token as a `float`, provided the next token is a well-formed string representation of a `float`.

Throws a `NoSuchElementException` if there are no more tokens.

Throws an `InputMismatchException` if the next token is not a well-formed string representation of a `float`.

Throws an `IllegalStateException` if the `Scanner` stream is closed.

(continued)

Methods in the Class `Scanner` (Part 8 of 11)

Display 10.6 Methods in the Class Scanner

```
public boolean hasNextFloat()
```

Returns `true` if the next token is a well-formed string representation of an `float`; otherwise returns `false`.

Throws an `IllegalStateException` if the `Scanner` stream is closed.

```
public String next()
```

Returns the `next` token.

Throws a `NoSuchElementException` if there are no more tokens.

Throws an `IllegalStateException` if the `Scanner` stream is closed.

(continued)

Methods in the Class `Scanner` (Part 9 of 11)

Display 10.6 Methods in the Class Scanner

```
public boolean hasNext()
```

Returns `true` if there is another token. May wait for a next token to enter the stream.

Throws an `IllegalStateException` if the `Scanner` stream is closed.

```
public boolean nextBoolean()
```

Returns the next token as a `boolean` value, provided the next token is a well-formed string representation of a `boolean`.

Throws a `NoSuchElementException` if there are no more tokens.

Throws an `InputMismatchException` if the next token is not a well-formed string representation of a `boolean` value.

Throws an `IllegalStateException` if the `Scanner` stream is closed.

(continued)

Methods in the Class `Scanner` (Part 10 of 11)

Display 10.6 Methods in the Class Scanner

```
public boolean hasNextBoolean()
```

Returns `true` if the next token is a well-formed string representation of a `boolean` value; otherwise returns `false`.

Throws an `IllegalStateException` if the `Scanner` stream is closed.

```
public String nextLine()
```

Returns the rest of the current input line. Note that the line terminator `'\n'` is read and discarded; it is not included in the string returned.

Throws a `NoSuchElementException` if there are no more lines.

Throws an `IllegalStateException` if the `Scanner` stream is closed.

(continued)

Methods in the Class **Scanner** (Part 11 of 11)

Display 10.6 Methods in the Class Scanner

```
public boolean hasNextLine()
```

Returns `true` if there is a next line. May wait for a next line to enter the stream.

Throws an `IllegalStateException` if the `Scanner` stream is closed.

```
public Scanner useDelimiter(String newDelimiter);
```

Changes the delimiter for input so that `newDelimiter` will be the only delimiter that separates words or numbers. See the subsection "Other Input Delimiters" in Chapter 2 for the details. (You can use this method to set the delimiters to a more complex pattern than just a single string, but we are not covering that.)

Returns the calling object, but we have always used it as a `void` method.

Preview: next Lecture

Path Names

- When a file name is used as an argument for opening a file, it is assumed that the file is in the same directory or folder as the one in which the program is run
- If it is not in the same directory, the **full** or **relative path name** must be given

Path Names

demo

- A *path name* not only gives the name of the file, but also the directory or folder in which the file exists
- A ***full path name*** gives a complete path name, starting from the **root** directory
- A ***relative path name*** gives the path to the file, starting with the directory in which the program is located

Path Names

- The way path names are specified depends on the operating system
  - A typical **Unix path** name that could be used as a file name argument is

```
"/user/sallyz/data/data.txt"
```

  - A `BufferedReader` input stream connected to this file is created as follows:

```
BufferedReader inputStream =
  new BufferedReader(new
  FileReader("/user/sallyz/data/data.txt"));
```

What the difference b/w Unix (aka UNIX) and Linux?

Path Names

- The Windows operating system specifies path names in a different way
  - A typical **Windows path** name is the following:

```
C:\dataFiles\goodData\data.txt
```

  - A `BufferedReader` input stream connected to this file is created as follows:

```
BufferedReader inputStream = new
  BufferedReader(new FileReader ("C:\\dataFiles\\goodData\\data.txt"));
```

  - Note that in Windows `\\` must be used in place of `\`, since a single backslash denotes an the beginning of an escape sequence

Why \\ and not \

Path Names

- A double backslash (\\) must be used for a Windows path name enclosed in a quoted string
  - **This problem does not occur with path names read in from the keyboard**
- Problems with escape characters can be avoided altogether by always using Unix conventions when writing a path name
  - **A Java program will accept a path name written in either Windows or Unix format regardless of the operating system on which it is run**

`System.in`, `System.out`, and `System.err`

- Using these methods, any of the three standard streams can be **redirected**
  - For example, instead of appearing on the screen, error messages could be redirected to a file
- In order to redirect a standard stream, a new stream object is created

  - Like other streams created in a program, a stream object used for **redirection must be closed** after I/O is finished
  - Note, **standard streams do not need to be closed**

`System.in`, `System.out`, and `System.err`

- Redirecting **`System.err`**:

```
public void getInput()
{
   . . .
   PrintStream errStream = null;
   try
   {
     errStream = new PrintStream(new FileOuptputStream("errMessages.txt"));
     System.setErr(errStream);
     . . . //Set up input stream and read
   }
```

System.in, System.out, and System.err

```
  catch(FileNotFoundException e)
  {
    System.err.println("Input file not found");
  }
  finally
  {
    . . .
    errStream.close();
  }
}
```

Hands-on: Class Activity (HoA)