Workshop:
Best of Java 9 – 15
Exercises

Procedure

This workshop is divided into several lecture parts, which introduce the subject Java 9 to 15, and gives an overview of the innovations. Following this, some exercises are to be solved by the participants - ideally in group work - on the computer.

Requirements

1) Current JDK 11, ideally also JDK 14/15 are installed,
2) Current Eclipse is installed (Alternatively: NetBeans or IntelliJ IDEA)

Attendees

- Developers with Java experience, as well as
- SW-Architects, who would like to learn/evaluate Java 9 to 15.

Course management and contact

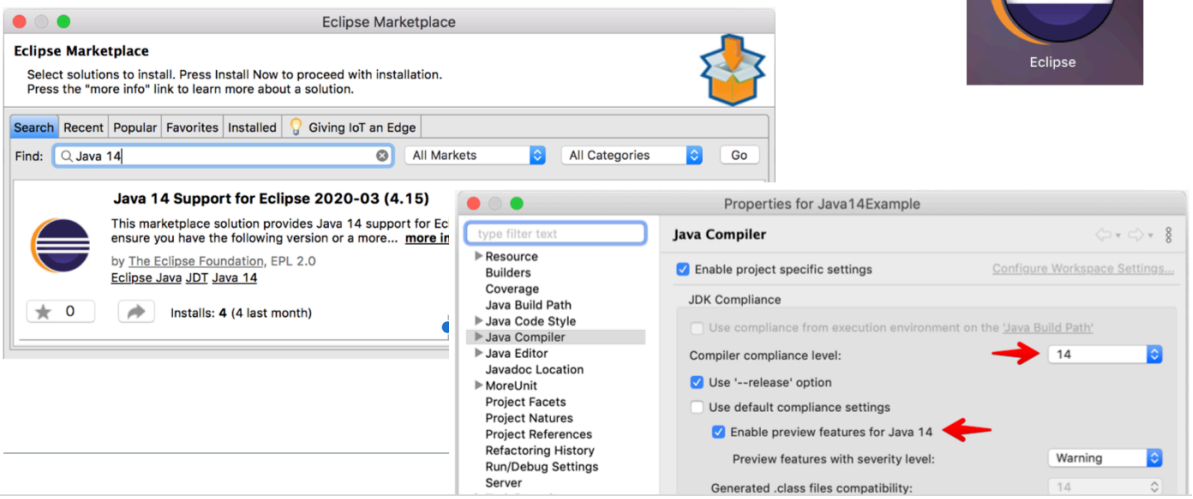
Michael Inden
Indepentent SW Consultant, Author and Trainer
E-Mail: michael.inden@hotmail.com
Blog: https://jaxenter.de/author/minden

Please do not hesitate to ask: Further courses (Java, Unit Testing, Design Patterns) are available on request as in-house training.

Configuration Eclipse / IntelliJ

Please keep in mind that we have to configure some small things before the exercises.

- **Eclipse 2020-09: Java 14 built in / Java 15 with plugin**
- **Activation of preview features required**



- **Activation of preview features required**

PART 1: Syntax Enhancements / News / API-Changes in Java 9 - 11

Objective: Learn about syntax innovations and various API extensions in Java 9 to 11 using examples.

Exercise 1 – Getting to know `var`

Get to know the new reserved word `var`.

Exercise 1a

Start the JShell or an IDE of your choice. Create a method `funWithVar()`. Define the variables `name` and `age` with the values `Mike` and `47`.

Exercise 1b

Expand your know-how regarding `var` and generics. Use it for the following definition. Initially create a local variable `personsAndAges` and then simplify with `var`:

```
Map.of("Tim", 47, "Tom", 7, "Mike", 47);
```

Exercise 1c

Simplify the following definition with var. What should be considered? Where's the difference?

```
List<String> names = new ArrayList<>();
ArrayList<String> names2 = new ArrayList<>();
```

Exercise 1d

Why do the following lambdas cause problems? How do you solve these?

```
var isEven = n -> n % 2 == 0;
var isEmpty = String::isEmpty;
```

Why then compile the following?

```
Predicate<Long> isEven = n -> n % 2 == 0;
var isOdd = isEven.negate();
```

Exercise 2 – Process Management

Identify the process ID and other properties of the current process. Use the interface `ProcessHandle` and its methods.

Exercise 2a

How much CPU time has the current process consumed and when was it started?

Exercise 2b

How many processes are currently running?

Exercise 2c

List all Java-processes. Use `Predicate<Info> isJavaProcess` for this task.

Exercise 2d

Try to terminate the current process. What happens then?

