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Mobile Programming

Kotlin Basics – Part III

Null Safety (1/5)

- NPE (NullPointerException)
  - One of the most common pitfalls in many programming languages (e.g., Java!)
  - Accessing a member of a null reference will result in a null reference exception

- Kotlin's type system is aimed at eliminating the danger of null references
  - Kotlin type system distinguishes between *references that can hold null* (nullable references) and *those that cannot* (non-null references)

Null Safety (2/5)

- Example
  - A regular variable of type String cannot hold null

```
var a: String = "abc" // Regular initialization means non-null by default
a = null // compilation error
```

```
val l = a.length
```

// it's guaranteed not to cause an NPE

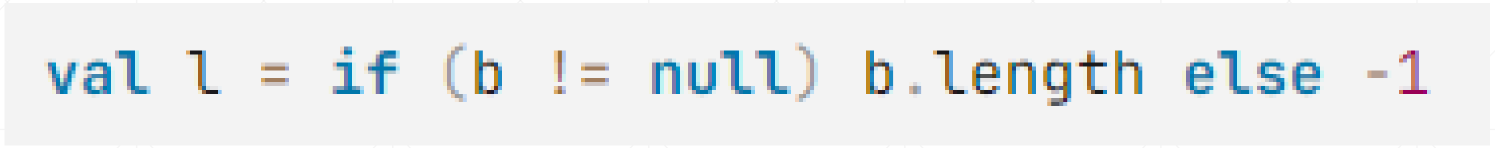
  - To allow nulls, you can declare a variable as a nullable string by writing String?

```
var b: String? = "abc" // can be set to null
b = null // ok
print(b)
```

```
val l = b.length // error: variable 'b' can be null
```

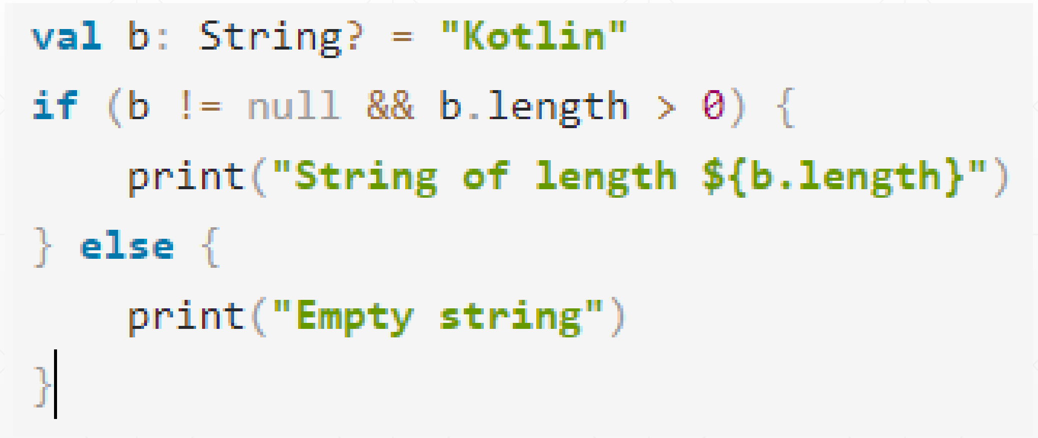
Null Safety (3/5)

- How to handle nullable references, then?
- Solution 1: Explicit check



```kotlin
val l = if (b != null) b.length else -1
```

  - The compiler tracks the information about the check you performed, and allows the call to length inside the if expression
  - More complex example



```kotlin
val b: String? = "Kotlin"
if (b != null && b.length > 0) {
    print("String of length ${b.length}")
} else {
    print("Empty string")
}
```

Null Safety (4/5)

- Solution 2: Safe calls
  - Second option for accessing a property on a nullable variable is using the safe call operator “?.”

```
val a = "null"
val b: String? = "string"
Log.d("ITM","${(b?.length)}")
Log.d("ITM","${(a?.length)}") // Unnecessary safe call
```

  - This returns b.length if b is not null, and null otherwise!

