

# COMP 250

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## INTRODUCTORY SCIENCE

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Week 3-1: Errors, exceptions, and blocks

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# WHAT ARE WE GOING TO DO IN THIS VIDEO?



- Errors and Exceptions
- Try/catch blocks

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## KIND OF ERRORS

- **Stylistic Errors**

The functionality of your code is not affected.

Your code is hard to read.

- **Compile-time**

Something is w

Your code does not compile!

- **Run-time errors**

Something goes wrong when you run your program.

Your code does not run!

- **Logic errors**

Something isn't working the way you think.

The program does not do the correct thing.

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## COMPILE TIME ERRORS

- These errors are detected by the compiler.

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- They prevent your the program violates the syntactic rules o <https://eduassistpro.github.io/>

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- Compile-time errors include missing a semicolon, adding an extra bracket, or using the incorrect types.
- Compile-time errors are the easiest to fix!

## RUN-TIME ERRORS

- These errors happen at run time. They are detected by the JVM when it tries to execute the instructions in the program.
- Common run-time errors include array index out of bounds exceptions, division by zero, or null pointer exceptions.
- They are more difficult to fix than compile-time errors, but the JVM outputs some useful text to help you with that.

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# EXCEPTIONS

Java displays a message with:

- the name of the exception,
- the line of the program and
- a "stack trace": the list of application was in the middle of when an exception occurred

```
java.lang.StringIndexOutOfBoundsException: String index out of range: 3
    at java.lang.String.charAt(Unknown Source)
    at Test.method3(Test.java:19)
    at Test.method2(Test.java:13)
    at Test.method1(Test.java:9)
    at Test.main(Test.java:4)
    at sun.reflect.NativeMethodAccessorImpl.invoke0(Native Method)
```

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# RUN TIME ERRORS AND EXCEPTIONS

An exception is an event, which occurs during the execution of a program, which disrupts the normal flow of the program.

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Exceptions happen when the computer is asked to do something that doesn't make sense.



## AN EXAMPLE

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```
int[  
System.out.println(  
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```

On the second line we try to access an element that does not exists. An `ArrayIndexOutOfBoundsException` will be thrown.

# THROWING EXCEPTIONS

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When you want to check whether an invalid input was passed during the execution of the program, you can deliberately stop the execution of your code by throwing an exception.

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## EXAMPLE

```
public static boolean isPrime (int n) {  
    if (n <  
        retu https://eduassistpro.github.io/  
    }  
    ...    Add WeChat edu_assist_pro  
}
```

Do we want to return false? We can instead throw an exception!

## EXAMPLE

```
public static boolean isPrime (int n) {  
    if (n <= 1) {  
        throw new IllegalArgumentException("Primality  
is not defined for number smaller than 2");  
    }  
    ...  
}
```

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## EXAMPLE

```
public static boolean isPrime (int n) {  
    if (n <= 1) {  
        throw new I tion("Primality  
is not defined for number sn an 2");  
    }  
    ...  
}
```

Keywords

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## EXAMPLE

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```
public static boolean isPrime (int n) {  
    if (n <= 1) {  
        throw new IllegalArgumentException("Primality  
is not defined for number sn an 2");  
    }  
    ...  
}
```

Keywords

Exception name

## EXAMPLE

```
public static boolean isPrime (int n) {  
    if (n <= 1) {  
        throw new I  
        tion("Primality  
is not defined for a number less than 2");  
    }  
    ...  
}
```

Message that will be displayed

# THROWING EXCEPTIONS

You can throw any kind of Exception you want.

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Example:

**ArithmeticException**, **ArrayStoreException**, **ClassCastException**, **IllegalArgumentException**,  
**IllegalMonitorStateException**, **IllegalThreadStateException**, **IndexOutOfBoundsException**,  
**NegativeArraySizeException**, **NullPointerException**,  
**NumberFormatException**, ...

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## THROWING EXCEPTIONS

In general, if you want to throw an exception you can add the following statement in your code:

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```
throw new IllegalArgumentException(message)
```

The type of message is `String` and the message is optional.

