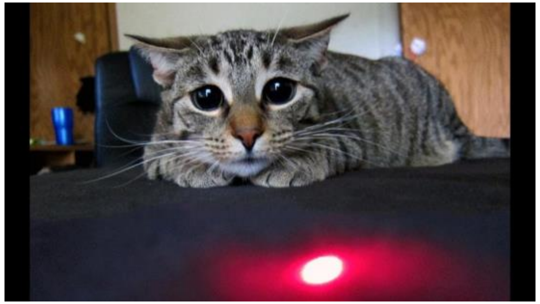
I’m trying to teach my cat Java programming

But he keeps complaining about a “NullLaserPointerException”



Module 1-16

Exceptions
File Input

Objectives

- Describe the concept of exception handling
- Implement a try/catch structure in a program
- Understand the java.io library File and Directory classes
- Explain what a character stream is
- Use a try-with-resources block
- Handle File I/O exceptions and how to recover from them
- Know how File I/O might be used on a job

Exceptions

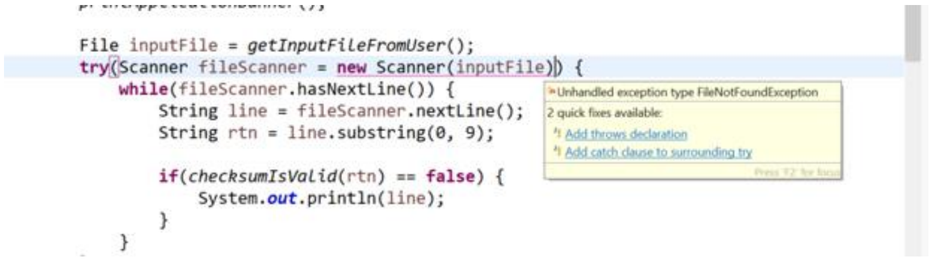
What are Exceptions?

Exceptions are occurrences that alter the flow of the program away from the ideal or “happy” path.

- *Sometimes it’s the developer’s fault*: i.e. accessing an array element greater than the actual number of elements present.
- *Other times it’s not*: i.e. loss of internet connection, a data file that was supposed to be there has been removed by a systems admin.

Checked vs. Unchecked Exceptions

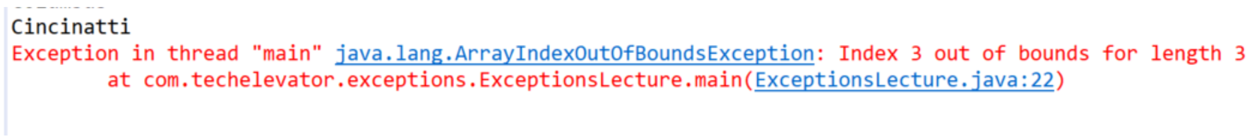
- Checked are compile-time exceptions
    - If code in a method throws a checked exception, method must handle it
        - Handle in method or pass up to parent



```
File inputFile = getInputFileFromUser();
try(Scanner fileScanner = new Scanner(inputFile)) {
    while(fileScanner.hasNextLine()) {
        String line = fileScanner.nextLine();
        String rtn = line.substring(0, 9);

        if(checksumIsValid(rtn) == false) {
            System.out.println(line);
        }
    }
```

```
Unhandled exception type FileNotFoundException
2 quick fixes available:
 Add throws declaration
 Add catch clause to surrounding try
                                        Press 'F2' for focus
```

- Unchecked are run-time exceptions
    - User or code does something that causes program to stop running



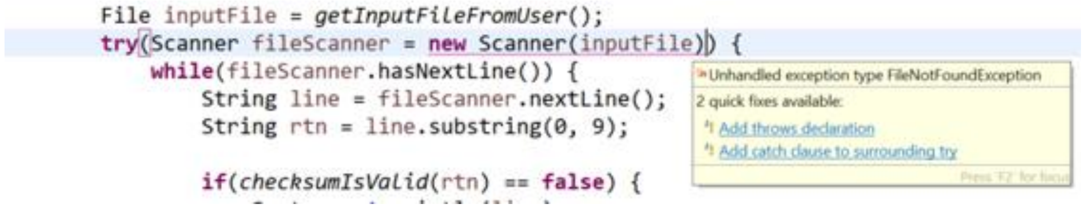
```
Cincinatti
Exception in thread "main" java.lang.ArrayIndexOutOfBoundsException: Index 3 out of bounds for length 3
	at com.techelevator.exceptions.ExceptionsLecture.main(ExceptionsLecture.java:22)
```

Compile-time Exceptions (Checked Exceptions)

They are not runtime exceptions, but they must be handled or declared.