Null Safety (5/5)

- Solution 3: Elvis Operator (?:)
  - When you have a nullable reference, b, you can say "if b is not null, use it, otherwise use some non-null value“

```
val l: Int = if (b != null) b.length else -1
```

```
val l = b?.length ?: -1
```

  - If the expression to the left of ?: is not null, the Elvis operator returns it, otherwise it returns the expression to the right
  - The expression on the right-hand side is evaluated only if the left-hand side is null

- Solution 4: !! Operator
  - Not-null assertion operator, however, throws an exception if the value is null

Scope Functions (1/4)

- Kotlin standard library contains several functions whose sole purpose is to execute a block of code ***within the context of an object***
- When you call such a function on an object with ***a lambda expression provided***, it forms a temporary scope, in which you can access the object without its name!
- Scope functions
  - let
  - run
  - with
  - apply
  - also

Scope Functions (2/4)

- Normal function calls

```
val alice = Person("Alice", 20, "Amsterdam")
println(alice)
alice.moveTo("London")
alice.incrementAge()
println(alice)
```

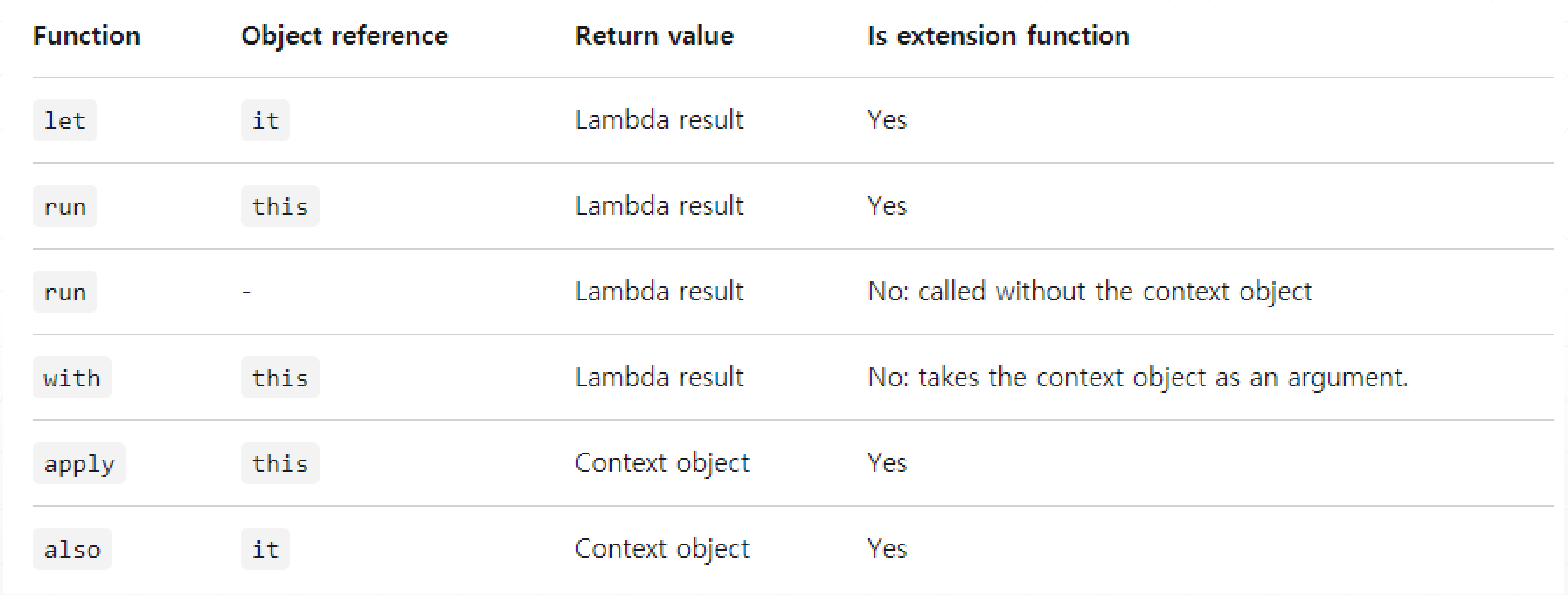
- Scope function calls

```
Person("Alice", 20, "Amsterdam").let {
    println(it)
    it.moveTo("London")
    it.incrementAge()
    println(it)
}
```

