JAVA 8 - *a revolutionary release of the development platform which brings some major tweaks and upgrades to the Java programming language -including enhanced JavaScript engine, new APIs for date and time manipulation, improved and faster JVM, and the lambda expressions, stream API, etc.*

Many of you may aware of this upgrades, but few who is wondering, what is it and how it works, we have brief explanation with simple example ☺ follows.

1. Lambda expressions – *The tech giant's most anticipated upgrade for programming language.*

What is lambda expression?

- To put in simple words, *expresses instances of functional interfaces, lambda expressions implement the only abstract function and therefore implements functional interfaces*

Syntax: `Lambda operator -> body`

Now, we have another question, what is functional interface?

- *an interface that contains only one abstract method, they can have only one functionality to exhibit and it can have any number of default methods*

First we will see how to create functional interface.

Ex: *creating function interface*

```
@FunctionalInterface
public interface MyFuntionalInterface {

	void arithmeticOp(int operand);

	 /**
	 * Some default methods
	 */

}
```

@FunctionalInterface annotation *is used to ensure that the functional interface can't have more than one abstract method. In case more than one abstract methods are present, the compiler flags an 'Unexpected @FunctionalInterface annotation' message. However, it is not mandatory to use this annotation.*

Now, will see how we can use this functional interface in our program.

```
.........
	FuntionalInterface mFI_ADD_Func = (a) -> a + a;

	System.out.println("Add the value : " + mFI_ADD_Func.arithmeticOp(4));

	FuntionalInterface mFI_MUL_Func = (a) -> a * a;

	System.out.println("Multiply the value : " + mFI_MUL_Func.arithmeticOp(4));

	FuntionalInterface divideWithPrint_Func = (a) -> {
		System.out.println("Divide the value From lambda :");
		return a / a;
	};
	System.out.println(" --> " + divideWithPrint_Func.arithmeticOp(4));

.........
```

Ref : GIT - lambda with on demand functions in java 8

So, Lambda is nothing but function on demand which is not belongs to any class and can access variables declared outside its scope (not advisable).

Functionalities of Lambda

Exs : GIT - lambda examples

- *Enable to treat functionality as a method argument, or code as data.*
- *A function that can be created without belonging to any class.*
- *A lambda expression can be passed around as if it was an object and executed on demand*
- *A lambda operator can have "**()**" - zero parameters, "**(a)**" - one parameter, "**(a, b, c)**" multiple parameters, Lambda expressions are just like functions and they accept parameters just like functions (parameters depends on abstract method in the functional interface designed)*

Now, will see how the same interface in Java 7 works

```
.....
    MyFuntionalInterface mFI_ADD_Func = new MyFuntionalInterface() {
       @Override
       public int arithmeticOp(int a) {
              return a + a;
       }
    };

    System.out.println("Java7 impl - Add the value : " + mFI_ADD_Func.arithmeticOp(4));

    MyFuntionalInterface mFI_MUL_Func = new MyFuntionalInterface() {
       @Override
       public int arithmeticOp(int a) {
              return a * a;
       }
    };

    System.out.println("Java7 impl - Mul the value : " + mFI_MUL_Func.arithmeticOp(4));

.....
```

Ref : GIT - On demand functions in java 7

*Yes, in Java7 too, we can have an on-demand functionality, but it cost us to create an Anonymous **InnerClass/ or new classes to implements interface on function**,* 

Java7, but stills does the works but on cost of bit ugly code design and it will compile with three more class files.

So, the Magic, ***lambda expression***  *Java8's cool Dude...! Allow us to write an on demand functions with, beautiful code design.*

Some of functional interfaces in Java - *Runnable, ActionListener, Comparable and some java8 util.function package has Predicate, BinaryOperator, and Function, etc.*

We can make functional interface as a generic type (above all the java's functional interface are generic type) and write our code with desired data types and various functions. (Ex: Function as name tells we can apply any functionality to it.)

Cool right?

Here it is, can we have hands on to implement lambda, which will be the best practice and will also have experience on functionality?

We can skip if you guys want to move on to next topic and can do the hands on later. But

Skip, skip, skip ....

Use case – have an Employee class with firstName, lastName, age and salary.

