ERROR HANDLING

https://www.tutorialspoint.com/java/java_exceptions.htm
https://docs.oracle.com/javase/8/docs/api/java/lang/Exception.html

SUBJECTS

- What are errors?
- Why do errors happen?
- Types of errors
- What to do about errors?
- Exceptions
  - Unchecked / Checked
  - Throws / TryCatchFinally
  - Throw
  - Custom / Extends / Methods

WHAT ARE ERRORS?

When the code produces erroneous results

2 + 2 = 5
404 not found

WHY DO ERRORS HAPPEN?

When the code generate errors it can happen for 3 reasons

1. The programmer made a mistake
2. The environment changed unexpectedly
3. The program user has made a mistake

BAD CODING

In the first case the programmer has made a mistake:

divide by zero
index out of bound

ENVIRONMENT PROBLEMS

In the second case some physical resource has failed in some way.

internet connection was lost
disk error

USER INITIATED

In the third case the user has made an error

403 forbidden when trying to access a protected resource
Not a number when putting letters in a number field in a form

TYPES OF ERRORS

Syntax errors: Language syntax is not respected
Semantic errors: Improper use of program statements
Logical errors: Undesired behavior
Compile time errors: Syntax errors and static semantic errors indicated by the compiler
Runtime errors: Dynamic semantic errors and logical errors, that cannot be detected by the compiler

WHAT TO DO ABOUT ERRORS?

Errors should be handled

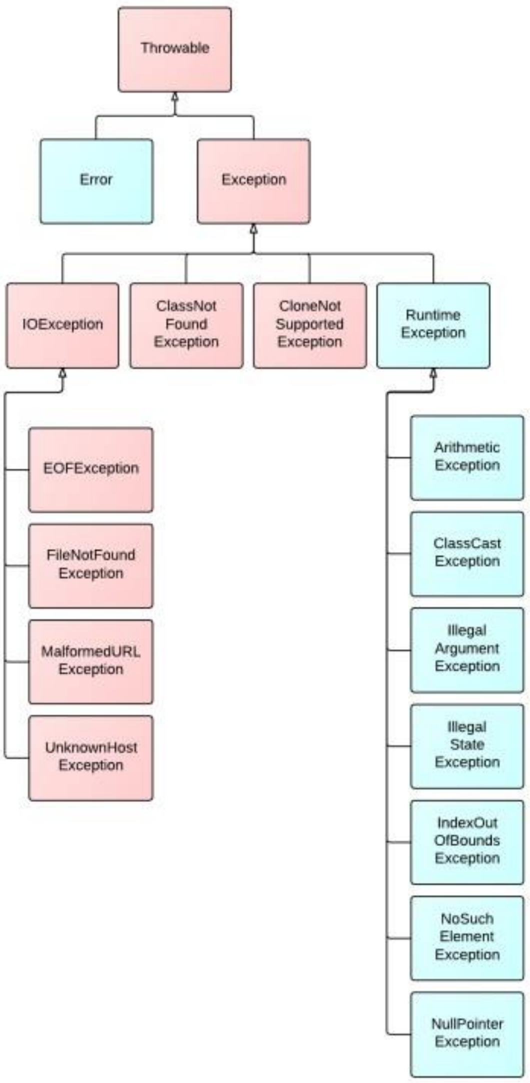
User should be notified

Log files should be updated

Program should continue

In Java there are exceptions:

When an exception occur the normal flow of the program is disrupted and the program/application terminates abnormally, which is not recommended, therefore, exceptions should be handled.



UNCHECKED EXCEPTIONS

- Unchecked exceptions occur at run time
- The code will compile even though code throws an exception
- These exceptions mostly comes from bad data from the user
- These exceptions are direct sub classes of RuntimeException class

```
int result = 2/0; //This will throw an arithmeticException, but it will compile
```

CHECKED EXCEPTIONS

- Checked exceptions occur at compile time
- These are also called ‘compile time exceptions’.
- These exceptions cannot be ignored at the time of compilation
- The programmer should take care of these exceptions

Netbeans message: “Exception must be caught or declared to be thrown”:

- FileNotFoundException
- IOException
- SQLException
- …

HANDLE EXCEPTIONS

THROWS

If a method does not handle a checked exception, the method must declare it using the **throws** keyword.
The throws keyword appears at the end of a method's signature.

```
public Person getPersons() throws ArithmeticException {....}

public Person getPersons() throws MyException {....}
```

THROW

You can throw an exception, either a newly instantiated one or an exception that you just caught, by using the **throw** keyword.

```
throw new ArithmeticException();

throw new MyException();
```

TRY-CATCH-FINALLY

- Try something that might throw an exception
- Catch the exception if it occurs
- Finally do something

Catch subclass or superclass

Catch subclass exception
```
catch (ArithmeticException Excep)
```
Catch superclass exception
```
catch (Exception Excep)
```

Multiple catch types

Different exceptions can be caught in a single catch
```
catch (NumberFormatException | ArithmeticException Excep){}
```

Use the different exception methods

- e.printStackTrace()
- e.getMessage()
- e.getStackTrace()[]

```
ex.printStackTrace();
System.out.println(Excep.getMessage());
System.out.println("printStackTrace: " + ex.getStackTrace()[0].toString());
System.out.println("printStackTraceArrays" + Arrays.toString(ex.getStackTrace()));
```

DON´T

- Catch an exception and do nothing
- Catch an exception and do `'Logger.getLogger(A.class.getName()).log(Level.SEVERE, null, ex);'` if Logger is not configured
- Throw architectural layer specific exceptions into layers where they do not belong
  - For instance SQL exceptions up through the layers to a Servlet (presentation layer)
  - Instead wrap and modify the exception as a domain layer specific exception -> and push to
    - The user
    - A log file

CUSTOM EXCEPTIONS

You can create your own exceptions in Java.

- If you want to write a checked exception, you need to extend the Exception class.
- If you want to write a runtime exception, you need to extend the RuntimeException class.

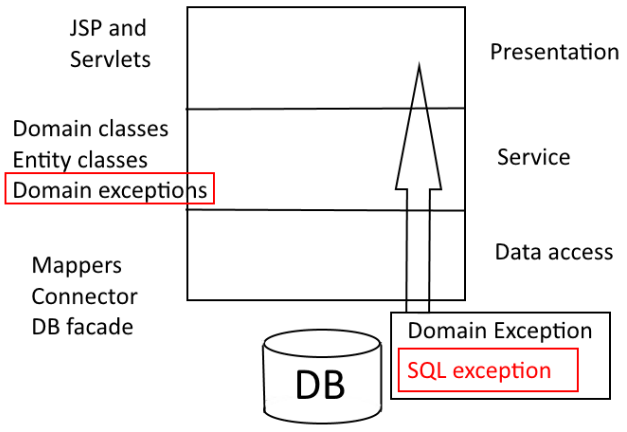
All exceptions must be a child of Throwable.

```
class MyException extends Exception {}
```

An exception class is like any other class and useful fields and methods can be added if needed.

DEMO

Example: How to catch sql exception and throw own exception up through the architectural layers and show it to the user


JSP and Servlets
Presentation
Domain classes
Entity classes
Domain exceptions
Service
Mappers
Connector
DB facade
Data access
DB
Domain Exception
SQL exception