Scope Functions (3/4)

- Note
  - The scope functions do not introduce any new technical capabilities, but they can make your code **more concise and readable**
  - Due to the similar nature of scope functions, choosing the right one for your case can be a bit tricky!
  - The choice mainly depends on your intent and the consistency of use in your project

Scope Functions (4/4)



Function	Object reference	Return value	Is extension function
`let`	`it`	Lambda result	Yes
`run`	`this`	Lambda result	Yes
`run`	-	Lambda result	No: called without the context object
`with`	`this`	Lambda result	No: takes the context object as an argument.
`apply`	`this`	Context object	Yes
`also`	`it`	Context object	Yes

Scope Functions: let

- *let* can be used to invoke one or more functions on results of call chains
  - Context object reference: *it*
  - Return value: lambda result
- Example)

```
val numbers = mutableListOf("one", "two", "three", "four", "five")
val resultList = numbers.map { it.length }.filter { it > 3 }
Log.d("ITM", "$resultList")


numbers.map { it.length }.filter { it > 3 }.let {
    Log.d("ITM","$it")
    // and more function calls if needed
}
```

Scope Functions: with

- Use *with* for calling functions on the context object without providing the lambda result
  - Non-extension function
  - Context object reference: *this (can be omitted, when accessing the member)*
  - Return value: lambda result

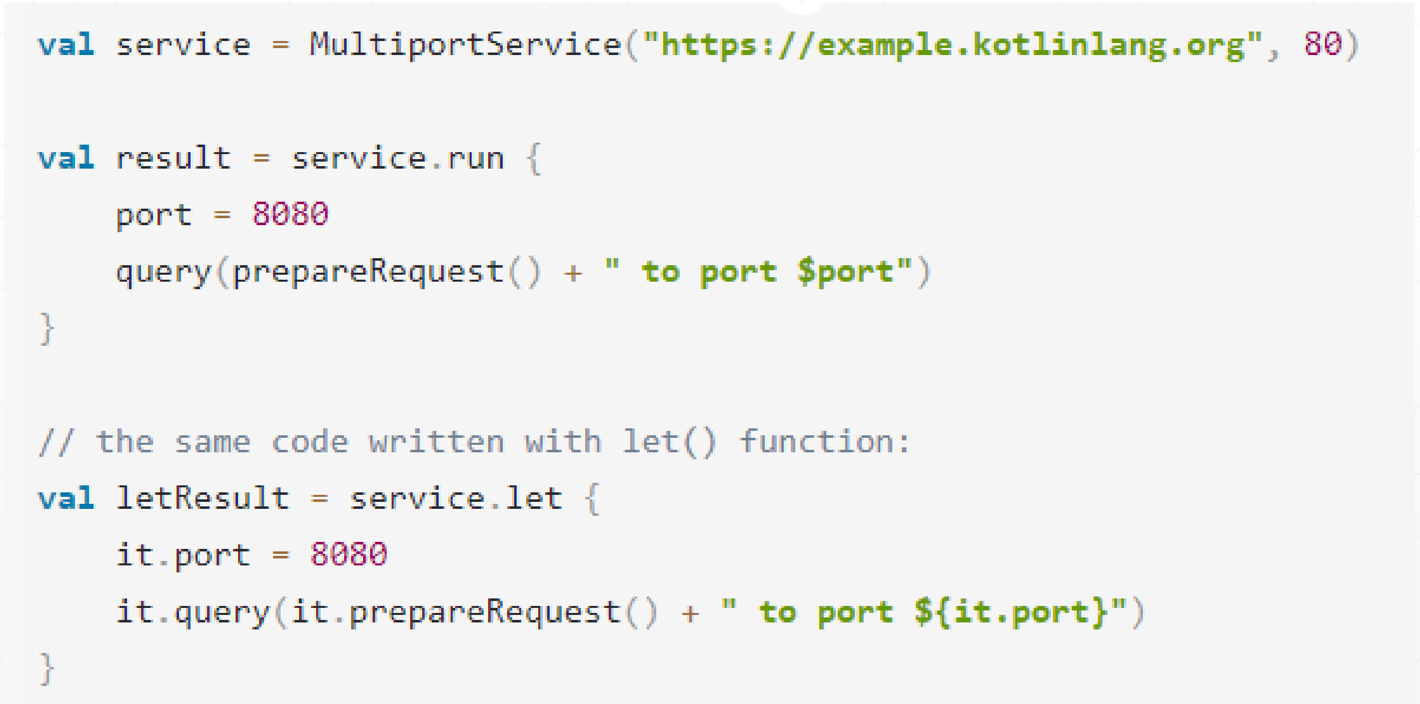
- Example)

```
val numbers = mutableListOf("one", "two", "three")
with(numbers) {
    Log.d("ITM","'with' is called with argument $this")
    Log.d("ITM","It contains $size elements")
    Log.d("ITM","It contains ${this.size} elements") // this can be skipped
}
```

