



## **Software Skills Lab**

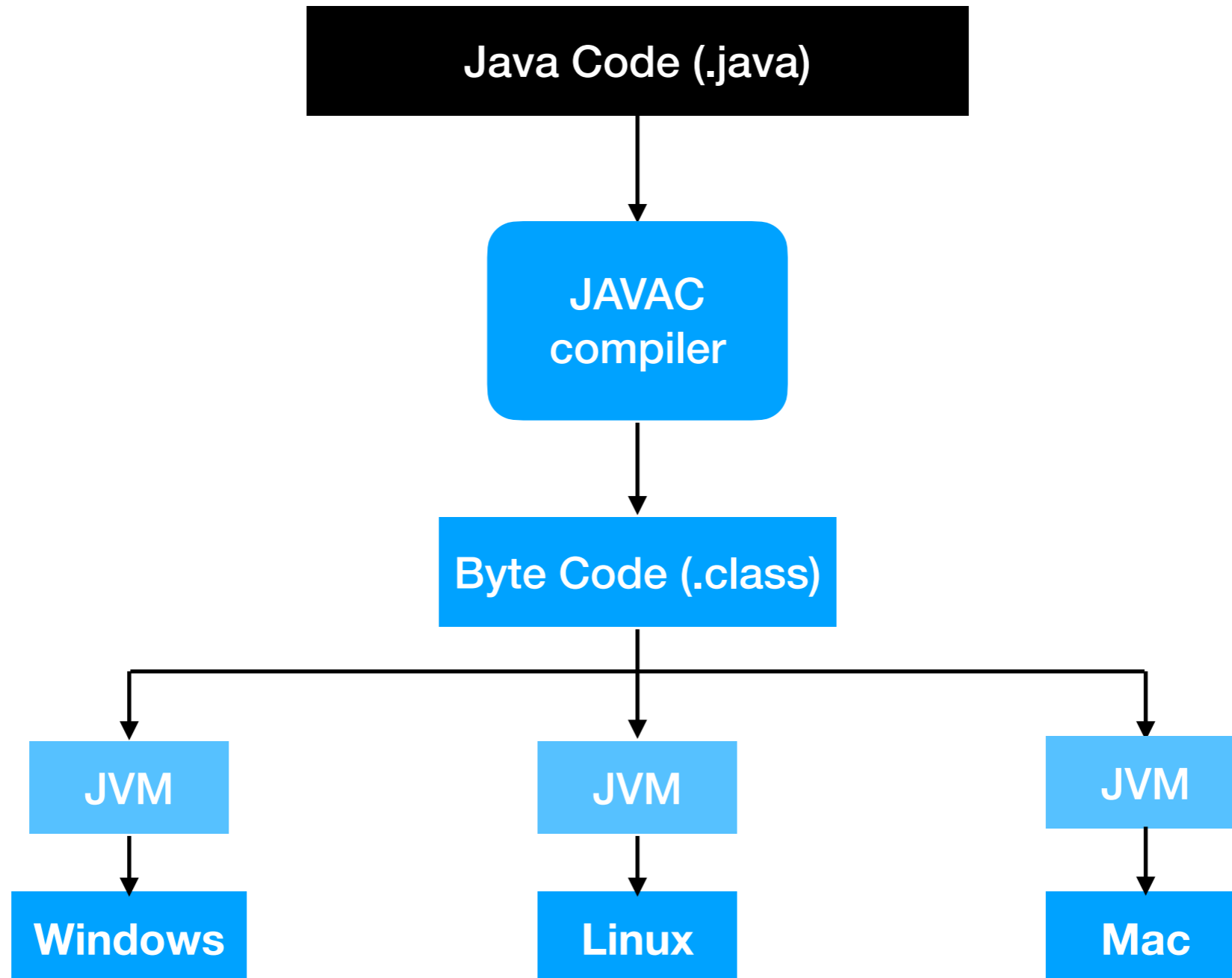
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# Java

- Java is a high-level object-oriented programming language
- Developed by Sun Microsystems which later acquired by Oracle Corporation
- Runs on Windows, Mac OS, UNIX based systems
- Write Once Run Anywhere (WORA)

# Program Execution



# Java code

```
for(int i=2; i< 1000; i++){  
    for (int j=2; j< i; j++){  
        if ( i % j == 0)  
            continue outer;  
    }  
    System.out.println (i);  
}
```

# Java bytecode

```
for(int i=2; i< 1000; i++){
    for (int j=2; j< i; j++){
        if ( i % j == 0)
            continue outer;
    }
    System.out.println (i);
}
```

```
0:   iconst_2
1:   istore_1
2:   iload_1
3:   sipush 1000
6:   if_icmpge 44
9:   iconst_2
10:  istore_2
11:  iload_2
12:  iload_1
13:  if_icmpge 31
16:  iload_1
17:  iload_2
18:  irem
19:  ifne 25
22:  goto 38
25:  iinc 2, 1
28:  goto 11
31:  getstatic #84;
    // Field java/lang/System.out:Ljava/io/PrintStream;
34:  iload_1
35:  invokevirtual #85; // Method java/io/PrintStream.println:(I)V
38:  iinc 1, 1
41:  goto 2
44:  return
```