Exercise 3 – Collection Factory Methods

Define a list, set, and map using the Collection Factory methods `of()` which are newly introduced in JDK 9. The following program fragment with JDK 8 serves as a starting point.

```
private static void collectionsExampleJdk8()
{
       final List<String> names = Arrays.asList("Tim", "Tom", "Mike");
       System.out.println(names);

       final Set<Integer> numbers = new TreeSet<>();
       numbers.add(1);
       numbers.add(3);
       numbers.add(4);
       numbers.add(2);
       System.out.println(numbers);

       final Map<Integer, String> mapping = new HashMap<>();
       mapping.put(5, "five");
       mapping.put(6, "six");
       mapping.put(7, "seven");
       System.out.println(mapping);
}
```

Exercise 4 – Streams

The Stream API has been enhanced with methods that allow you to read elements only as long as a condition is met or to skip elements while a condition is met. The following two streams are used as starting point:

```
final Stream<String> values1 = Stream.of("a", "b", "c", "", "e", "f");
final Stream<Integer> values2 = Stream.of(1, 2, 3, 11, 22, 33, 7, 10);
```

Exercise 4a

Determine values from the stream `values1` until an empty string is found. Print out the values to the console.

Exercise 4b

In the stream `values2`, skip the values as long as the value is smaller than 10. Print out the values to the console.

Exercise 4c

What is the difference between the two methods `dropWhile()` and `filter()`?

Tip: The expected result is as follows:

```
takeWhile
a
b
c

dropWhile
11
22
33
7
10

with filter
11
22
33
10
```

Exercise5– Streams Take / Drop While

Extract the head and body information with appropriate predicates and the previously presented methods.

```
final Predicate<String> isBodyStart = // TODO
final Predicate<String> isBodyEnd = // TODO

final List<String> tokens = List.of("<html>",
      "<head>", "<title>This is TTLE</title>", "</head>",
      "<body>",
           "<h1>Hello everyone @ JAX London</h1>",
           "<p>Welcome to this hands-on lab</p>",
      "</body>",
    "</html>");

extractor(tokens, isBodyStart, isBodyEnd).forEach(System.out::println);
```

Tip: Create a help method with the following signature:

```
private static List<String> extractor(final List<String> tokens,
                                      final Predicate<String> isStart,
                                      final Predicate<String> isEnd)
```

Exercise 6 – The Class `Optional`

Given the following method, which performs a person search and, depending on the result of the match, calls the method `doHappyCase(person)` or otherwise `doErrorCase()`.

```
private static void findJdk8()
{
      final Optional<Person> opt = findPersonByName("Tim");
      if (opt.isPresent())
      {
            doHappyCase(opt.get());
      }
      else
      {
            doErrorCase();
      }

      final Optional<Person> opt2 = findPersonByName("UNKNOWN");
      if (opt2.isPresent())
      {
            doHappyCase(opt2.get());
      }
      else
      {
            doErrorCase();
      }
}
```

```
private static Optional<Person> findPersonByName(final String searchFor)
{
       final Stream<Person> persons = Stream.of(new Person("Mike"),
                                                new Person("Tim"),
                                                new Person("Tom"));

       return persons.filter(person -> person.getName().equals(searchFor)).
                      findFirst();

}

private static void doHappyCase(final Person person)
{
       System.out.println("Result: " + person);
}

private static void doErrorCase()
{
       System.out.println("not found");
}
```

Use the new methods from class `Optional<T>` to make the program fragment more elegant within a findJdk9() method that produces the following outputs like findJdk8():

```
Result: Person: Tim
not found$
```

Exercise 7 – The Class `Optional`

The following program fragment is given, which executes a multi-level search: first in the cache, then in memory, and finally in the database (just simulated here). This search chain is indicated by three `find()` methods and implemented as shown below.

```
static Optional<String> multiFindCustomerJdk8(final String customerId)
{
       final Optional<String> opt1 = findInCache(customerId);
       if (opt1.isPresent())
       {
              return opt1;
       }
       else
       {
              final Optional<String> opt2 = findInMemory(customerId);
              if (opt2.isPresent())
              {
                     return opt2;
              }
              else
              {
                     return findInDb(customerId);
              }
       }

}
```

```
private static Optional<String> findInMemory(final String customerId)
{
    final Stream<String> customers = Stream.of("Tim", "Tom", "Mike", "Andy");

    return customers.filter(name -> name.contains(customerId))
                    .findFirst();
}

private static Optional<String> findInCache(final String customerId)
{
    return Optional.empty();
}

private static Optional<String> findInDb(final String customerId)
{
    return Optional.empty();
}
```

Simplify the call chain using the new methods from the `Optional<T>` class. See how it all becomes clearer.

