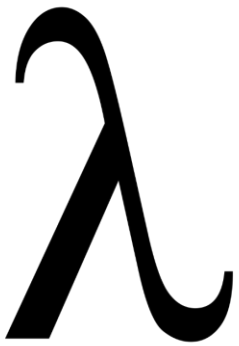
Kotlin



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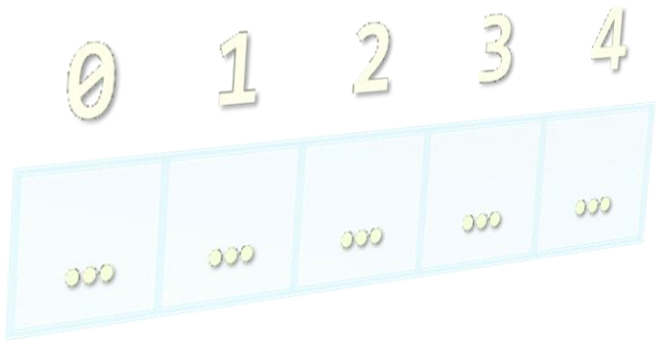
Collections



Back

Arrays

- Kotlin has a special class called **Array<T>** to declare arrays

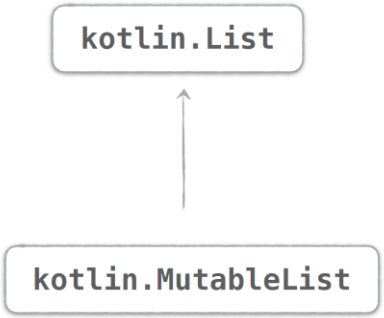
```
val colors: Array<String> = arrayOf("Red", "Green", "Blue")
val names: Array<String> = emptyArray()
val nulls: Array<String?> = arrayOfNulls(10)

val numbers: Array<Int> = emptyArray()
val nums: Array<Int> = arrayOf(2, 3, 4)
val nullNums: Array<Int?> = arrayOfNulls(10)

colors.forEach { println(it) }
```

- Better to use **List, Set, Map**

List




```
// Immutable list – cannot add/remove elements
val numsList = listOf(1, 2, 3)

// mutable list – can add/remove elements
val mutableList = mutableListOf(1, 2, 3)

mutableList.add(4)

mutableList.removeAt(0)
```

Set

- *Set is same as List but does not allow duplicates*

```
// immutable set and mutable set
val colors = setOf("red", "blue", "yellow")
val mutableColors = mutableSetOf("red", "blue", "yellow")
mutableColors.add("pink")
mutableColors.add("blue") // will not be added
```

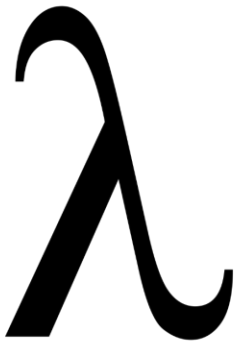
Map

- Stores keys and associated values

```
val languages = mapOf(
    1 to "Python",
    2 to "Kotlin",
    3 to "Java"
)

for ((key, value) in languages) {
    println("$key => $value")
}
```

Lambda



Imperative vs. Declarative

Imperative Programming

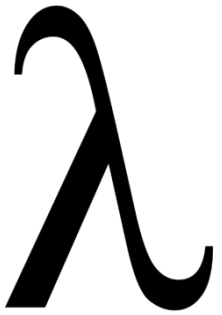
- You tell the computer **how** to perform a task.

Declarative Programming

- You tell the computer **what you want**, and you let the compiler (or runtime) figure out the best way to do it. This makes the code simpler and more concise
- Also known as **Functional Programming**
- `Declarative programming using Lambdas helps us to achieve KISS`

KEEP IT SHORT & SIMPLE

What is a Lambda?



- Lambda is very similar to *a function*. It has:
  - Parameters
  - A body
  - A return type
- It **don't have a name** (anonymous method)
- It can be assigned to a variable
- It **can be passed as a parameter** to other function:
  - As *code* to be executed by the receiving function
- Concise syntax:

```
{ Parameters -> Body }
```

Passing Lambda as a Parameter

- Lambda expression can be passed as a parameter to methods such as ***forEach***, ***filter*** and ***map*** methods :