- **FileNotFoundException**: This is thrown programmatically, when the program tries to do something with a file that doesn't exist.

- **IOException**: A more general exception related to problems reading or writing to a file.
  - Note that FileNotFoundException extends from IOException.



```
File inputFile = getInputFileFromUser();
try(Scanner fileScanner = new Scanner(inputFile)) {
    while(fileScanner.hasNextLine()) {
        String line = fileScanner.nextLine();
        String rtn = line.substring(0, 9);

        if(checksumIsValid(rtn) == false) {
```

```
Unhandled exception type FileNotFoundException
2 quick fixes available:
  Add throws declaration
  Add catch clause to surrounding try
```

Runtime Exceptions (Unchecked Exceptions)

Runtime exceptions are errors that occur whilst the program is executing in the JVM. Here are three common examples:

- **NullPointerException**: you tried to call a method or access a data member for a null reference.
- **ArithmeticException**: you tried to divide by zero.
- **ArrayIndexOutOfBoundsException**: you tried to access an array element with an index that is out of bounds.

Exceptions “Throwing”

Throwing means making everyone aware that a deviation from normal program flow has occurred.

- Throwing can be done behind the scenes by the JVM.
- It can be triggered via code, by using the *throw* statement.

Exceptions “Handling”

Handling are the actions taken (defined by the programmer) when an exception is encountered.

Java exceptions in a nutshell

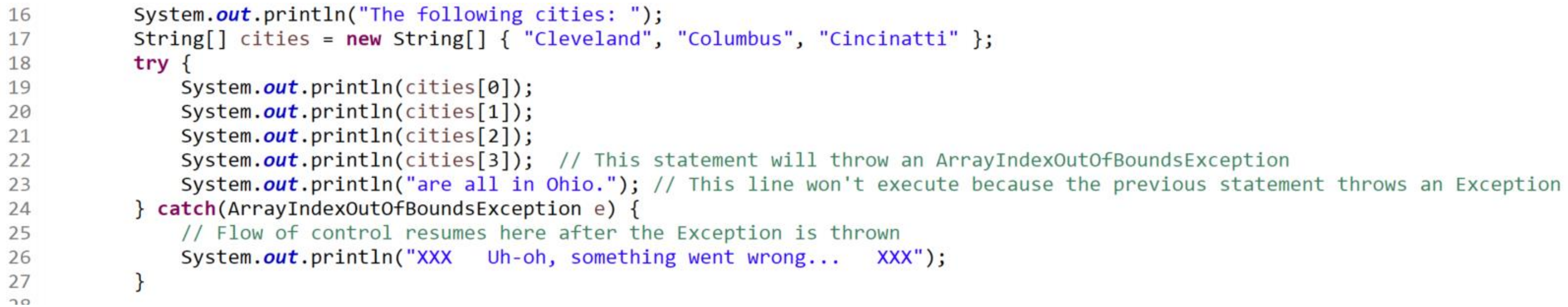
Try / Catch

The Try Catch block follows the following format:

```
try {
   // Code where an exception might be triggered
}
catch (FileNotFoundException e) {
   // Catch and specify actions to take if an exception is encountered.
}
finally {
   // Action to take regardless of whether an exception was encountered.

}
```

Both the catch and finally blocks are optional but one of them must be present (either try or finally, or both).

Try / Catch



```java
System.out.println("The following cities: ");
String[] cities = new String[] { "Cleveland", "Columbus", "Cincinatti" };
try {
    System.out.println(cities[0]);
    System.out.println(cities[1]);
    System.out.println(cities[2]);
    System.out.println(cities[3]);  // This statement will throw an ArrayIndexOutOfBoundsException
    System.out.println("are all in Ohio."); // This line won't execute because the previous statement throws an Exception
} catch(ArrayIndexOutOfBoundsException e) {
    // Flow of control resumes here after the Exception is thrown
    System.out.println("XXX   Uh-oh, something went wrong...   XXX");
}
```

Exceptions Handling: Example

Consider the following example:

```
import java.io.FileNotFoundException;

public class SuspiciousClass {

   public void doSomething() throws
                    FileNotFoundException {

      throw new FileNotFoundException();
   }

}
```

```
public class MyMainClass {

   public static void main(String[] args)  {
      SuspiciousClass test = new
                   SuspiciousClass();
      test.doSomething();
   }
}
```

An exception is programatically thrown.