Exercise 8 – The Class `Collectors`

Exercise 8a

Filter all long names (> 5 characters) from the given list of names and provide the result values in the console.

```
final Stream<String> names = Stream.of("Tim", "Tom", "Michael",
                                       "Thomas", "Karthikeyan", "Marius");
```

Exercise 8b

Group the previously filtered names according to the first letter and provide the result values in the console. The expected result is:

```
{T=[Thomas], K=[Karthikeyan], M=[Michael, Marius]}
```

Exercise 8c

Combine now the knowledge about a filtering when grouping. Use the following map as a starting point to group only all adults according to the first letter:

```
final Map<String, Long> personAgeMapping = Map.of("Tim", 47L, "Tom", 12L,
                                                  "Michael", 47L, "Max", 5L);
```

The expected result is:

```
{T=[Tim=47], M=[Michael=47, Max=5]}
```

Exercise 8d

Deepen your knowledge of combining collectors. The above result should be restricted to the name using collector `mapping()`. The expected result is:

```
{T=[Tim], M=[Max, Michael]}
```

Exercise 8e

Compress a stream with multiple sets of letters to a set.

```
final Stream<Set<String>> characters = Stream.of(Set.of("a", "c", "e"),
                                                 Set.of("a", "b"),
                                                  Set.of("a", "b", "c", "d"),
                                               Set.of("a", "b", "c", "d", "f"));
```

The expected result is:

```
[a, b, c, d, e, f]
```

Exercise 9: Strings

The processing of strings has been made easier in Java 11 with some useful methods.

Exercise 9a

Use the following stream as input:

```
Stream.of(2,4,7,3,1,9,5)
```

Implement a method that outputs the numbers one below the other, repeated as often as the digit as follows:

```
22
4444
7777777
333
1
999999999
55555
```

Exercise 9b

Modify the output so that the numbers are right aligned with a maximum of 10 characters:

```
‘      4444’
‘   7777777’
‘ 999999999’
```

Tip: Use a helper method

```
private static String formatRightAligned(final int num,
                                         final int desiredLength)
{
      // TODO
}
```

Exercise 9c
Modify the whole thing so that instead of spaces leading zeros are output, as follows:

```
‘0000004444’
‘0007777777’
‘0999999999’
```

Bonus: Expand the whole thing so that any fill characters can be used.

Exercise 9d
Modify the output so that the largest numbers are output last. Find at least two variants:

```
Stream.of(2,4,7,3,1,9,5).sorted().map(mapper1)
Stream.of(2,4,7,3,1,9,5).map(mapper2)
```

Where is the difference?

PART 2: Multi-Threading and Reactive Streams

Objective: In this section, we will look at more advanced APIs, such as CompletableFuture <T> and Reactive Streams.

Exercise 1 – The class CompletableFuture<T>

Refresh your knowledge about the class CompletableFuture <T>.

Exercise 1a

Analyze the following program lines, which read a file asynchronously in the main () method. Then two filters are defined, which are then executed with thenApplyAsync(), if the file is actually read. With the addition Async () both filter actions happen in parallel. Finally, the results must be brought together again. For this there is the method is thenCombine(), where a combination function must be passed.

```
public static void main(final String[] args) throws IOException,
                                                     InterruptedException,
                                                     ExecutionException
{
    final Path exampleFile = Paths.get("./Example.txt");

    // Possibly longer lasting action
    final CompletableFuture<List<String>> contents = CompletableFuture
                    .supplyAsync(extractWordsFromFile(exampleFile));
    contents.thenAccept(text -> System.out.println("Initial: " + text));

    // Run filters in parallel
    final CompletableFuture<List<String>> filtered1 =
                            contents.thenApplyAsync(removeIgnorableWords());
    final CompletableFuture<List<String>> filtered2 =
                            contents.thenApplyAsync(removeShortWords());

    // Bring the results together
    final CompletableFuture<List<String>> result =
                                filtered1.thenCombine(filtered2,
                                                      calcIntersection());

    System.out.println("result: " + result.get());
}

private static BiFunction<? super List<String>,
                          ? super List<String>,
                          ? extends List<String>> calcIntersection()
{
    return (list1, list2) ->
    {
        list1.retainAll(list2);
        return list1;
    };
}
```

Exercise 1b

Imagine that one would run parallel data retrievals that provide a list as a result and would like to combine the results. How does the combination function change then? Rewrite the above code to use two methods: retrieveData1 () and retrieveData2 () and combineResults() (analogous to calcIntersection ()). Start with the following lines:

```
public static void main(final String[] args) throws IOException,
                                                     InterruptedException,
                                                     ExecutionException

      {
              final CompletableFuture<List<String>> data1 =
                                  CompletableFuture.supplyAsync(()->retrieveData1());
```

For two lists with names, the result should be something like this:

```
retrieveData1(): ForkJoinPool.commonPool-worker-9
combineResults(): main
retrieveData2(): ForkJoinPool.commonPool-worker-2
result: [Jennifer, Lili, Carol, Tim, Tom, Mike]
```