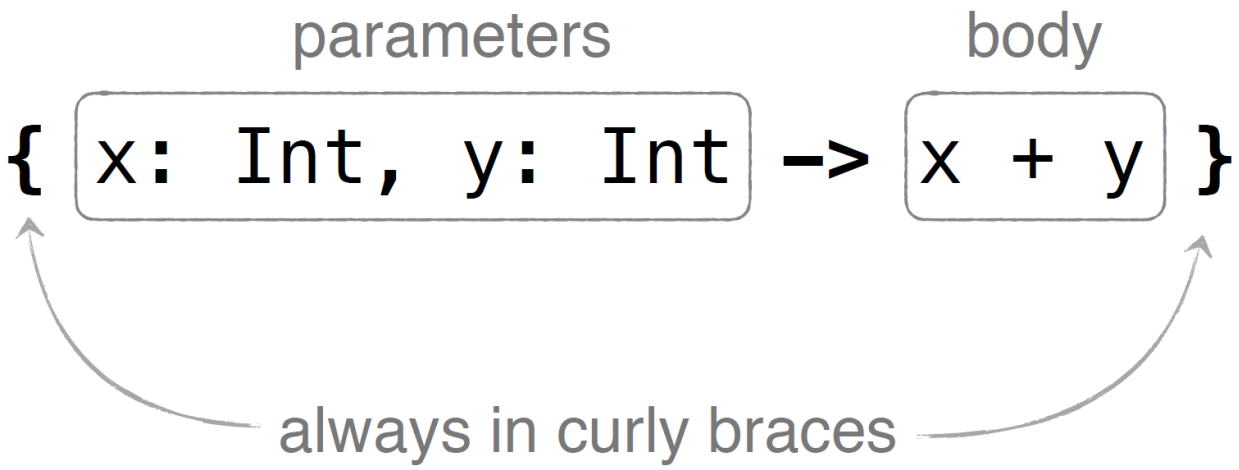
```
val numbers = listOf(1, 2, 3, 4, 5, 6, 7, 8, 9)
numbers.forEach { e -> println(e) }
```

forEach - Calls a Lambda on Each Element of the list

- Left side of `->` operator is a parameter variable
- Right side is the code to operate on the parameter and compute a result
- When using a lambda with a `List` the compiler can determine the parameter type

Lambda

- **Lambda** is an anonymous function that you can store in a variable, pass them as parameter, or return from other function




```
list.any({ i: Int -> i > 0 })
```

full syntax

Lambda Short Form

```
list.any() { i: Int -> i > 0 }
```

when lambda is the last argument,
it can be moved out of parentheses

```
list.any { i: Int -> i > 0 }
```

empty parentheses can be omitted

```
list.any { i -> i > 0 }
```

type can be omitted if it's clear from the context

```
list.any { it > 0 }
```

it denotes an argument (if it's only one)

Multi-line lambda

```
list.any {
    println("processing $it")
    it > 0
}
```

Last expression is the result

Lambda usage

- Allows working with collections in a **functional style**

```
val nums = 1..10
//Version 1
var hasEvenNumber = nums.any(isEven)
//Version 2
hasEvenNumber = nums.any { n -> n % 2 == 0 }
//Version 3 - best
hasEvenNumber = nums.any { it % 2 == 0 }

//Version 1
var evens = nums.filter(isEven)
//Version 2
evens = nums.filter { n -> n % 2 == 0 }
//Version 3 - best
evens = nums.filter { it % 2 == 0 }
```

Lambda usage

e.g. What's the average age of employees working in Doha?

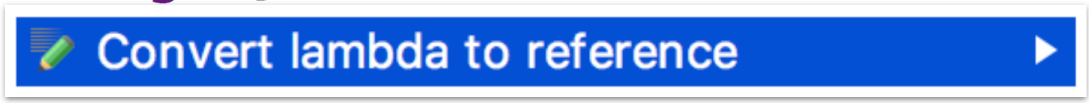
```
val employees = listOf<Employee>(
        Employee("Sara Faleh", "Doha",30),
        Employee("Mariam Saleh", "Istanbul",22),
        Employee("Ali Maleh", "Doha",24)
)

val avgAge = employees.filter { it.city == "Doha" }
                      .map { it.age }
                      .average()
```

Member references

```
class Person(val name: String, val age: Int)

people.maxBy { it.age }
```