Scope Functions: run

- Useful when your lambda contains both the object initialization and the computation of the return value
  - Both extension and non-extension function
  - Context object reference: *this (can be omitted, when accessing the member)*
  - Return value: lambda result

- Example)
  - Extension function



```kotlin
val service = MultiportService("https://example.kotlinlang.org", 80)

val result = service.run {
    port = 8080
    query(prepareRequest() + " to port $port")
}

// the same code written with let() function:
val letResult = service.let {
    it.port = 8080
    it.query(it.prepareRequest() + " to port ${it.port}")
}
```

Scope Functions: run

- Example)
  - Non-extension function (without context object)

```
val hexNumberRegex = run {
    val digits = "0-9"
    val hexDigits = "A-Fa-f"
    val sign = "+-"

    Regex("[$sign]?[$digits$hexDigits]+")
}

for (match in hexNumberRegex.findAll("+1234 -FFFF not-a-number")) {
    Log.d("ITM",match.value)
}
```

Scope Functions: apply

- Use apply for code blocks that do not return a value and mainly operate on the members of the receiver object
  - Context object reference: *this (can be omitted, when accessing the member)*
  - Return value: context object
- Example)
  - The common case for apply is the object configuration

```
class MainActivity : AppCompatActivity() {
    override fun onCreate(savedInstanceState: Bundle?) {
        super.onCreate(savedInstanceState)
        setContentView(R.layout.activity_main)

        val adam = Person("Adam").apply {
            age = 32
            city = "London"
        }
        Log.d("ITM",adam.toString())

    }
}

data class Person(var name:String, var age:Int=0, var city:String="")
```

Scope Functions: also

- Good for performing some actions that take the context object as an argument
  - Context object reference: *it*
  - Return value: context object

- Example)

```
val numbers = mutableListOf("one", "two", "three")
numbers
    .also { Log.d("ITM","The list elements before adding new one: $it") }
    .apply {
        add("four")
        Log.d("ITM","$this")
    }
```

Scope Functions: Output Distinction (1/2)

- Context object
  - apply and also
  - Can be included into call chains
  - You can continue chaining function calls **on the same object** after them

```
val numberList = mutableListOf<Double>()
numberList.also { Log.d("ITM","Populating the list, length: ${it.size}") }
    .apply {
        add(2.71)
        Log.d("ITM","Sorting the list, length: $size")
        add(3.14)
        add(1.0)
    }
    .also { Log.d("ITM","Sorting the list, length: ${it.size}") }
    .sort()
```

Scope Functions: Output Distinction (2/2)

- Lambda result
  - let, run, with
  - You can use them when assigning the result to a variable

```
val numbers = mutableListOf("one", "two", "three")
val countEndsWithE = numbers.run {
    add("four")
    add("five")
    count { it.endsWith("e") }
}
Log.d("ITM","There are $countEndsWithE elements that end with e.")
```