Exercise 2 – The class CompletableFuture<T>

Experiment with the class CompletableFuture <T> and the new methods introduced in JDK 9: failedFuture(), orTimeOut() and completeOnTimeout(). Use your knowledge about exceptionally() to handle exceptions during processing. Start with the following basic structure and complete the error and time-out handling.

```
public static void main(final String[] args) throws ExecutionException
{
    // CompletableFuture.// TODO
    //   .exceptionally(ex -> { System.out.println("ALWAYS FAILING"); return -1;});

    CompletableFuture.supplyAsync(() -> longRunningCreateMsg(5))
                     // TODO
                     .thenAccept(CompletableFutureJdk9Example::notifySubscribers);

    CompletableFuture.supplyAsync(() -> longRunningCreateMsg(5))
                     // TODO
                     .thenAccept(CompletableFutureJdk9Example::notifySubscribers);

    sleepInSeconds(10); // Give Completablefutures the chance to complete
}

public static String longRunningCreateMsg(final int durationInSecs)
{
    System.out.println(getCurrentThread() + " >>> longRunningCreateMsg");
    sleepInSeconds(durationInSecs);
```

```
    System.out.println(getCurrentThread() + " <<< longRunningCreateMsg");
    return "longRunningCreateMsg";
}

public static String getCurrentThread()
{
    return Thread.currentThread().getName();
}

public static void notifySubscribers(final String msg)
{
    System.out.println(getCurrentThread() + " notifySubscribers: " + msg);
}
```

Output is expected to be analogous to the following:

```
ALWAYS FAILING
ForkJoinPool.commonPool-worker-9 >>> longRunningCreateMsg
ForkJoinPool.commonPool-worker-2 >>> longRunningCreateMsg
CompletableFutureDelayScheduler notifySubscribers: TIMEOUT-FALLBACK
CompletableFutureDelayScheduler notifySubscribers: exception occurred:
java.util.concurrent.TimeoutException
ForkJoinPool.commonPool-worker-2 <<< longRunningCreateMsg
ForkJoinPool.commonPool-worker-9 <<< longRunningCreateMsg
```

Exercise 3 – Reactive Streams

Consider a program Exercise3_ReactiveStreamsExample with a `Publisher<String>` publishing names from a list to registered `Subscribers<String>` in the doWork () method:

```
public class Exercise3_ReactiveStreamsExample
{
    public static void main(final String[] args) throws IOException,
                                                         InterruptedException
    {
        final NamePublisher publisher = new NamePublisher();
        publisher.subscribe(new ConsoleOutSubscriber());

        publisher.doWork();

        Thread.sleep(10_000); // auf das Ende der Verarbeitung warten
    }
}
```

Outputs should be as follows:

```
2018-04-11T18:00:09.788635 onNext(): Tim
2018-04-11T18:00:10.742126 onNext(): Tom
…
```

The Publisher<String> is implemented as follows:

```
public class NamePublisher implements Flow.Publisher<String>
{
	private static final List<String> names = Arrays.asList("Tim", "Tom",
	   "Mike", "Alex", "Babs", "Jörg", "Karthi", "Marco", "Peter", "Numa“);

	private int counter = 0;
	private final SubmissionPublisher<String> publisher =
	                                                new SubmissionPublisher<>();

	public void subscribe(final Subscriber<? super String> subscriber)
	{
		publisher.subscribe(subscriber);
	}

	public void doWork()
	{
		for (;;)
		{
			final String item = names.get(counter++ % names.size());
			publisher.submit(item);

			try
			{
				Thread.sleep(1_000);
			}
			catch (InterruptedException e)
			{ // ignore }
		}
	}
}
```

The following class ConsoleOutSubscriber lists all occurrences on the console:

```
class ConsoleOutSubscriber implements Subscriber<String>
{
	public void onSubscribe(final Subscription subscription)
	{
		subscription.request(Long.MAX_VALUE);
	}

	public void onNext(final String item)
	{
		System.out.println(LocalDateTime.now() + " onNext(): " + item);
	}

	public void onComplete()
	{
		System.out.println(LocalDateTime.now() + " onComplete()");
	}

	public void onError(final Throwable throwable)
	{
		throwable.printStackTrace();
	}
}
```

Based on the above class ConsoleOutSubscriber, implement a separate `Subscriber<String>` called SkipAndTakeSubscriber, which skips the first n occurrences and then outputs m occurrences. After that, the communication should be stopped.

Expenses are expected to be approximately as follows:

```
SkipAndTakeSubscriber - Subscription:
java.util.concurrent.SubmissionPublisher$BufferedSubscription@23c34259
SkipAndTakeSubscriber 1 x onNext()
SkipAndTakeSubscriber 2 x onNext()
SkipAndTakeSubscriber 3 x onNext()
Mike
SkipAndTakeSubscriber 4 x onNext()
Alex
SkipAndTakeSubscriber 5 x onNext()
Babs
SkipAndTakeSubscriber 6 x onNext()
Jörg
SkipAndTakeSubscriber 7 x onNext()
Karthi
```

PART 3: Misc

Objective: In this section we want to learn about some practical API extensions: `Arrays` as well as `LocalDate` and `InputStream`.