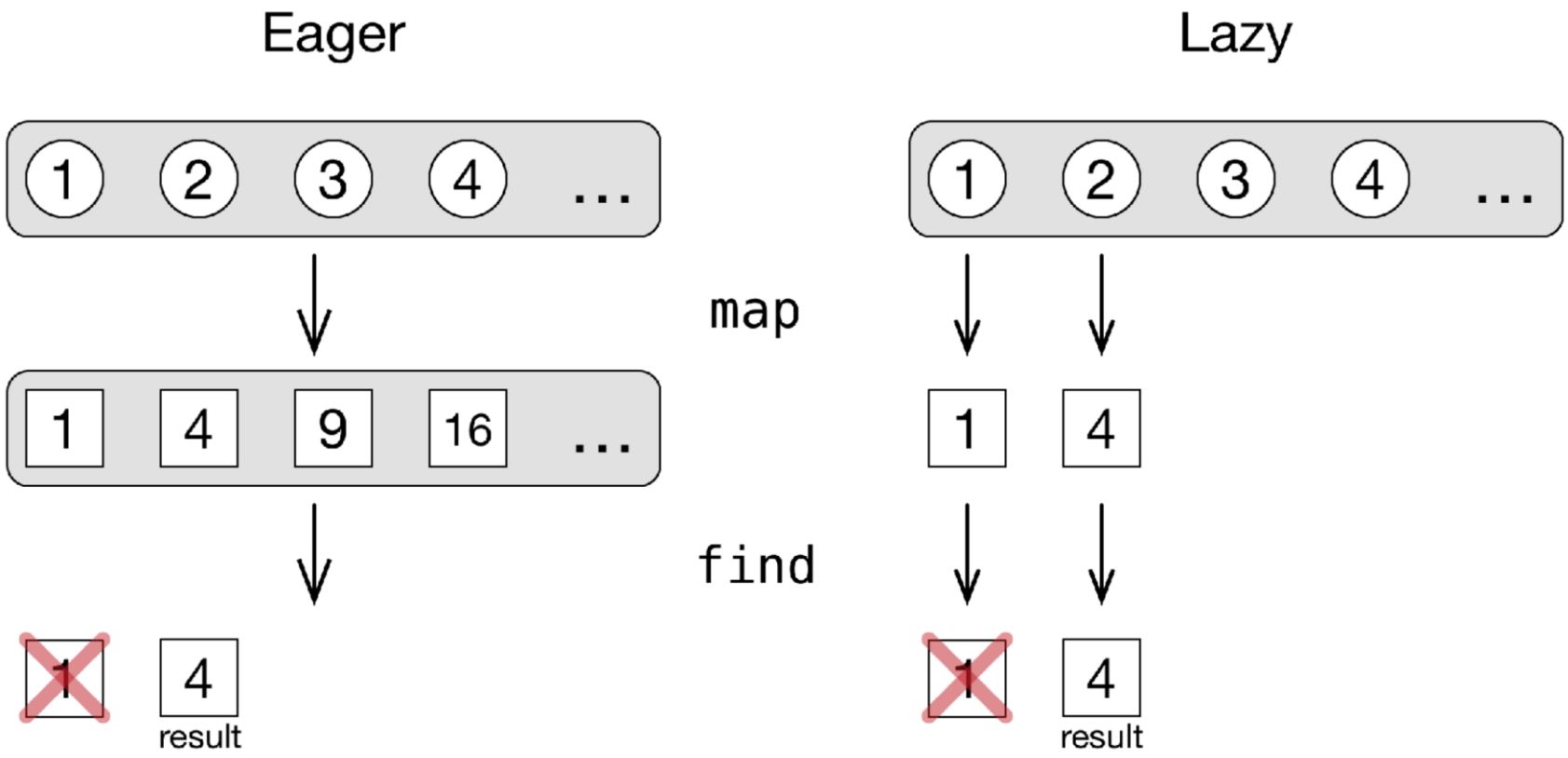

```
people.maxBy(Person::age)
```

Class

Member

Collections vs Sequences
=> Eager vs Lazy evaluation

- Eager: each operation produces an intermediate collection having all the results then passes it to the next operation in the pipeline
- Lazy: **no** intermediate collections are created on chained calls