Java will complain as we try to invoke doSomething() as it expects us to handle or catch the exception.

Exceptions Handling: Example

Our first choice is to just state that on the main method (from which we call doSomething) that there is a possibility an exception will be thrown:

```
public static void main(String[] args) throws
   FileNotFoundException {

      SuspiciousClass test = new SuspiciousClass();
      test.doSomething();

}
```

Exceptions Handling: Example

Or, we could use a try / catch block to both catch the exception and specify a set of actions to do in the event we run into the exception.

```
public static void main(String[] args) {

    SuspciousClass test = new SuspciousClass();

    try {
       test.doSomething();
    }
    catch (FileNotFoundException e) {
       System.out.println("ok... that's fine, moving on.");
    }
}
```

You must specify the name of the exception along with a placeholder variable.

File Input

No hoomin! I denies eating dat tasty
brekfast snausij yu left on teh table..

File Input

Java has the ability to read in data stored in a text file.

It is one of many forms of inputs available to Java:

- Command Line user input (we have covered this one)
- Through a relational database (Module 2)
- Through an external API (Module 2)

APCS: "Find the average of this .txt file full of integers using an array" Me:

File Input : The File Class

The file class is the Java class that encapsulates what it means to be a file containing data. This is an instantiation of a File object.

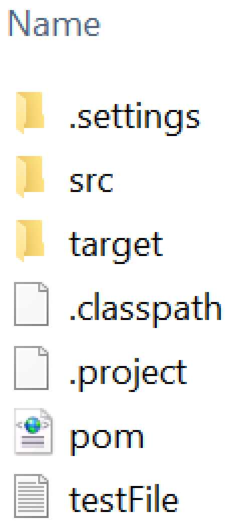
```
File <<variable name>> = new File(<<Location of the file>>);
```

In its simplest form it has a constructor that takes in the location of the file (including the name). Here is a concrete example:

```
File inputFile = new File("testFile.txt");
```

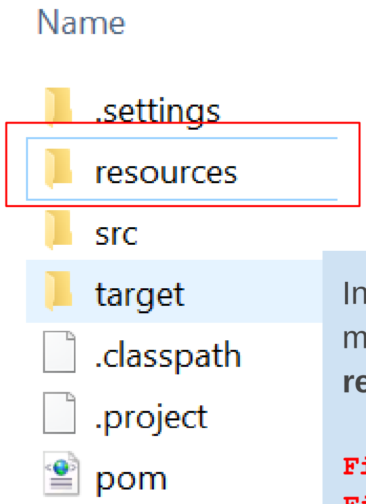
File Input : The File Class

The file location corresponds to the root of that particular Java project. Again, in this example our file is testFile.txt:



In this example, testFile.txt is located in the project root, we can refer to it like so:

```
File inputFile = new
     File("testFile.txt");
```



In this example, testFile.txt has been moved **inside a folder called resources**.

```
File inputFile = new
File("resources/testFile.txt");
```

File Input : The File Class Methods

There are several methods of the file class that can be used for file input:

- **.exists()**: returns a boolean to check to see if a file exists. We would not want to proceed to parse a file if the file itself was missing!

- **.isFile()**: returns a boolean to check to see if what we are looking at is a File. Returns false if it is not a file (perhaps a folder)
- **.getAbsoluteFile()**: returns the same File object you instantiated but with an absolute path. You can think of this as a getter. It returns a File object.

File and Scanner

A File object and a Scanner object will work in conjunction with one another to read the file data.

Once a file object exists, we instantiate a Scanner object with the file as a constructor argument. Previously, we used System.in as the argument.