Exercise 1 – The class `Arrays`

Determine if the text described by search appears in the original text. To do this, first convert the strings to the type byte[] and find the position of match of `search`:

```
final String originaltext = "BLABLASECRET-INFO:42BLABLA";
final String search = "SECRET-INFO:42";
```

Exercise 2 – The class `Arrays`

Determine for the two arrays given below

```
final byte[] first =  { 1,1,0,1,1,0,1,1,1,1,0,1,1 };
final byte[] second = { 1,1,0,1,1,0,1,0,1,1,1,1,1 };
```

a) the first deviation and
b) the subsequent deviation.

Exercise 3 – The class `Arrays`

Compare the two arrays given below:

```
final byte[] first =  "ABCDEFGHIJk".getBytes();
final byte[] second = "XYZABCDEXYZ".getBytes();
```

a) Which is «bigger»?
b) From which position first is greater than second, if you always remove one letter from second in every further comparison. For a better understanding, log the compared values for all start positions.

Exercise 4 – The Class `LocalDate`

Get to know useful things in the LocalDate class.

Exercise 4a

Write a program that counts all Sundays in 2017.

Exercise 4b

List the Sundays, starting with the 5th and ending with the 10th. The result should be as follows:

```
[2017-02-05, 2017-02-12, 2017-02-19, 2017-02-26, 2017-03-05]
```

Exercise 5 – The class `LocalDate`

Learn useful things in the LocalDate class.

Exercise 5a

Write a program that determines all Fridays 13th in the years 2013 to 2017. Use the following lines as starting point:

```
final LocalDate start = LocalDate.of(2013, 1, 1);
final LocalDate end = LocalDate.of(2018, 1, 1);
```

As a result, the following values should appear:

```
[2013-09-13, 2013-12-13, 2014-06-13, 2015-02-13, 2015-03-13, 2015-11-13,
 2016-05-13, 2017-01-13, 2017-10-13]
```

Group the occurrences by year. The following issues should appear:

```
Year 2013: [2013-09-13, 2013-12-13]
Year 2014: [2014-06-13]
Year 2015: [2015-02-13, 2015-03-13, 2015-11-13]
Year 2016: [2016-05-13]
Year 2017: [2017-01-13, 2017-10-13]
```

Exercise 5b

How many times have there been February 29 between the beginning of 2010 and the end of 2017?

```
final LocalDate start2010 = LocalDate.of(2010, 1, 1);
final LocalDate end2017 = LocalDate.of(2018, 1, 1);
```

Exercise 5c

How often was your birthday a Sunday between the beginning of 2010 and the end of 2017? For the 7th of February the following result should be calculated:

```
My Birthday on Sunday between 2010-2017: [2010-02-07, 2016-02-07]
```

Exercise 6 – The Class `InputStream`

Write a program that creates a copy of a file given by a filename. Simplified Java 8-based source code below:

```
    private static void copyFileUsingStream(final File source,
                                            final File dest) throws IOException
    {
        try (final InputStream is = new FileInputStream(source);
             final OutputStream os = new FileOutputStream(dest))
        {
            final byte[] buffer = new byte[2048];
            int length;
            while ((length = is.read(buffer)) > 0)
            {
                os.write(buffer, 0, length);
            }
        }
    }
```

Exercise 7 – The Class `InputStream`

Simplify the following Java 8-based source code and write methods that do the following:

a) Read in the data from an InputStream completely.
b) Only read the first 6 characters from an InputStream.
c) Transfer all data from an InputStream to an OutputStream.

```
public static void main(final String[] args) throws IOException
{
    final byte[] buffer = { 72, 65, 76, 76, 79 };

    final byte[] resultJdk8 = readAllBytesJdk8(/* TODO */);
    System.out.println(Arrays.toString(resultJdk8));

    transferToJdk8(/* TODO */ System.out);
}

private static byte[] readAllBytesJdk8(final InputStream is) throws IOException
{
    try (final ByteArrayOutputStream os = new ByteArrayOutputStream())
    {
        transferToJdk8(is, os);
        os.flush();

        return os.toByteArray();
    }
}

private static void transferToJdk8(final InputStream in,
                                   final OutputStream out) throws IOException
{
    final byte[] buffer = new byte[1024];
```

```
        int len;
        while ((len = in.read(buffer)) != -1)
        {
            out.write(buffer, 0, len);
        }
    }
```

Exercise 8: Enhancement in the class Reader

Transfer the content from a `StringReader` to a file hello.txt. Read this again and give out the content. Complete the following lines:

```
var textFile = new File("hello.txt");
var sr = new StringReader("Hello\nWorld");
try (Writer bfw = null /*TODO*/)
{
      // TODO
}

var sw = new StringWriter();
try (Reader bfr = null /*TODO*/)
{
      // TODO
}
```