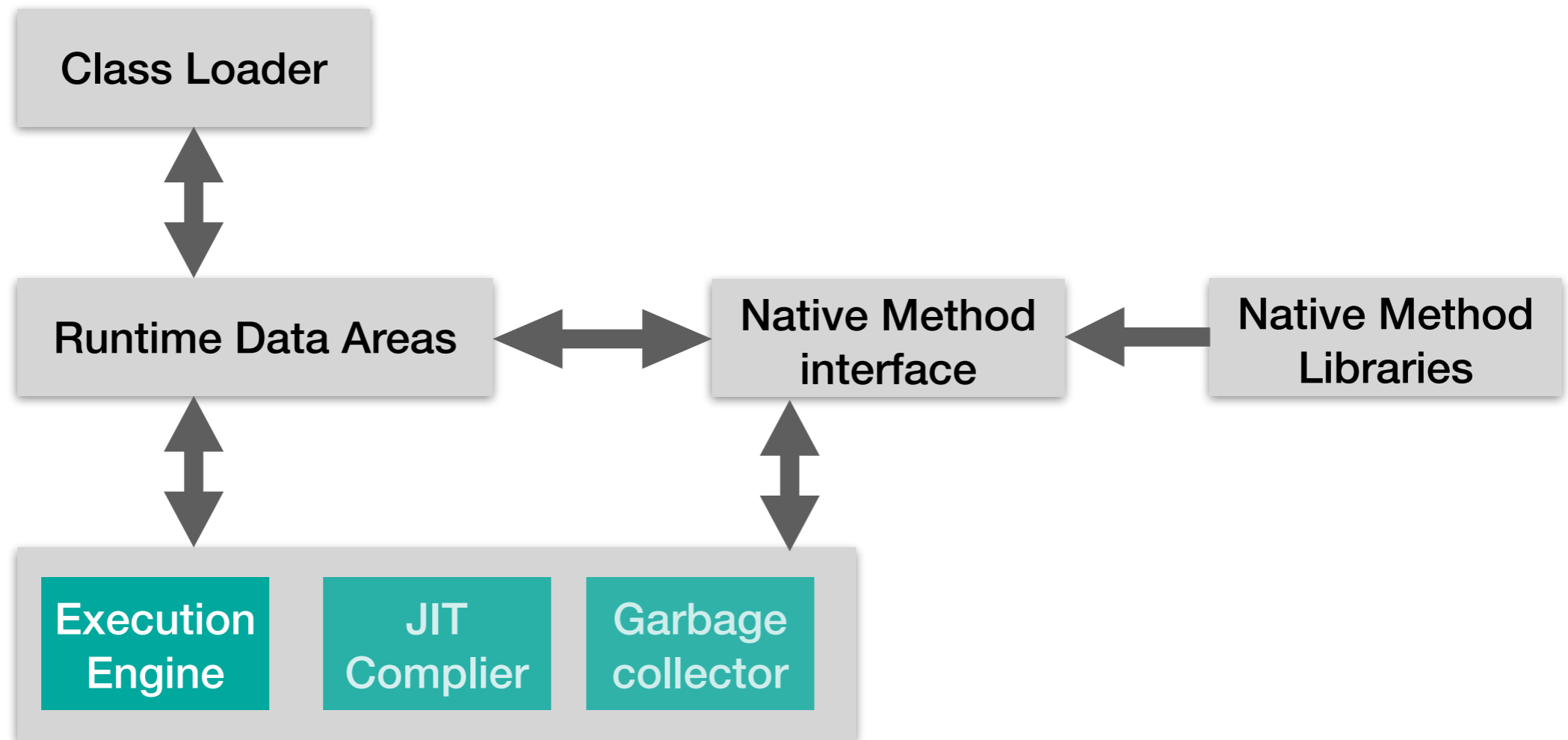
# Java Virtual Machine(JVM)

JVM enables a machine to run Java programs (bytecodes)

JVM is responsible for:

- Loads code
- Verifies code
- Executes code
- Provides runtime environment

# Java Virtual Machine(JVM)



# Java Development Kit(JDK)

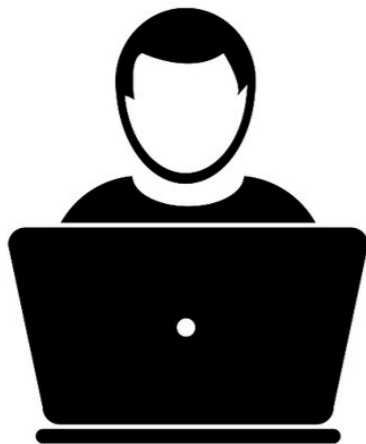
- JDK is used for developing Java applications and applets
- JDK includes Java Runtime Environment (JRE), a compiler (javac), an archiver (jar), a documentation generator (javadoc) and other tools for Java development



# JRE vs. JDK

- JRE is responsible to execute your java program
- JDK is a full featured software development and includes JRE and other tools