File and Scanner: Example

Consider this example:

```
public static void main(String[] args) throws FileNotFoundException {

     File inputFile = new File("resources/testFile.txt");

     if (inputFile.exists()) {
          System.out.println("found the file");
     }

     try (Scanner inputScanner = new Scanner(inputFile)) {

        while (inputScanner.hasNextLine()) {
            String lineInput = inputScanner.nextLine();
            String [] wordsOnLine = lineInput.split(" ");

            for (String word : wordsOnLine) {
                 System.out.print(word + ">>>");
            }
        }
   }
}
```

We need to handle an exception, but we can pass it up to the parent class.

New file object being instantiated.

Instantiating a scanner but using a file object instead of System.in.

The while loop will iterate until it has processed all lines.

File and Scanner: Example

Here is a cleaner version of the example:

```
public static void main(String[] args) throws FileNotFoundException {

    File inputFile = new File("resources/testFile.txt");

    if (inputFile.exists())
         System.out.println("found the file");
    }

    try (Scanner inputScanner = new Scanner(inputFile)) {

        while (inputScanner.hasNextLine()) {
            String lineInput = inputScanner.nextLine();
            String [] wordsOnLine = lineInput.split(" ");

            for (String word : wordsOnLine) {
                System.out.print(word + ">>>");
            }
        }
    }
}
```

SOLID Principles

- SRP – Single Responsibility Principle
  - Every class (or similar structure) should only have one job to do
- OCP – Open Closed Principle
  - Classes should be open for extension but closed for modification
- LSP – Liskov Substitution Principle
  - In inheritance, design your classes so that dependencies can be substituted without needing modification in the client (use interfaces)
    - If it looks like a Duck, quacks like a Duck, but needs batteries, you probable have the wrong extraction (Tractor was not a child of FarmAnimal)
- ISP – Interface Segregation Principle
  - Keep interfaces small so you don’t force classes to provide methods that have no meaning
- DIP – Dependency Inversion Principle
  - High-level modules should not depend on low-level modules, they should depend on abstractions

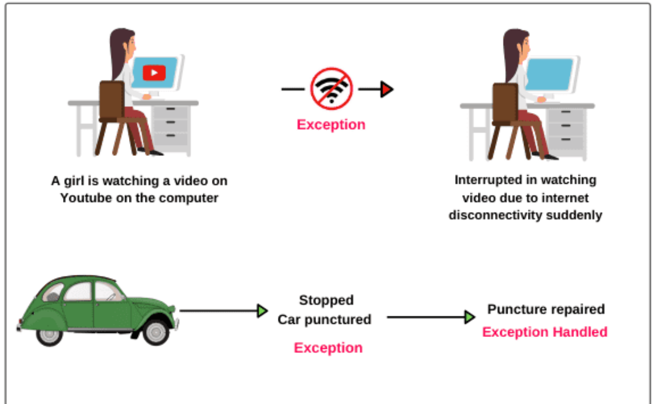
https://www.jrebel.com/blog/solid-principles-in-java

Objectives

- Describe the concept of exception handling
- Implement a try/catch structure in a program
- Understand the java.io library File and Directory classes
- Explain what a character stream is
- Use a try-with-resources block
- Handle File I/O exceptions and how to recover from them
- Know how File I/O might be used on a job