Exercise 9: Strings und Files

Until Java 11 it was a bit difficult to write texts directly into a file or to read them from it. Now you can use the methods `writeString()` and `readString()` from the class `Files`. Use them to write the following lines to a file. Read this again and prepare a `List<String>` from it.

```
1: One
2: Two
3: Three
```

Exercise 10: Predicates

Simplify the following Predicates in terms of negation:

```
Predicate<Long> isEven = n -> n % 2 == 0;
var isOdd = isEven.negate();

Predicate<String> isBlank = String::isBlank;
var notIsBlank = isBlank.negate();
```

Exercise 11 – HTTP/2

The following HTTP communication is given, which accesses the Oracle Web page and formats it textually.

```
private static void readOraclePageJdk8() throws MalformedURLException,
                                                 IOException
{
    final URL oracleUrl = new URL("https://www.oracle.com/index.html");
    final URLConnection connection = oracleUrl.openConnection();

    final String content = readContent(connection.getInputStream());
    System.out.println(content);
}

public static String readContent(final InputStream is) throws IOException
{
    try (final InputStreamReader isr = new InputStreamReader(is);
         final BufferedReader br = new BufferedReader(isr))
    {
        final StringBuilder content = new StringBuilder();

        String line;
        while ((line = br.readLine()) != null)
        {
            content.append(line + "\n");
        }

        return content.toString();
    }
}
```

Exercise 11a

Convert the source code to use the new HTTP/2 API from JDK 11. Use the classes `HttpRequest` and `HttpResponse` and create a method `printResponseInfo(HttpResponse)`, which reads the body analogous to the method `readContent(InputStream)` above and also provides the HTTP status code.
Start with the following program fragment:

```
private static void readOraclePageJdk11() throws URISyntaxException,
                                                 IOException,
                                                 InterruptedException
{
    final URI uri = new URI("https://www.oracle.com/index.html");
    final HttpClient httpClient = // TODO
    final HttpRequest request = // TODO
    final BodyHandler<String> asString = // TODO
    final HttpResponse<String> response = // TODO

    printResponseInfo(response);
}

private static void printResponseInfo(final HttpResponse<String> response)
{
    final int responseCode = response.statusCode();
    final String responseBody = response.body();
    final HttpHeaders headers = response.headers();
```

```
        System.out.println("Status:  " + responseCode);
        System.out.println("Body:    " + responseBody);
        System.out.println("Headers: " + headers.map());
    }
```

Exercise 11b
Start the queries asynchronously by calling `sendAsync()` and process the received `CompletableFuture<HttpResponse>`.

Aufgabe 12 – REST-CALL

Imagine that you need to calculate the exchange rates for a period of several months. On the net, these can be retrieved via REST at https://exchangeratesapi.io/. For this you can use the HTTP/2-API profitably, for which we write a method `performGet()`. To define the time period we use the innovation `datesUntil()` to create a `Stream<LocalDate>` with monthly increments. With a `TemporalAdjuster` we jump to the end of the month and then execute the GET call.

For the period January to October 2020 we expect the following issues:

```
2020-01-31 reported {"rates":{"CHF":1.0694},"base":"EUR","date":"2020-01-31"}
2020-02-29 reported {"rates":{"CHF":1.0614},"base":"EUR","date":"2020-02-28"}
2020-03-31 reported {"rates":{"CHF":1.0585},"base":"EUR","date":"2020-03-31"}
2020-04-30 reported {"rates":{"CHF":1.0558},"base":"EUR","date":"2020-04-30"}
2020-05-31 reported {"rates":{"CHF":1.072},"base":"EUR","date":"2020-05-29"}
2020-06-30 reported {"rates":{"CHF":1.0651},"base":"EUR","date":"2020-06-30"}
2020-07-31 reported {"rates":{"CHF":1.0769},"base":"EUR","date":"2020-07-31"}
2020-08-31 reported {"rates":{"CHF":1.0774},"base":"EUR","date":"2020-08-31"}
2020-09-30 reported {"rates":{"CHF":1.0804},"base":"EUR","date":"2020-09-30"}
```

Exercise 13 – Direct compilation and execution

Write a HelloWorld class in the package `java11.direct.compilation` and save it in a Java file of the same name (or use `cat > HelloWorld.java` *Ctrl-C). Then execute these directly with the command java.

```
public class Exercise1_HelloWorld
{
    public static void main(String... args)
    {
        System.out.println("Hello Execute After Compile");

        var procesInfo = ProcessHandle.current().info();
        System.out.println(procesInfo);
    }
}
```

What is special about that?

PART 4/5: News in Java 12 / 13 / 14

Objective: In this section we will look at extensions and API improvements in Java 12 & 13 & 14.