**JRE**



**JDK**



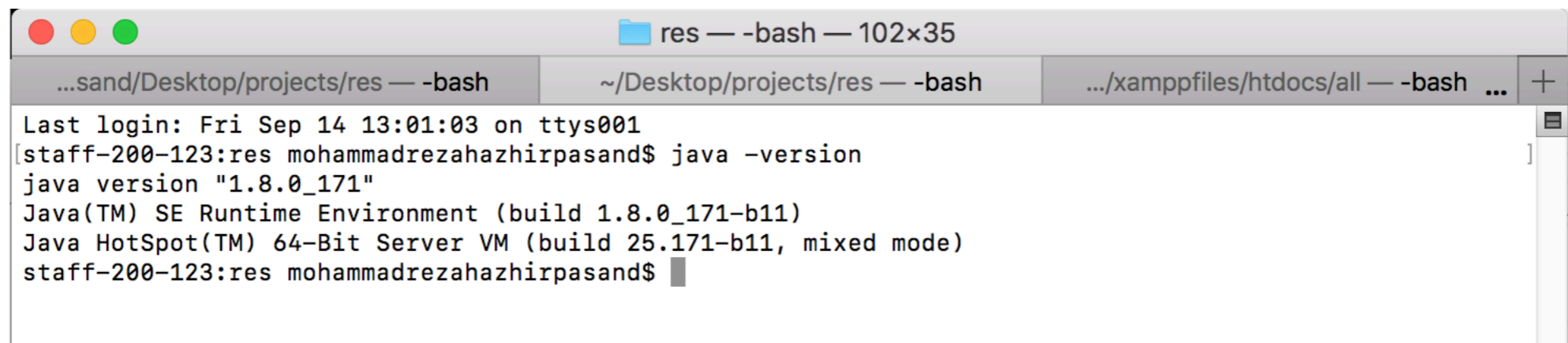
# Download JDK

- As a developer, you need to install JDK

Java SE Development Kit 8u181		
You must accept the <a href="#">Oracle Binary Code License Agreement for Java SE</a> to download this software.		
<input type="radio"/> Accept License Agreement <input type="radio"/> Decline License Agreement		
Product / File Description	File Size	Download
Linux ARM 32 Hard Float ABI	72.95 MB	<a href="#">jdk-8u181-linux-arm32-vfp-hflt.tar.gz</a>
Linux ARM 64 Hard Float ABI	69.89 MB	<a href="#">jdk-8u181-linux-arm64-vfp-hflt.tar.gz</a>
Linux x86	165.06 MB	<a href="#">jdk-8u181-linux-i586.rpm</a>
Linux x86	179.87 MB	<a href="#">jdk-8u181-linux-i586.tar.gz</a>
Linux x64	162.15 MB	<a href="#">jdk-8u181-linux-x64.rpm</a>
Linux x64	177.05 MB	<a href="#">jdk-8u181-linux-x64.tar.gz</a>
Mac OS X x64	242.83 MB	<a href="#">jdk-8u181-macosx-x64.dmg</a>
Solaris SPARC 64-bit (SVR4 package)	133.17 MB	<a href="#">jdk-8u181-solaris-sparcv9.tar.Z</a>
Solaris SPARC 64-bit	94.34 MB	<a href="#">jdk-8u181-solaris-sparcv9.tar.gz</a>
Solaris x64 (SVR4 package)	133.83 MB	<a href="#">jdk-8u181-solaris-x64.tar.Z</a>
Solaris x64	92.11 MB	<a href="#">jdk-8u181-solaris-x64.tar.gz</a>
Windows x86	194.41 MB	<a href="#">jdk-8u181-windows-i586.exe</a>
Windows x64	202.73 MB	<a href="#">jdk-8u181-windows-x64.exe</a>

# After installation

To check version of Java

A screenshot of a macOS terminal window. The window title is "res — -bash — 102x35". The terminal shows the command "java -version" being executed, which returns the output: "java version \"1.8.0\_171\" Java(TM) SE Runtime Environment (build 1.8.0\_171-b11) Java HotSpot(TM) 64-Bit Server VM (build 25.171-b11, mixed mode)". The prompt is "staff-200-123:res mohammadrezahazhirpasand\$".

```
res — -bash — 102x35
...sand/Desktop/projects/res — -bash  ~/Desktop/projects/res — -bash  .../xamppfiles/htdocs/all — -bash  ... +
Last login: Fri Sep 14 13:01:03 on ttys001
[staff-200-123:res mohammadrezahazhirpasand$ java -version
java version "1.8.0_171"
Java(TM) SE Runtime Environment (build 1.8.0_171-b11)
Java HotSpot(TM) 64-Bit Server VM (build 25.171-b11, mixed mode)
staff-200-123:res mohammadrezahazhirpasand$
```

# Know your tools

- IDEs - e.g., Eclipse
- Version control system - e.g., git
- Build tools - e.g., Maven, ant, make
- Testing Framework - e.g., Junit
- Debuggers- e.g., jdb
- Profilers - e.g., java-prof, tip
- Documentation generation- e.g., javadoc

# IDEs

- Netbeans is an integrated development environment (IDE) for java. It also has extensions for other languages such as PHP, C and C++
- Eclipse is an IDE and it is widely used for Java. It has an extensible plug-in system for customizing the environment
- IntelliJ, another popular advanced IDE with built-in tools