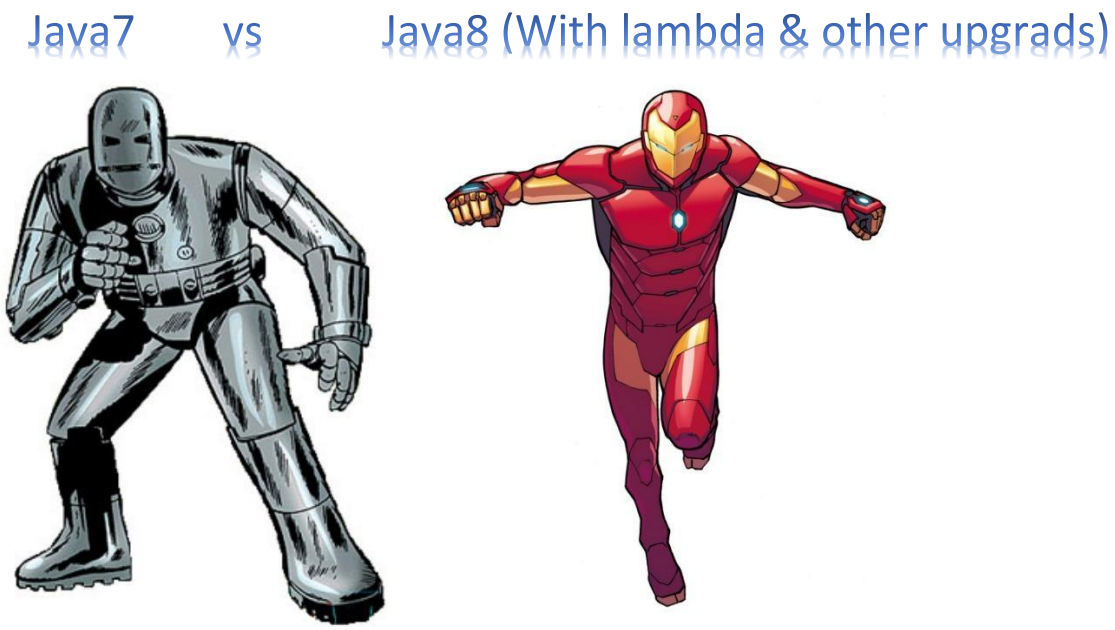
Conditions:

- *Sort by first name*
- *Sort by last name first letter*
- *Sort by last name last letter*
- *Sort by age and,*
- *Sort by salary*

It is easy with lambda,

Hints *- use Collections.sort() for sorting with Comparable/ comparator user interface.*

Ref : Git - lambda exercise



That's how the transformation design happened from java7 -> java8, still we have more API's & upgrade to know about.

2. The New Date/ Time API - *is introduced to cover the drawbacks of old date-time API.*

- ***Not Thread safe*** – Developer must deal with concurrency (In Java8 it is immutable).
- ***Poor design*** - Default Date starts from 1900.
- ***Difficult in time zone handling*** – new API has domain-specific design in mind.

Java 8 introduces a new date-time API under the package java.time. Following are some of the important classes introduced in java.time package

- ***Local*** – Simplified date-time API with no complexity of timezone handling.
- ***Zoned*** – Specialized date-time API to deal with various timezones.

Simple example to get** local **time and date, UTC.

LocalDate/LocalTime and LocalDateTime classes simplify the development where timezones are not required

```
LocalDateTime currentTime = LocalDateTime.now();
System.out.println("Current DateTime: " + currentTime);
System.out.println("Current Date: " + currentTime.toLocalDate());
System.out.println("Current Time: " + currentTime.toLocalTime());

Instant dateTime = Instant.now();
System.out.println("UTC DateTime: " + dateTime);
```

Ref : Git - Local Date Time

Java8, have more fine-grained control over our date and time representation

Simple example to handle zoned time.

Ref : Zone List Java

```
Instant dateTime = Instant.now();

System.out.println("Current Europe/London time:
"+dateTime.atZone(ZoneId.of("Europe/London")));

System.out.println("Current Atlantic/Azores time:
"+dateTime.atZone(ZoneId.of("Atlantic/Azores")));

System.out.println("Current Africa/Lagos time: "+dateTime.atZone(ZoneId.of("Africa/Lagos")));

ZonedDateTime zonedDate = ZonedDateTime.parse("2007-12-03T10:15:30+05:30[Asia/Karachi]");

System.out.println("Zoned Date : " + zonedDate);
```

Ref : Git - Zoned Date Time

Using java8 handling time zone becomes easy.