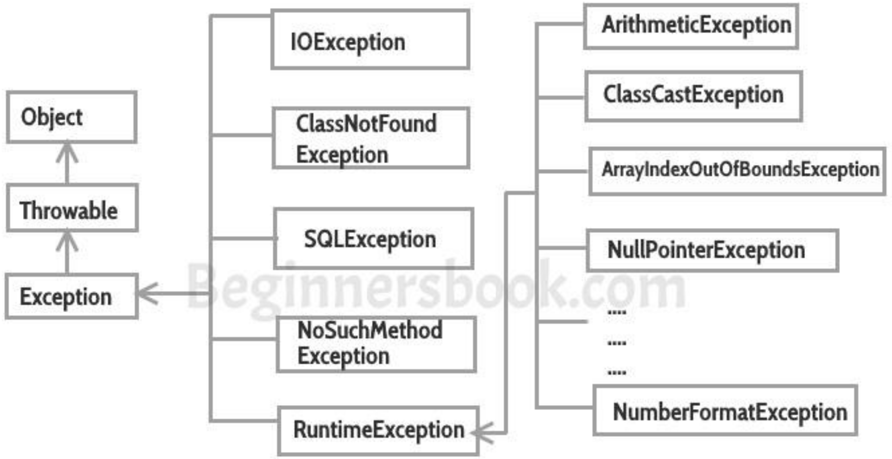
Objectives

- Describe the concept of exception handling



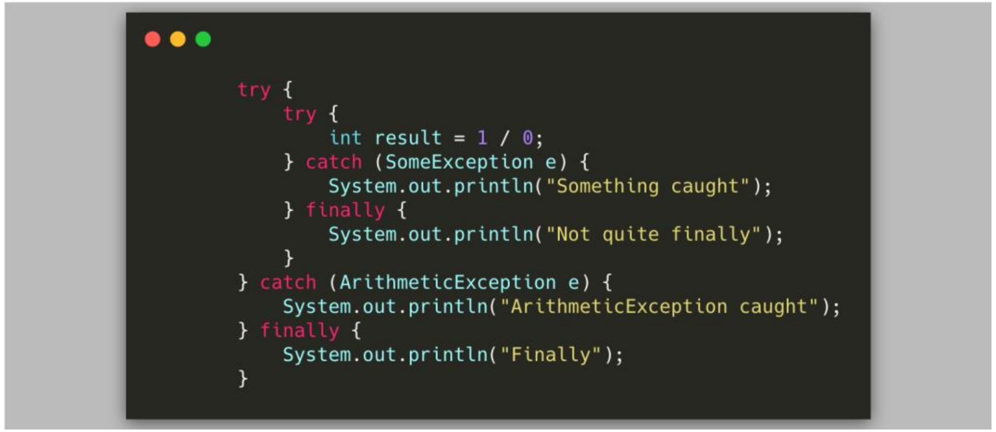
Exception
A girl is watching a video on Youtube on the computer
Interrupted in watching video due to internet disconnectivity suddenly
Stopped Car punctured
Exception
Puncture repaired
Exception Handled

Fig: Realtime Example of Exception Handling

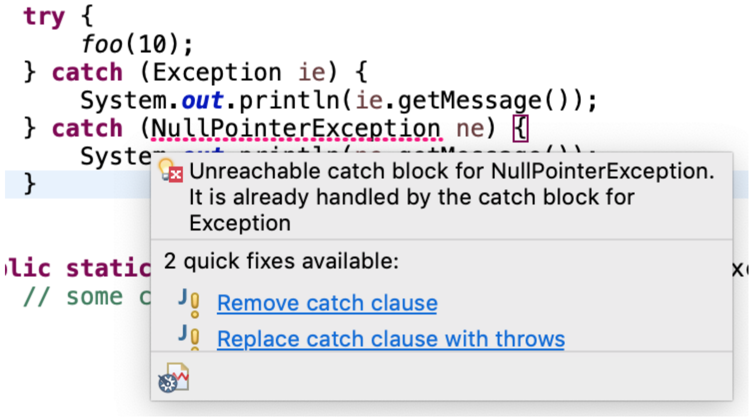


Objectives

- Describe the concept of exception handling
- Implement a try/catch structure in a program



```
try {
    try {
        int result = 1 / 0;
    } catch (SomeException e) {
        System.out.println("Something caught");
    } finally {
        System.out.println("Not quite finally");
    }
} catch (ArithmeticException e) {
    System.out.println("ArithmeticException caught");
} finally {
    System.out.println("Finally");
}
```



```
try {
    foo(10);
} catch (Exception ie) {
    System.out.println(ie.getMessage());
} catch (NullPointerException ne) {
    Syste
}

lic static
// some c
```

Unreachable catch block for NullPointerException. It is already handled by the catch block for Exception

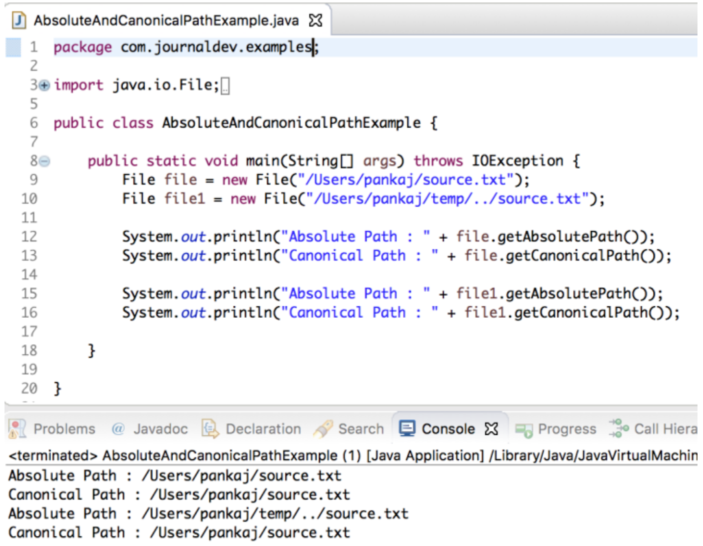
2 quick fixes available:

Remove catch clause

Replace catch clause with throws

Objectives

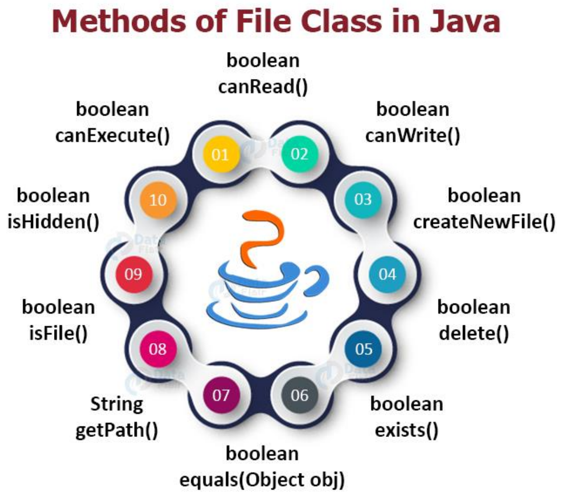
- Describe the concept of exception handling
- Implement a try/catch structure in a program
- Understand the java.io library File and Directory classes



AbsoluteAndCanonicalPathExample.java

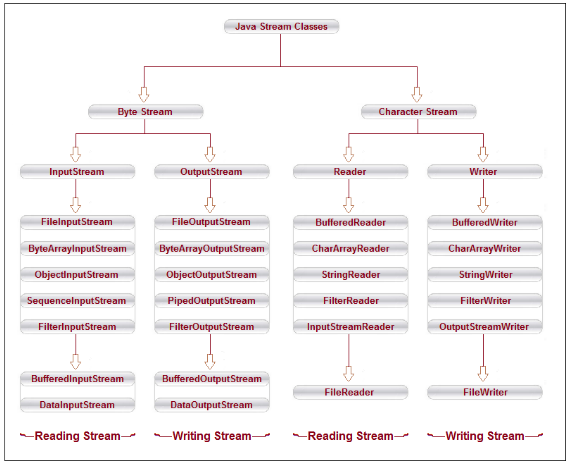
```java
package com.journaldev.examples;

import java.io.File;

public class AbsoluteAndCanonicalPathExample {

    public static void main(String[] args) throws IOException {
        File file = new File("/Users/pankaj/source.txt");
        File file1 = new File("/Users/pankaj/temp/../source.txt");

        System.out.println("Absolute Path : " + file.getAbsolutePath());
        System.out.println("Canonical Path : " + file.getCanonicalPath());

        System.out.println("Absolute Path : " + file1.getAbsolutePath());
        System.out.println("Canonical Path : " + file1.getCanonicalPath());

    }

}
```

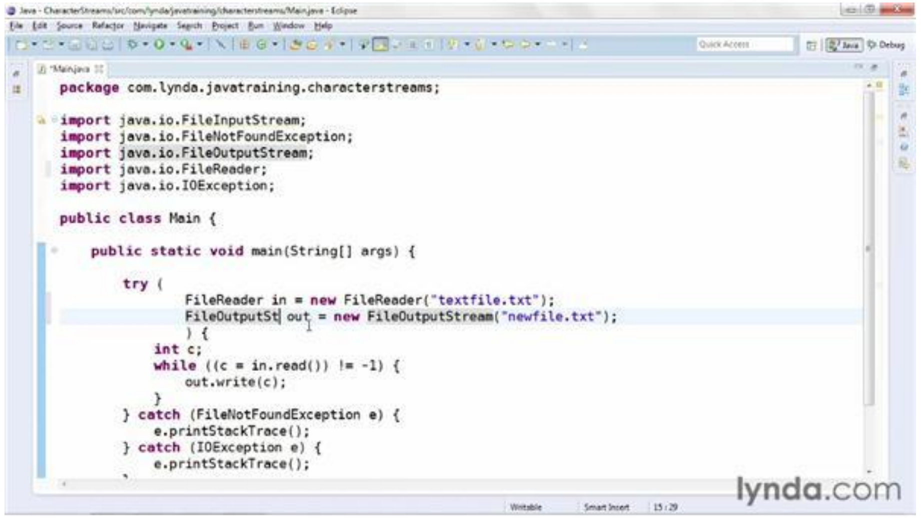
```
<terminated> AbsoluteAndCanonicalPathExample (1) [Java Application] /Library/Java/JavaVirtualMachin
Absolute Path : /Users/pankaj/source.txt
Canonical Path : /Users/pankaj/source.txt
Absolute Path : /Users/pankaj/temp/../source.txt
Canonical Path : /Users/pankaj/source.txt
```