**NetBeans**

<https://netbeans.org/>



**eclipse**

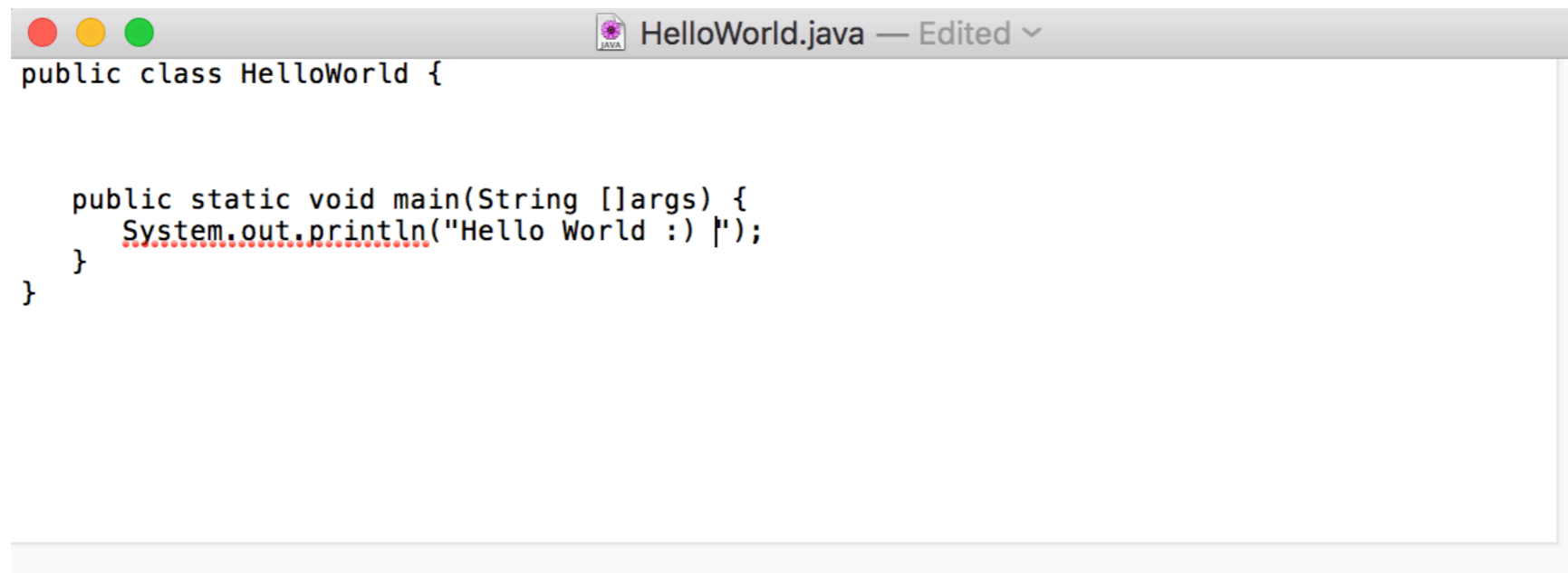
<https://www.eclipse.org/>



<https://www.jetbrains.com/idea>

# Text editors

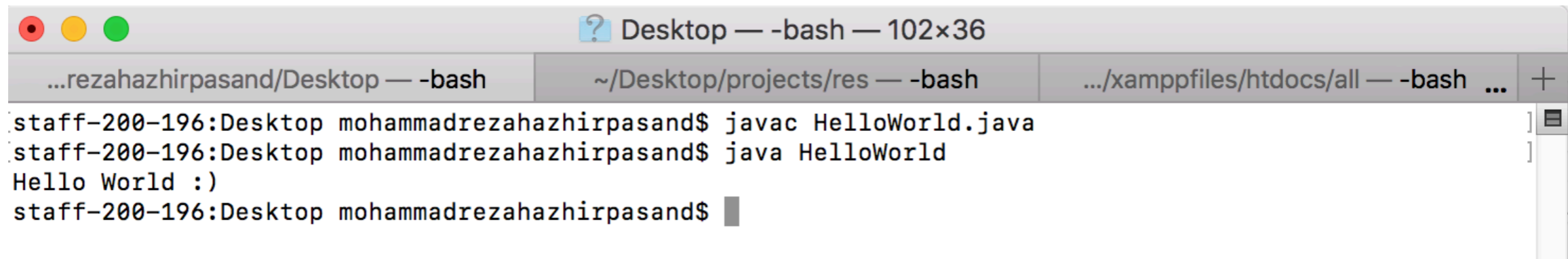
- You don't need an IDE to write a Java program

A screenshot of a text editor window. The title bar shows three colored window control buttons (red, yellow, green) on the left, followed by a Java icon and the text "HelloWorld.java — Edited" with a dropdown arrow. The main area of the window contains the following Java code:

```
public class HelloWorld {  
  
    public static void main(String []args) {  
        System.out.println("Hello World :) |");  
    }  
}
```