Exercise 1 – Syntax changes for switch

Simplify the following source code with a conventional switch-case with the new syntax.

```
private static void dumbEvenOddChecker(int value)
{
      String result;

      switch (value)
      {
      case 1, 3, 5, 7, 9:
            result = "odd";
            break;

      case 0, 2, 4, 6, 8, 10:
            result = "even";
            break;

      default:
            result = "only implemented for values < 10";
      }

      System.out.println("result: " + result);
}
```

Exercise 1a

First use the Arrow syntax to write the method shorter and clearer.

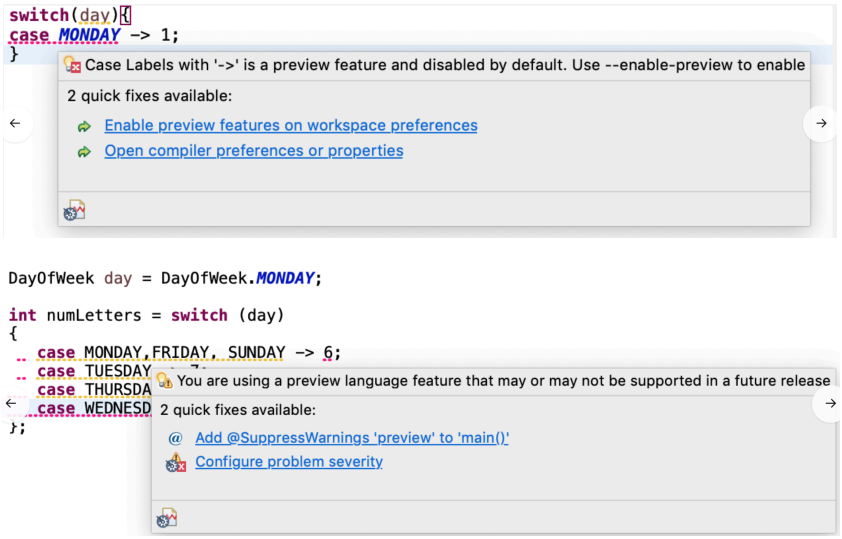
Exercise 1b

Now use the possibility to specify returns directly and change the signature in `String dumbEvenOddChecker(int value).`

Exercise 1c

Convert the above code so that it uses the special form "yield with return value".

Tips: Activation of the preview feature and suppression of warnings:



Exercise 2: The class `CompactNumberFormat`

Write a program to output and parse 1,000, 1,000,000 and 1,000,000,000 depending on locale and style. Use the Locale GERMANY for SHORT and ITALY for LONG.

Use the following values for parsing:

```
List.of("13 KILO", "1 Mio.", "1 Mrd.")
List.of("1 mille", "1 milione")
```

Exercise 3: Strings

The processing of strings has been extended by two methods in Java 12. First, get to know `indent()` better.

Exercise 3a

Enter the following input by 7 characters, output this and remove 3 more characters from the indentation.

```
String originalString = "first_line\nsecond_line\nlast_line";
```

Exercise 3b

What happens if you put a left-aligned text with negative values for the indent? What happens if you use an -10 index for subsequent input?

```
String multipleIndendedString =
       "class A {\n    public static void main(String[] args) {" +
       "\n        System.out.println(\"Hello\"";
```

Exercise 4: Strings

The processing of strings has been extended by two methods in Java 12. Learn more about `transform()`. Given the following comma-separated input:

```
var csvText = "HELLO,WORKSHOP,PARTICIPANTS,!,LET'S,HAVE,FUN";
```

Exercise 4a

Convert these completely to lowercase and replace the commas with spaces.

Exercise 4b

Use other transformations and replace HELLO with the Swiss greeting "GRÜEZI", then split the whole thing into individual components, resulting in the following list as result:

```
[GRÜEZI, workshop, participants, !, let's, have, fun]
```

Exercise 5: Teeing-Collector

Use the Teeing Collector to find both minimum and maximum in one pass. Start with the following lines:

```
Stream<String> values = Stream.of("CCC", "BB", "A", "DDDD");
List<Optional<String>> optMinMax = values.collect(teeing(…
```

Exercise 6: Teeing- Collector

Vary the `BiFunction` to properly influence the results of the Teeing Collector.
Start with the following lines and complete them at the marked places:

```
var names = Stream.of("Michael", "Tim", "Tom", "Mike", "Bernd");

final Predicate<String> startsWithMi = text -> text.startsWith("Mi");
final Predicate<String> isShort = text -> text.length() <= 4;

final BiFunction<List<String>, List<String>, List<List<String>>>
      combineResults = (list1, list2) -> List.of(list1, list2);

final BiFunction<List<String>, List<String>, Set<String>>
      combineResultsUnique = null; // TODO;

final BiFunction<List<String>, List<String>, Set<String>>
      combineResultsIntersection = null; // TODO;

var result = names.collect(teeing(
                           filtering(startsWithMi, toList()),
                           filtering(isShort, toList()),
                           combineResults));
```