Objectives

- Describe the concept of exception handling
- Implement a try/catch structure in a program
- Understand the java.io library File and Directory classes
- Explain what a character stream is

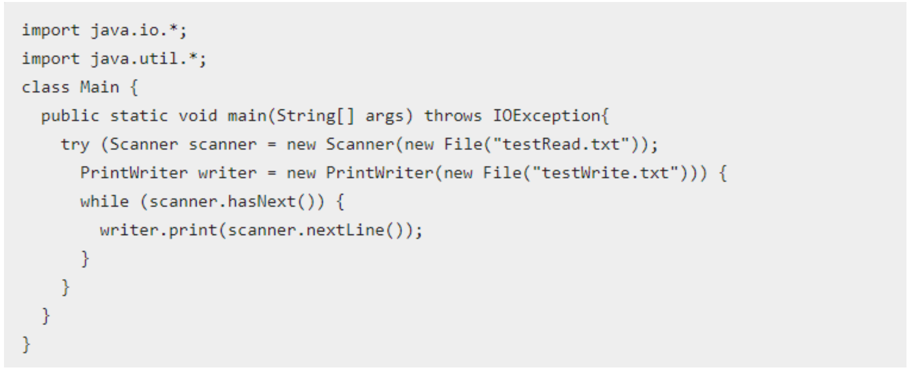



Java - CharacterStreams/src/com/lynda/javatraining/characterstreams/Main.java - Eclipse
File Edit Source Refactor Navigate Search Project Run Window Help
Quick Access
Java
Debug
*Main.java
Writable
Smart Insert
15 : 29
lynda.com

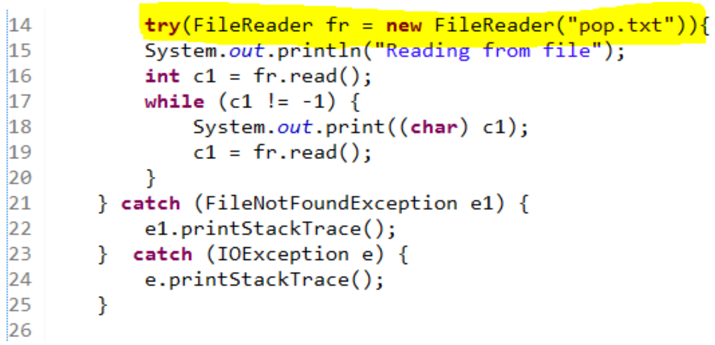
```java
package com.lynda.javatraining.characterstreams;

import java.io.FileInputStream;
import java.io.FileNotFoundException;
import java.io.FileOutputStream;
import java.io.FileReader;
import java.io.IOException;

public class Main {

    public static void main(String[] args) {

        try (
                FileReader in = new FileReader("textfile.txt");
                FileOutputSt out = new FileOutputStream("newfile.txt");
                ) {
            int c;
            while ((c = in.read()) != -1) {
                out.write(c);
            }
        } catch (FileNotFoundException e) {
            e.printStackTrace();
        } catch (IOException e) {
            e.printStackTrace();
```

Objectives

- Describe the concept of exception handling
- Implement a try/catch structure in a program
- Understand the java.io library File and Directory classes
- Explain what a character stream is
- Use a try-with-resources block