# Hello World

- We need to compile and run our first program



```
Desktop — -bash — 102x36
...rezahazhirpasand/Desktop — -bash  ~/Desktop/projects/res — -bash  .../xamppfiles/htdocs/all — -bash ... +
staff-200-196:Desktop mohammadrezahazhirpasand$ javac HelloWorld.java
staff-200-196:Desktop mohammadrezahazhirpasand$ java HelloWorld
Hello World :)
staff-200-196:Desktop mohammadrezahazhirpasand$
```

# Keypoints

- Case Sensitivity
- Program File name and Class Name
- `Public static void main(String args[])`
- Comments in Java is either for multiple lines `/* */` or for single line `//`



# Primitive Datatypes

In Java we have eight primitive datatypes, predefined by the language.

```
byte, short, int, long, float, double, boolean, char
```

```
public class Test{  
  
float pi;  
int id;  
double gamma = 1.2;  
boolean flag = false;
```

# Reference Datatypes

- A reference type is a data type that's based on a class rather than the primitive types that are built in to the Java language.
- The class can be a class that's provided as part of the Java API class library or a class that you write yourself
- Default value of any reference variable is null

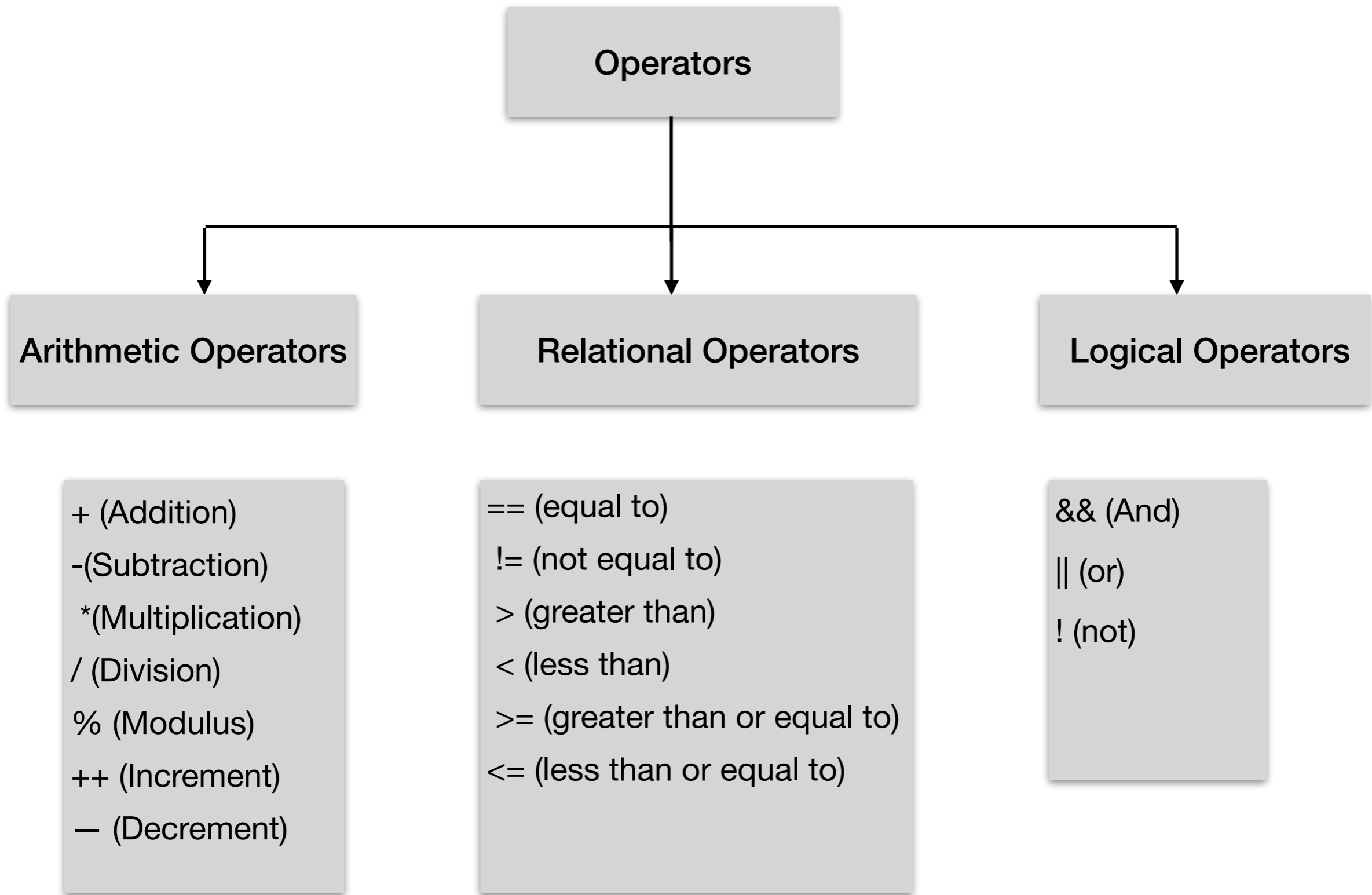
```
Human hr;  
Human hr = new Human("Jack");
```