The expected results are

- `combineResults: [[Michael, Mike], [Tim, Tom, Mike]]`
- `combineResultsUnique: [Mike, Tom, Michael, Tim]`
- `combineResultsIntersection: [Mike]`

Exercise 7: Teeing-Collector

Use a Teeing Collector to find all cities in Europe by name, as well as the number of cities in Asia. Start with the following lines:

```
Stream<City> exampleCities = Stream.of(
                  new City("Zürich", "Europe"),
                  new City("Bremen", "Europe"),
                  new City("Kiel", "Europe"),
                  new City("San Francisco", "America"),
                  new City("Aachen", "Europe"),
                  new City("Hong Kong", "Asia"),
                  new City("Tokyo", "Asia"));

Predicate<City> isInEurope = city -> city.locatedIn("Europe");
Predicate<City> isInAsia = city -> city.locatedIn("Asia");

var result = exampleCities.collect(teeing(…
```

Given the class City is as follows:

```
static class City
{
      private final String name;
      private final String region;

      public City(final String name, final String region)
      {
            this.name = name;
            this.region = region;
      }

      public String getName()
      {
            return name;
      }

      public String getRegion()
      {
            return region;
      }

      public boolean locatedIn(final String region)
      {
            return this.region.equalsIgnoreCase(region);
      }
}
```

Exercise 8 – Text Blocks

Simplify the following source code with a conventional string that spans multiple lines and use the syntax introduced in Java 13.

```
String multiLineStringOld = "THIS IS\n" +
            "A MULTI\n" +
            "LINE STRING\n" +
            "WITH A BACKSLASH \\\n";

String multiLineHtmlOld = "<html>\n" +
            "    <body>\n" +
            "        <p>Hello, world</p>\n" +
            "    </body>\n" +
            "</html>";

String java13FeatureObjOld = ""
              + "{\n"
              + "    version: \"Java13\",\n"
              + "    feature: \"text blocks\",\n"
              + "    attention: \"preview!\"\n"
              + "}\n";
```

Exercise 9 – Text Blocks with Placeholders

Simplify the following source code with a conventional string that spans multiple lines and use the syntax introduced in Java 13:

```
String multiLineStringWithPlaceHoldersOld =
       String.format("HELLO \"%s\"!\n" +
                     "  HAVE %s\n" +
                     "  NICE \"%s\"!",
                     new Object[]{"WORLD", "A", "DAY"});

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

Produce the following output with the new syntax:

```
HELLO "WORLD"!
  HAVE A
  NICE "DAY"!
```

Exercise 10 – Record Basics

Two simple classes are given, which represent pure data containers and thus only provide a public attribute. Convert them into records:

```
class Square
{
     public final double sideLength;

     public Square(final double sideLength)
     {
          this.sideLength = sideLength;
     }
}

class Circle
{
     public final double radius;

     public Circle(final double radius)
     {
          this.radius = radius;
     }
}
```

What are the advantages - apart from the shorter spelling - of using records instead of separate classes?

Exercise 11 – Record

Based on the record shown below, create two methods that produce JSON and XML output. Add a validation check so that the last name and first name are at least 3 characters long and the birthday is not in the future.

```
record Person(String firstName, String lastName,
              LocalDate birthday) {}
```

```
<Person>
   <firstName>Michael</firstName>
   <lastName>Inden</lastName>
   <birthday>1971-02-07</birthday>
</Person>
```

```
{
   "firstName" : "Michael",
   "lastName" : "Inden",
   "birthday" : "1971-02-07"
}
```

Exercise 12 – `instanceof` Basics

Given are the following lines with an `instanceof` and a cast. Simplify the whole thing with the new features of Java 14.

```
Object obj ="BITTE ein BIT";

if (obj instanceof String)
{
     final String str = (String)obj;
     if (str.contains("BITTE"))
     {
          System.out.println("It contains the magic word!");
    }
}
```

Exercise 13 – `instanceof` and `record`

Simplify the source code using the syntax innovations in `instanceof` and then using the special features in Records.

```
record Square(double sideLength) {
}

record Circle(double radius) {
}

public double computeAreaOld(final Object figure)
{
     if (figure instanceof Square)
     {
          final Square square = (Square) figure;
          return square.sideLength * square.sideLength;
     }
     else if (figure instanceof Circle)
     {
          final Circle circle = (Circle) figure;
          return circle.radius * circle.radius * Math.PI;
     }
     throw new IllegalArgumentException("figure is not a
recognized figure");
}
```

Although we have certainly achieved an improvement in terms of readability and number of lines by using `instanceof`, several of these checks indicate a violation of the open-closed principle, one of the SOLID principles of good design. What would an object-oriented design be? The answer in this case is simple: Often `instanceof` checks can be avoided by introducing a base type. **Simplify the whole thing with an interface `BaseFigure` and use it appropriately.**

Bonus
Introduce with rectangles another type of figures. However, this should not require any modifications in the `computeArea()` method.