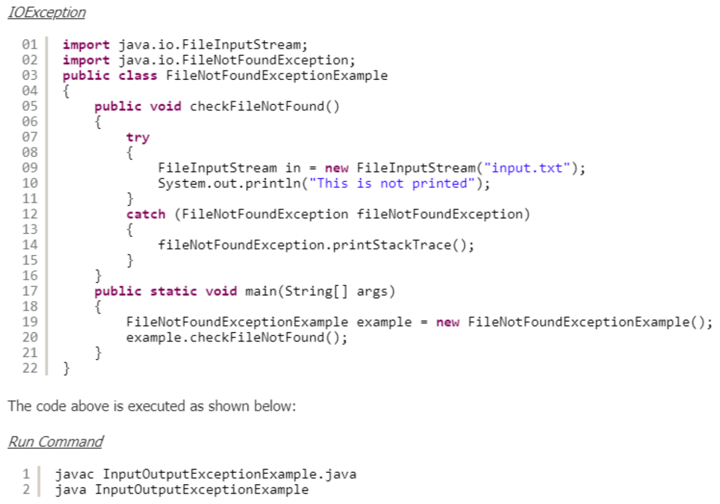
```java
import java.io.*;
import java.util.*;
class Main {
  public static void main(String[] args) throws IOException{
    try (Scanner scanner = new Scanner(new File("testRead.txt"));
      PrintWriter writer = new PrintWriter(new File("testWrite.txt"))) {
      while (scanner.hasNext()) {
        writer.print(scanner.nextLine());
      }
    }
  }
}
```



```java
        try(FileReader fr = new FileReader("pop.txt")){
        System.out.println("Reading from file");
        int c1 = fr.read();
        while (c1 != -1) {
            System.out.print((char) c1);
            c1 = fr.read();
        }
    } catch (FileNotFoundException e1) {
        e1.printStackTrace();
    }  catch (IOException e) {
        e.printStackTrace();
    }
```

Objectives

- Describe the concept of exception handling
- Implement a try/catch structure in a program
- Understand the java.io library File and Directory classes
- Explain what a character stream is
- Use a try-with-resources block
- Handle File I/O exceptions and how to recover from them



IOException

```java
import java.io.FileInputStream;
import java.io.FileNotFoundException;
public class FileNotFoundExceptionExample
{
    public void checkFileNotFound()
    {
        try
        {
            FileInputStream in = new FileInputStream("input.txt");
            System.out.println("This is not printed");
        }
        catch (FileNotFoundException fileNotFoundException)
        {
            fileNotFoundException.printStackTrace();
        }
    }
    public static void main(String[] args)
    {
        FileNotFoundExceptionExample example = new FileNotFoundExceptionExample();
        example.checkFileNotFound();
    }
}
```

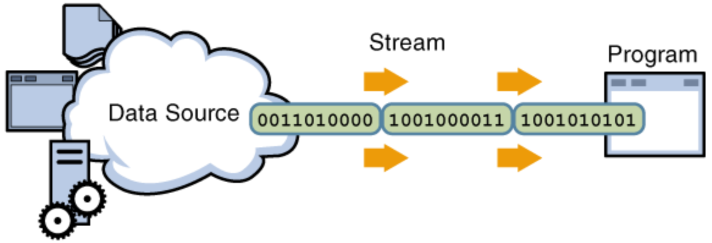
The code above is executed as shown below:

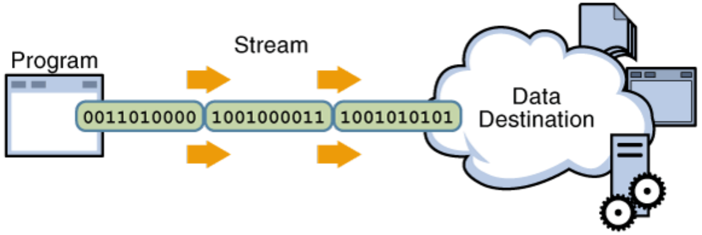
Run Command

```
javac InputOutputExceptionExample.java
java InputOutputExceptionExample
```

Objectives

- Describe the concept of exception handling
- Implement a try/catch structure in a program
- Understand the java.io library File and Directory classes
- Explain what a character stream is
- Use a try-with-resources block
- Handle File I/O exceptions and how to recover from them
- Know how File I/O might be used on a job


Data Source
Stream
Program
0011010000
1001000011
1001010101


Program
Stream
Data Destination
0011010000
1001000011
1001010101