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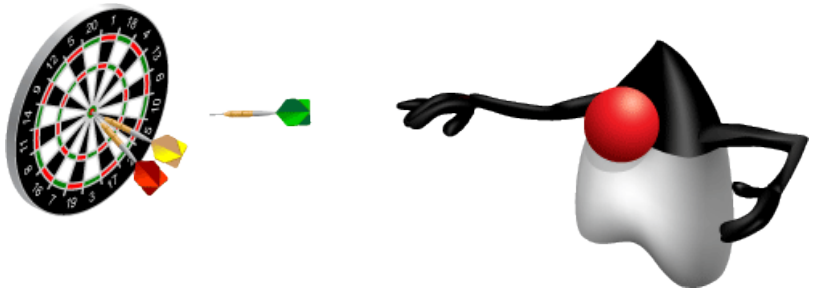
Collections, Streams, and Filters

Objectives

After completing this lesson, you should be able to:

- Describe the Builder pattern
- Iterate through a collection by using lambda syntax
- Describe the Stream interface
- Filter a collection by using lambda expressions
- Call an existing method by using a method reference
- Chain multiple methods
- Define pipelines in terms of lambdas and collections



Collections, Streams, and Filters

- Iterate through collections using forEach
- Streams and Filters

The Person Class

- Person class
  - Attributes like name, age, address, etc.
- Class created by using the Builder pattern
  - Generates a collection persons for examples
- RoboCall Example
  - An app for contacting people via mail, phone, email
  - Given a list of people query for certain groups
  - Used for test and demo
- Groups queried for
  - Drivers: Persons over the age of 16
  - Draftees: Male persons between 18 and 25 years old
  - Pilots: Persons between 23 and 65 years old

Person Properties

- A Person has the following properties:

```
 9 public class Person {
10   private String givenName;
11   private String surName;
12   private int age;
13   private Gender gender;
14   private String eMail;
15   private String phone;
16   private String address;
17   private String city;
18   private String state;
19   private String code;
```

Builder Pattern

- Allows object creation by using method chaining
  - Easier-to-read code
  - More flexible object creation
  - Object returns itself
  - A fluent approach
- Example

```
260     people.add(
261       new Person.Builder()
262             .givenName("Betty")
263             .surName("Jones")
264             .age(85)
265             .gender(Gender.FEMALE)
266             .email("betty.jones@example.com")
267             .phoneNumber("211-33-1234")
272             .build()
273     );
```

Collection Iteration and Lambdas

- RoboCall06 Iterating with `forEach`

```
 9 public class RoboCallTest06 {
10
11   public static void main(String[] args){
12
13     List<Person> pl = Person.createShortList();
14
15     System.out.println("\n=== Print List ===");
16     pl.forEach(p -> System.out.println(p));
17
18   }
19 }
```

RoboCallTest07: Stream and Filter

```
10 public class RoboCallTest07 {
11
12   public static void main(String[] args){
13
14     List<Person> pl = Person.createShortList();
15     RoboCall05 robo = new RoboCall05();
16
17     System.out.println("\n=== Calling all Drivers Lambda
===");
18     pl.stream()
19         .filter(p -> p.getAge() >= 23 && p.getAge() <= 65)
20         .forEach(p -> robo.roboCall(p));
21
22   }
23 }
```

RobocallTest08: Stream and Filter Again

```
10 public class RoboCallTest08 {
11
12   public static void main(String[] args){
13
14     List<Person> pl = Person.createShortList();
15     RoboCall05 robo = new RoboCall05();
16
17     // Predicates
18     Predicate<Person> allPilots =
19         p -> p.getAge() >= 23 && p.getAge() <= 65;
20
21     System.out.println("\n=== Calling all Drivers Variable
===");
22     pl.stream().filter(allPilots)
23         .forEach(p -> robo.roboCall(p));
24   }
```

SalesTxn Class

- Class used in examples and practices to follow
- Stores information about sales transactions
  - Seller and buyer
  - Product quantity and price
- Implemented with a Builder class
- Buyer class
  - Simple class to represent buyers and their volume discount level
- Helper enums
  - BuyerClass: Defines volume discount levels
  - State: Lists the states where transactions take place
  - TaxRate: Lists the sales tax rates for different states

Java Streams

- Streams
  - `java.util.stream`
  - A sequence of elements on which various methods can be chained
- Method chaining
  - Multiple methods can be called in one statement
- Stream characteristics
  - They are immutable.
  - After the elements are consumed, they are no longer available from the stream.
  - A chain of operations can occur only once on a particular stream (a pipeline).
  - They can be serial (default) or parallel.

The Filter Method

- The Stream class converts collection to a pipeline
  - Immutable data
  - Can only be used once and then tossed
- Filter method uses Predicate lambdas to select items.
- Syntax:

```
15          System.out.println("\n== CA Transations Lambda ==");
16          tList.stream()
17              .filter(t -> t.getState().equals("CA"))
18              .forEach(SalesTxn::printSummary);
```

Method References

In some cases, the lambda expression merely calls a class method.

- `.forEach(t -> t.printSummary())`

- Alternatively, you can use a method reference
  - `.forEach(SalesTxn::printSummary));`
- You can use a method reference in the following situations:
  - Reference to a static method
    - `ContainingClass::staticMethodName`
  - Reference to an instance method
  - Reference to an instance method of an arbitrary object of a particular type (for example, `String::compareToIgnoreCase`)
  - Reference to a constructor
    - `ClassName::new`

Method Chaining

- Pipelines allow method chaining (like a builder).
- Methods include filter and many others.
- For example:

```
21          tList.stream()
22              .filter(t -> t.getState().equals("CA"))
23              .filter(t -> t.getBuyer().getName()
24                  .equals("Acme Electronics"))
25              .forEach(SalesTxn::printSummary);
```

Method Chaining

- You can use compound logical statements.
- You select what is best for the situation.

```
15          System.out.println("\n== CA Transations for ACME ==");
16          tList.stream()
17              .filter(t -> t.getState().equals("CA") &&
18                  t.getBuyer().getName().equals("Acme Electronics"))
19              .forEach(SalesTxn::printSummary);
20
21          tList.stream()
22              .filter(t -> t.getState().equals("CA"))
23              .filter(t -> t.getBuyer().getName()
24                  .equals("Acme Electronics"))
25              .forEach(SalesTxn::printSummary);
```

Pipeline Defined

- A stream pipeline consists of:
  - A source
  - Zero or more intermediate operations
  - One terminal operation
- Examples
  - Source: A Collection (could be a file, a stream, and so on)
  - Intermediate: Filter, Map
  - Terminal: `forEach`

Summary

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Practice Overview

- Practice 8-1: Update RoboCall to use Streams
- Practice 8-2: Mail Sales Executives using Method Chaining
- Practice 8-3: Mail Sales Employees over 50 using Method Chaining
- Practice 8-4: Mail Male Engineering Employees Under 65 Using Method Chaining