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# DEALING WITH EXCEPTIONS

What can we do to prevent our code from crashing at run-time? **Assignment Project Exam Help**

```
public static void main(String[] args) {  
    if (args != null) {  
        // something with args  
    }  
}
```

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What type of exception are we trying to prevent?

Is there another way?

# CATCHING EXCEPTIONS

In order to prevent our code from crashing, we can *catch* Exceptions as follows:

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e is the name I gave  
to my variable of  
type Exception

```
try {  
    // code that might be problematic  
}  
catch(Exception e) {  
    // code that should be executed if there was a problem  
}  
// whatever comes after
```

## TRY/CATCH BLOCKS

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A try/catch block allows us to try some code, and if an exception is raised, we can catch it and handle it. <https://eduassistpro.github.io/>

An exception that is caught will prevent the program to crash. Add WeChat edu\_assist\_pro

## EXAMPLE 1

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```
int[] x = {1,2,3};
try {
    System.out.println(x
}
catch (ArrayIndexOutOfBoundsException
    System.out.println("Wrong index!");
}
System.out.println("Everything else");
```

What prints?

➤ Wrong index!

Everything else

## EXAMPLE 2

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<https://eduassistpro.github.io/> What prints?

Add WeChat edu\_assist\_pro Non-time error!

```
int[] x = {1,2,3};
try {
    System.out.println(x
}
catch (NullPointerException e) {
    System.out.println("It is null!");
}
System.out.println("Everything else");
```

`ArrayIndexOutOfBoundsException`  
is thrown and it is not caught  
by any catch block.

## CATCHING MULTIPLE EXCEPTIONS

If we want to do something different depending on the type of the exception caught, we can use multiple catch blocks.

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```
try {  
    // code t  
}  
catch (ArrayIndexOutOfBoundsException e) {  
    // what to do in this case  
}  
catch (NullPointerException e) {  
    // what to do in this other case  
}  
// whatever comes after
```

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## EXAMPLE

```
int[] x = {1,2,3};
try {
    System.out.println(x
}
catch (ArrayIndexOutOfBoundsException e) {
    System.out.println("Wrong index
}
catch (ArithmeticException e) {
    System.out.println("Bad math");
}
System.out.println("Everything else");
```

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What prints?

➤ Bad math

Everything else

## CATCHING ALL EXCEPTIONS

If we would like to catch all possible exceptions with the same catch block we can do the following:

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```
try {  
    // c  
} catch(Exception e) {  
    // what to do in case of issues  
}  
// whatever comes after
```

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All different exceptions are considered to be of type `Exception`.

## WHAT ABOUT ALL THE INFO?

NOTE: `e` is the name of the variable name used in the catch block.

- If you would like to display all the information related to some caught exception (what you would normally see in red when the code crashes), you can use the following method:

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- If you want to just print the name of the exception you can use a `print/println` statement:

```
System.out.println(e);
```

## finally BLOCK

- The `finally` block ***always*** executes when the `try` block exists. This ensures that the `finally` block is executed even if one of the following happens:
  - an unexpected exception occurs
  - an exception occurs
  - There's a `return/continue/break` in the `try/catch` block.
- You can have a `finally` even with just a `try` block (and no `catch`).
- The `finally` block is useful for more than just exception handling.  
Good practice: put cleanup code in a `finally` block even if no exception is anticipated.

CHECKED

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VS

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EXCEPT  
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# CHECKED VS UNCHECKED EXCEPTIONS

In java there are two kinds of exceptions:

- **Checked**

- Exception
- IOException
- FileNotFoundException

- **Unchecked**

- NullPointerException
- ArrayIndexOutOfBoundsException
- ArithmeticException

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# UNCHECKED EXCEPTIONS

- These exceptions are **not** checked at compile-time.

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- Most (if not all) exceptions that are unchecked, they can cause your code to crash at run-time.

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- You are not forced by the compiler to handle these exceptions. It is up to the programmer to decide if to catch the exceptions.

# CHECKED EXCEPTIONS

- These exceptions are checked at compile-time!

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- Usually, these kind of errors are due to something that isn't the programme trying to read from a file whose name is misspelled. These are 'recoverable' errors, which is why you have to handle them - it might be possible to keep going and not just crash!

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## CHECKED EXCEPTIONS

The programmer is forced to *handle* these exceptions. There are 2 ways to do that:

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1. Use try/catch block that might throw a checked exception

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2. Specify in the method header that the method contains code that might throw an exception, and therefore the method itself (might) **throws** an exception.

## EXAMPLE – READING FROM A FILE

You can read from a file in Java using the same `Scanner` class that we use to read from standard input!

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You use an overloaded constructor inside the `Scanner` class.

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`File` is an object meant to store information related to the File. You can create one by providing a path to a file.

## EXAMPLE – READING FROM A FILE

Notice the "throws" keyword in the method header. This means that you need to *handle* a `FileNotFoundException` to avoid the compiler error.

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## EXAMPLE

For example,  
filePath **could be**  
"C:\\documents\\  
\\whatever.txt"

We would like to write the method below, but we get the following compile-time error:

unreported exception FileNotFoundException;  
must be thrown

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```
public static void myMethod(String filePath) {  
    File f = new File(filePath);  
    Scanner fileReader = new Scanner(f);  
    int firstNumber = fileReader.nextInt();  
}
```

## OPTION 1

Surround the code that might throw an exception with a try/catch block.

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```
public static void main(String[] args) {  
    try {  
        File f = new File("file.txt");  
        Scanner fileReader = new Scanner(f);  
        int firstNumber = fileReader.nextInt();  
    }  
    catch (FileNotFoundException e) {  
        System.out.println("File not found");  
    }  
}
```

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## OPTION 2

Specify in the method header that there's an exception using the `throws` keyword followed by the type of the exception.

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```
public static void myMethod() throws FileNotFoundException {  
    File f = new File(filePath);  
    Scanner fileReader = new Scanner(f);  
    int firstNumber = fileReader.nextInt();  
}
```

Whenever this method is called, the `FileNotFoundException` will have to be handled. To do so, you can use any of the two options we have just seen.

## EXAMPLE

```
public static void test() throws FileNotFoundException {  
    // code from the previous slide  
}  
  
public static void test2() throws FileNotFoundException {  
    :  
    test();  
    :  
}  
  
public static void test3() throws FileNotFoundException {  
    :  
    test2();  
    :  
}  
  
public static void main(String[] args) throws FileNotFoundException {  
    test3();  
}
```

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```
public static void test() throws FileNotFoundException {  
    // code from the previous slide  
}
```

```
public static void test2() throws FileNotFoundException {  
    :  
    test();  
    :  
}
```

```
public static void test3() throws FileNotFoundException {  
    :  
    test2();  
    :  
}
```

```
public static void main(String[] args) {  
    try{  
        test3();  
    } catch(FileNotFoundException e) {  
        System.out.println("Caught here!");  
    }  
}
```

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```
public static void test() throws FileNotFoundException {  
    // code from the previous slide  
}  
  
public static void test2() throws FileNotFoundException {  
    :  
    test();  
    :  
}  
  
public static void t  
    :  
    try{  
        test2();  
    } catch(FileNotFoundException e) {  
        System.out.println("Caught here!");  
    }  
    :  
}  
  
public static void main(String[] args) {  
    test3();  
}
```

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An orange paint roller with a red handle, positioned horizontally. The roller is covered in orange paint, which is dripping down the left side. The words "Coming Soon" are written in white, sans-serif font across the middle of the orange roller.

Coming Soon

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In the next video

t objects and classes.

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