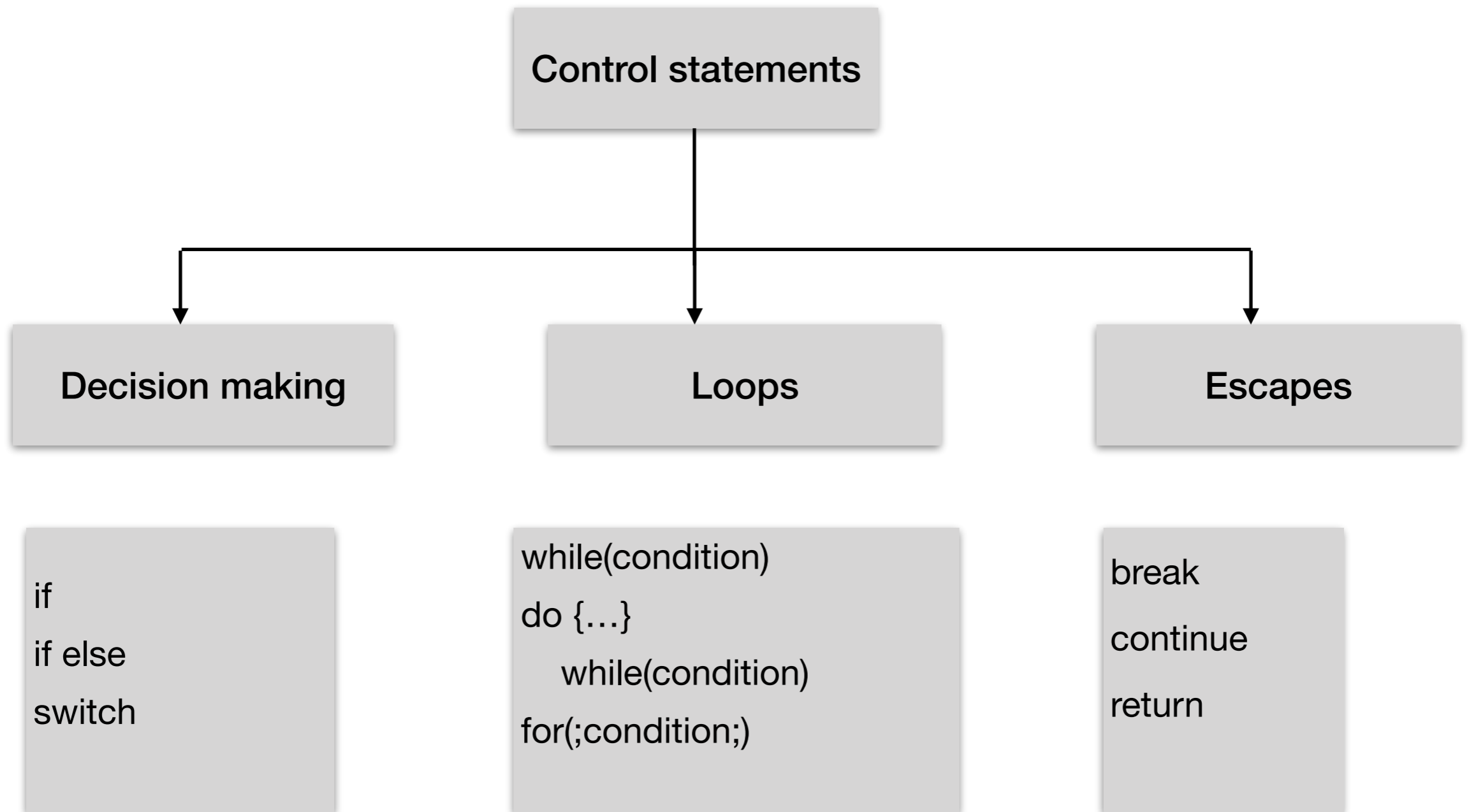
# Classes and Objects

- A class is a user defined blueprint or prototype from which objects are created
- It represents the set of properties or methods that are common to all objects of one type

```
public class Human{  
    String name;  
  
    public void Human(String name){  
    }  
}
```

```
Human hr = new Human("Jack");
```





# Decision Making

- If statement consists of a boolean expression followed by one or more statements
- If..else statement can be followed by an optional else statement which executes when the boolean expression is false
- Nested if statement means if or else if statement inside another if or else if statement

# Loops

If you need to execute a block of code for several times, you need to use loops.

- While loop repeats a statement or group of statements while a given condition is true
- For loop execute a sequence of statements multiple times till the condition is true
- Do..while loop is like a while statement except that it tests the condition at the end of the loop body

# Escapes

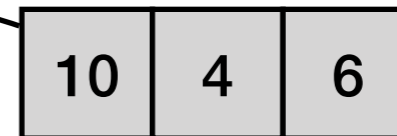
- Break statement: cause an exit from the **innermost loop/switch** statement
- Continue: can only be used with loops, cause the **innermost loop** to start the next iteration
- return: return from the function



# Arrays

- An array, which stores a fixed-size sequential collection of elements of the same type
- Array size can not be changed during the execution of the code
- Array must be declare with name, type and length

```
int myArray[] = new int[3];
```