Some Special Mentions (Date and Time API features)

Ref : Git - Date Time Exercise

- *Formatting - Using the DateTimeFormat*
- *Difference in Time: Duration() and Period*
  - *Period – It deals with date based amount of time.* *(Zoom In)*
  - *Duration – It deals with time based amount of time.*
- *Chrono Units Enum - enum is added in Java 8 to replace the integer values used in old API*
- *Temporal Adjusters - used to perform the date mathematics*
- *Backward Compatibility - A toInstant() method is added to the original Date and Calendar objects, which can be used to convert them to the new Date-Time API. Use an ofInstant(Insant,ZoneId) method to get a LocalDateTime or ZonedDateTime object*

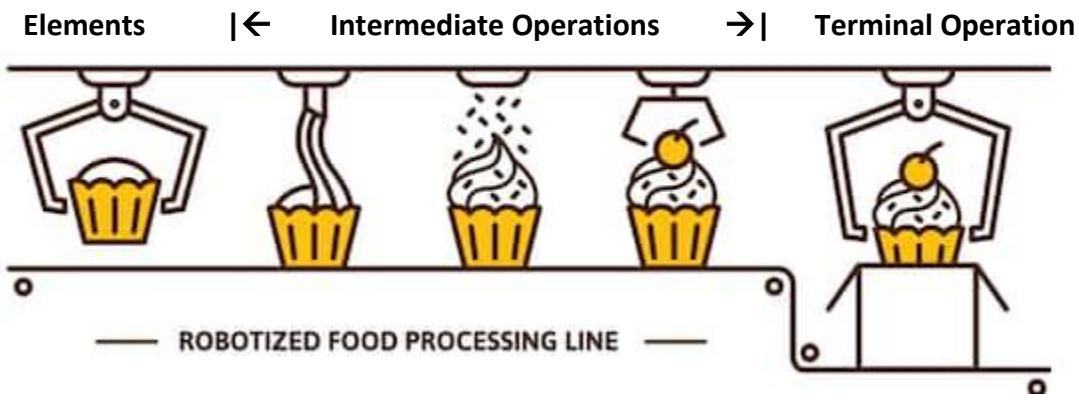
No hands On - 🙃 // but no stopping 😀

3. The Stream API – 

- *supports functional-style operations on streams of elements, such as map-reduce transformations on collections.*
- *stream operations are divided into intermediate and terminal operations.*
- *stream pipeline consists of a stream source, followed by zero or more intermediate operations, and a terminal operation*

How stream works?

Take below example



As above image represents, we are going to do the similar kind of process in our stream, the data flow depends on the operations we choose. (stream the list of elements -> apply the operations on the elements -> pack it).

Yes, it is that simple, if we understood, what Operations (ingredients/ design) we must apply and how we expected it (End product).

How to create stream?

There are many ways to create stream on object, array or list, we see few in following example

```
Space[] arrayOfSpaceObject = { new Space(1, "comet", 170), // temp in degree
                           new Space(2, "Meteorite", 3000),
                           new Space(3, "dwarf planet", -223),
                           new Space(4, "kuiper belt", -223),
                           new Space(5, "oort cloud", 4) };

// Streaming on Arrays using Stream of
List<Space> sorted = Stream.of(arrayOfSpaceObject)
                   .sorted((obj1, obj2) -> (int) (obj1.getTemperature() -obj2.getTemperature()))
                   .collect(Collectors.toList());

System.out.println("Sorted List :" + sorted);

// Streaming on List
List<Space> sortedOnId = sorted.stream().sorted(Comparator.comparing(Space::getId))
                        .collect(Collectors.toList());

System.out.println("Sorted List by Id :" + sortedOnId);

// Streaming on single object using stream of
Space ob = arrayOfSpaceObject[0];
System.out.println("Object modified :" + ob);

ob = Stream.of(ob).peek((object) -> object.setTemperature(object.getTemperature() * 10)
                  .findFirst().orElse(null);

System.out.println("Object modified :" + ob);
```

Ref : Git - few ways to create stream

We can also use Stream builder to create stream.

We should do hands on for each functions/ topic, as stream is vast, we may want to experience hands on to understand clearly.