Interfaces and Lambda Expressions

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`Java` integrates aspects of functional programming in the object-oriented approach.

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Such sequence can take many forms!

Interfaces at work

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- test if there is another element in the list;
- get the next element.

These informal descriptions allow us to derive the following interface:

```
public interface IntSequence {
  boolean hasNext();
  int next();
}
```

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```
public static double average(IntSequence seq, int n) {
  int count = 0;
  double sum = 0;
  while (seq.hasNext() && count<n) {
    count++;
    sum += seq.next();
  }
  return count == 0 ? 0 : sum/count;
}
```

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This interface allow us to implement method average:

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  while (seq.hasNext() && count<n) {
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  return count == 0 ? 0 : sum/count;
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```

We don't know the exact implementation of IntSequence!

Implementing an Interface

The classes that want to be usable with the average method must implement the IntSequence interface

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```
public class SquareSequence implements IntSequence {

  private int i=0;

  public boolean hasNext() {
    return true;
  }

  public int next() {
     i++;
    return i*i;
  }

}
```

Example: Fibonacci Sequence

```
public class FibonacciSequence implements IntSequence {

  private int a = 1;
  private int b = 1;

  public boolean hasNext() {
    return true;
  }

  public int next() {
    int res = a;
    a = b;
    b = res+a;
    return res;
  }

}
```

Example: Digit Sequence

```
public class DigitSequence implements IntSequence {
  private int number;
  public DigitSequence( int number ) {
    this.number = number;
  }
  public boolean hasNext() {
    return this.number != 0;
  }
  public int next() {
    int result = this.number % 10;
    this.number /= 10;
    return result;
  }
  public int rest() {
    return this.number;
  }
}
```

Interface type

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```
IntSequence seq = new DigitSequence(19876);
double avg = Util.average(seq, 100);
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If **really needed** use instanceof to checlk the correctness of the operation.

Extending Interfaces

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```
public interface Closeable {
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```
public interface Channel extends Closeable {
  boolean isOpen();
}
```

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Warning: handle possible clash of names!

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Example:

```
SwingConstants.NORTH
```

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- static;
- default;
- private methods.

Static Methods

It may be convenient to equip interfaces with static methods (like the factory methods) that provide generic functionalities for a given type.

```
public interface IntSequence {

   ...

   static IntSequence digitsOf(int n) {
     return new DigitSequence(n);
   }

}
```

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The use of default methods is particularly useful for interface evolutions!

Resolving default methods conflict

Let us consider the following interfaces:

```
public interface Person {
  String getName();
  default int getId() { return 0; }
}

public interface Identified {
  default int getId() { return Math.abs(hashCode()); }
}
```

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Consider now the class Employee defined as follows:

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public class Employee implements Person, Identified {
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  default int getId() { return Math.abs(hashCode()); }
}
```

Consider now the class Employee defined as follows:

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public class Employee implements Person, Identified {
  ...
}
```

There is a conflict that we have to resolve by providing an implementation of getId.

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These private methods typically implement utility features and their use should be limited.

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- EventHandler<T>.

Lambda Expressions

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(String first, String second)->first.length()-second.length()
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```
(String first,String second)->first.length()-second.length()
```

or a block:

```
(String first,String second) -> {
  int difference = first.length()-second.length();
  if (difference<0) return -1;
  else if (difference>0) return 1;
  else return 0;
}
```

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We can use a lambda expression (with the appropriate type) when a functional interface is expected:

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Arrays.sort(anArray, (x,y) -> x.length()-y.length());
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```

The type of parameters can be inferred!

Method References

Suppose that we want to sort strings regardless of letter case. We could call:

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There are many examples of use:

- list .remove(Objects:: isNull)
- list .forEach(System.out:: println)

Method References

There are three variations for method references:

- Class :: instanceMethod
- Class :: staticMethod
- object :: instanceMethod
- Class :: new

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Example:

```
public class AClass {
  private int value = 0;

  public void setValue( int value ) {
    this.value = value;
  }

  public Function<Integer, Integer> getLambda() {
    return (x) -> this.value+x;
  }
}
```

To be continued...