0 1 2

```
int myArray[][] = new int[3][2];
```

# Strings

Sequence of characters

```
String name;  
String name = new String("Jack");
```

```
Public static void manipulateString(string name) {  
  
    name.substring(..);  
    name.endsWith(..);  
    name.startsWith(...);  
    name.trim();  
    name.toLowerCase();  
  
}
```

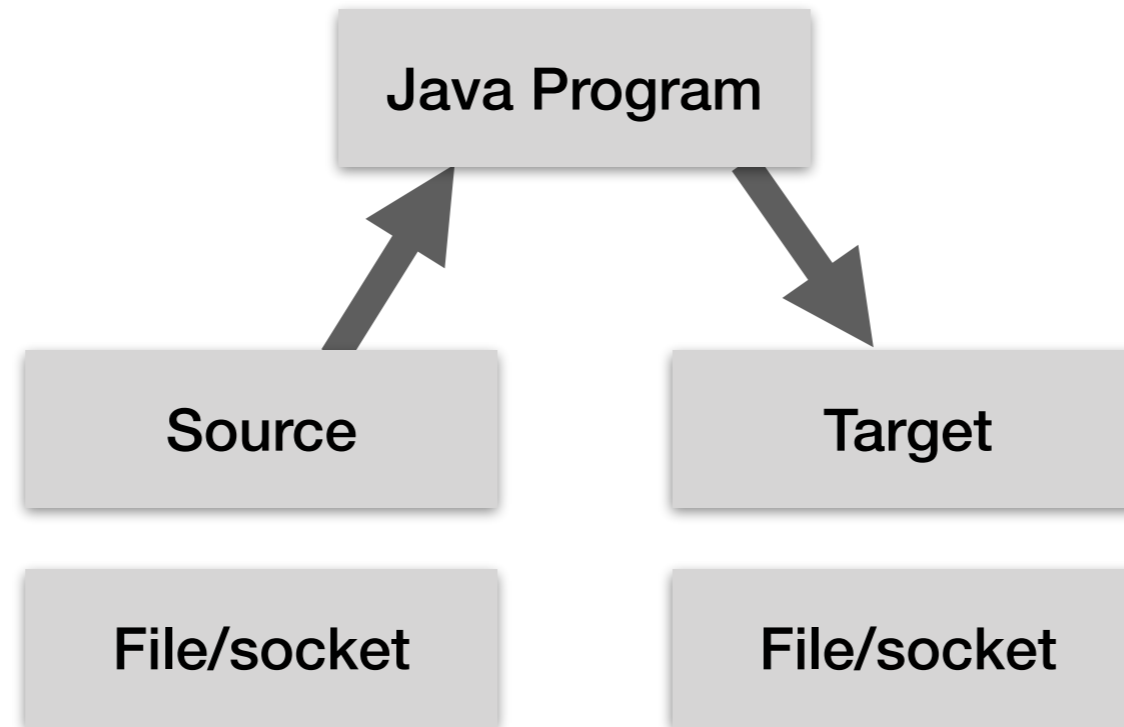
# Methods

A method in java is a sequence of statements that are executed to perform an operation.

modifier      return type      method name      Parameter

```
Public static double methodName(string name) {  
    int id = 6;  
    System.out.println("id is:" + id + "with name: " + name);  
    return id;  
}
```

# Streams



```
FileInputStream(File file)
```

```
FileOutputStream(File file)
```

```
Public static void main(String[] args) throws IOException{  
  
    File inputFile = new File("iSkills.txt");  
    File outFile = new File("oSkills.txt");  
    FileInputStream in = new FileInputStream(inputFile);  
    FileOutputStream out = new FileOutputStream(outFile);  
    int c;  
    while((c = in.read()) != -1){  
        out.write(c);}  
    in.close;  
    out.close();  
}
```

# Reader

- If you need to get an input from a user in run-time, the scanner class can be a good option
- To create an object of Scanner class, we usually pass the predefined object system.in
- To read strings, we use `nextLine()`

# Reader

```
Public static void main(String[] args){  
  
    String username;  
    Scanner sc = new Scanner(System.in);  
    username = sc.nextLine();  
    ...  
}
```

# Reader

```
Public static void main(String[] args) throws FileNotFoundException{  
  
    File inputFile = new File("iSkills.txt");  
    Scanner sc = new Scanner(inputFile);  
    String line;  
    while(sc.hasNextLine()){  
        line = sc.nextLine();  
        ...  
    }  
}
```



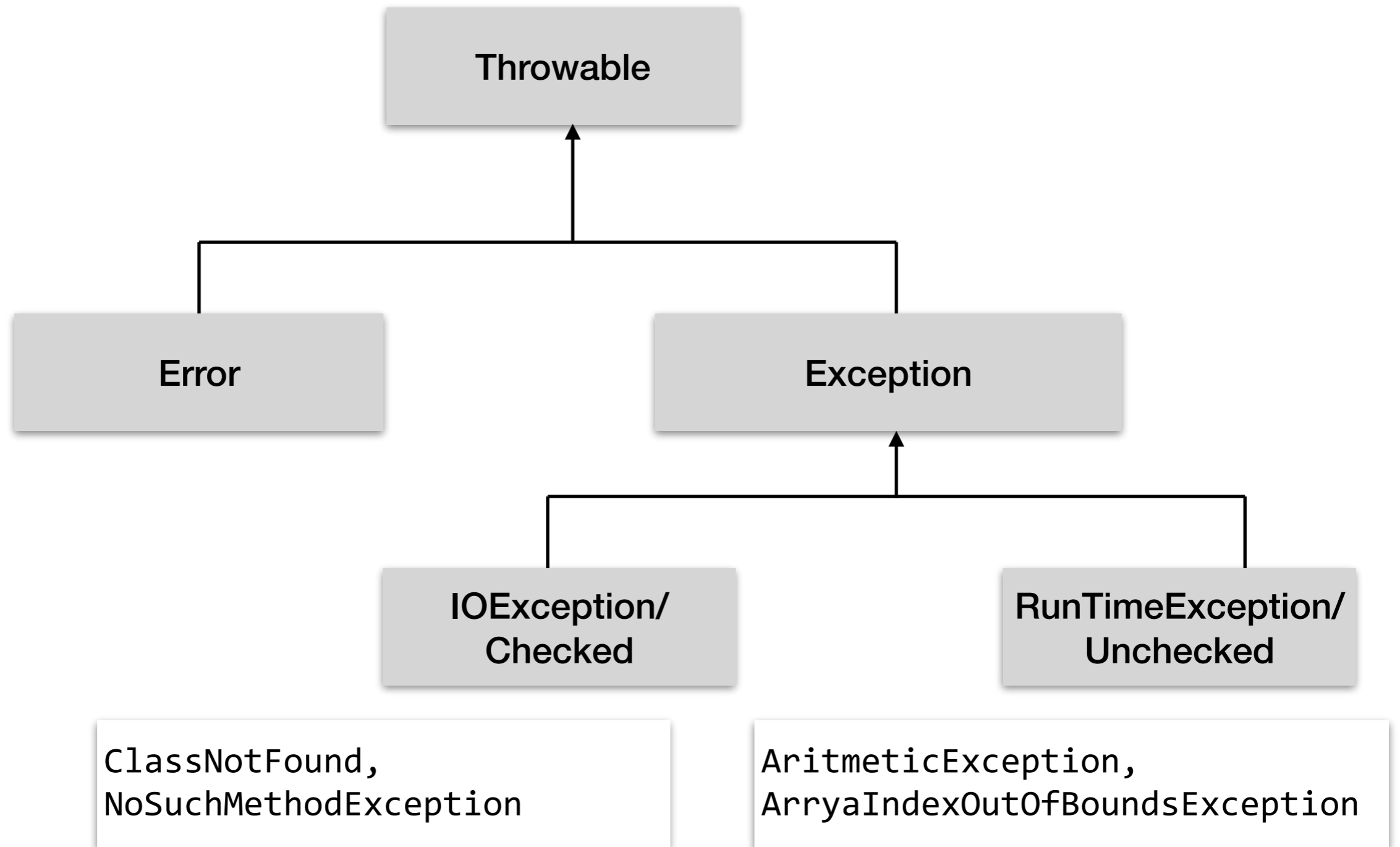
# LocalDateTime

- Java 8 LocalDateTime class is designed to represents a date-time without time-zone information such as '2017-07-12T10:35:55'.
- By calling `getYear()`, `getMonth()` and `getDayOfMonth()` methods of the LocalDateTime class, respectively year, month and day will be returned.
- And also `getHour()`, `getMinute()` and `getSecond()` methods of the LocalDateTime class return hour, minute and second respectively

# Exceptions

- An exception (or exceptional event) is a problem that arises during the execution of a program
- When an Exception occurs the normal flow of the program is disrupted and the program/Application terminates abnormally, which is not recommended, therefore, these exceptions are to be handled.
- A try/catch block is placed around the code that might generate an exception.
- Code within a try/catch block is referred to as protected code

# Exceptions



# try ..catch

```
public FirstSquare extends Square{  
    try{  
        x = a/b;  
    catch (ArithmeticException e){  
        System.out.println("divide by zero");  
    }  
}
```

```
public FirstSquare extends Square{  
  
    try{  
        // code to monitor  
    catch (ExceptionType1 e1){  
    }  
    catch (ExceptionType2 e2){  
    }  
    catch (ExceptionType3 e3){  
    }  
    //...  
    finally{  
        //block of code to be executed before try block ends  
    }  
}
```

# Custom Exception

```
//Custom Exception  
public MyCustomException extends Exception{  
    public MyCustomException(){  
        super();  
    }  
}
```

# References

- <https://www.geeksforgeeks.org>
- <https://www.tutorialspoint.com>
- [https://en.wikipedia.org/wiki/Java \(programming language\)](https://en.wikipedia.org/wiki/Java_(programming_language))
- [https://en.wikipedia.org/wiki/Java virtual machine](https://en.wikipedia.org/wiki/Java_virtual_machine)

# Exercise



# How to store login details?

# Ways to store

- Plain text
- Hash
- Encryption

**What all you need?**

# Write a Java program

- Write a class
- Method to encrypt login details
- Method to read a file
- Method to write a file

# Brainstorming session

**DEMO**