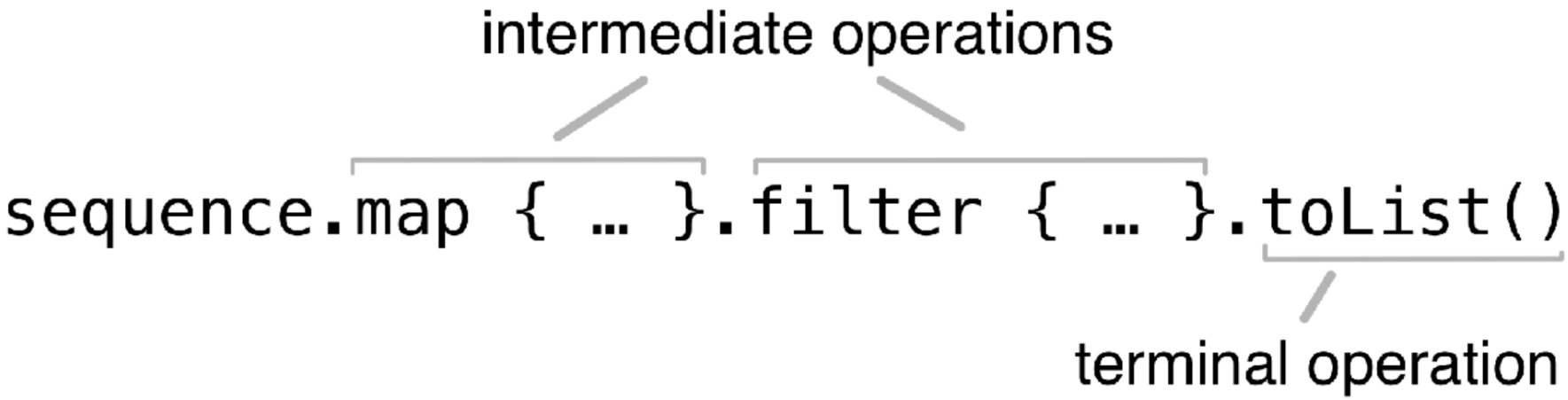
Sequence

```
// Sequences represent lazily-evaluated collections
val numSequence = generateSequence(1, { it + 1 })
// Nothing happens until terminal operation .toList() is called
val nums = numSequence.take(10).toList()
println(nums) // => [1, 2, 3, 4, 5, 6, 7, 8, 9, 10]

// Convert list to a sequence to enable lazy evaluation
val numbers = listOf(1, 2, 3, 4, 5)
val sum = numbers.asSequence()
        .map { it * 2 } // Lazy
        .filter { it % 2 == 0 } // Lazy
        .reduce(Int::plus) // Terminal (eager)
println(sum) // 30
```

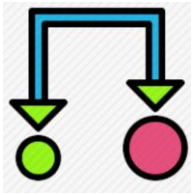
Lazy Evaluation

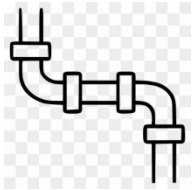
- Nothing happens until terminal operation is called
- No intermediate collections are created on chained calls



Common operations on collections

Filter, Map, Reduce, and others





Common operations on collections

`.map`

- Applies a function to each list element

`.filter(condition)`

- Returns a new list with the elements that satisfy the condition

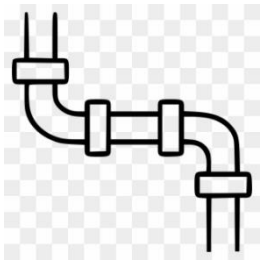
`.find(condition)`

- Returns the first list element that satisfy the condition

`.reduce`

- Applies an accumulator function to each element of the list to reduce them to a single value

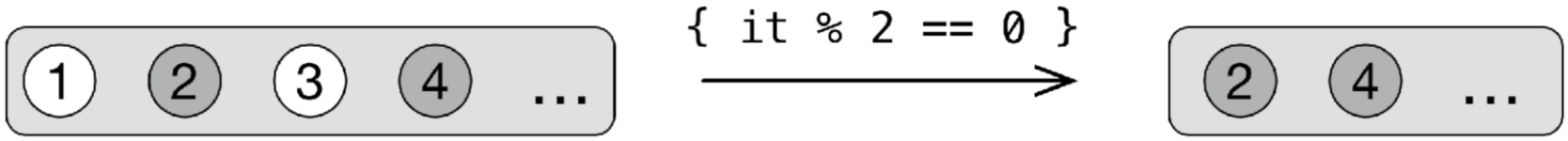
Operations Pipeline



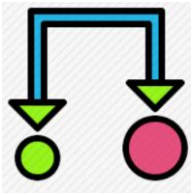
- **A pipeline of operations:** a sequence of operations where the output of each operation becomes the input into the next
  - e.g., .filter -> .map -> .sum
- Operations are either **Intermediate** or **Terminal**
- **Intermediate operations** produce a new list as output (e.g., map, filter, …)
- **Terminal operations** are the final operation in the pipeline (e.g., find, reduce, sum …)
  - Once a terminal operation is invoked then no further operations can be performed

Filter

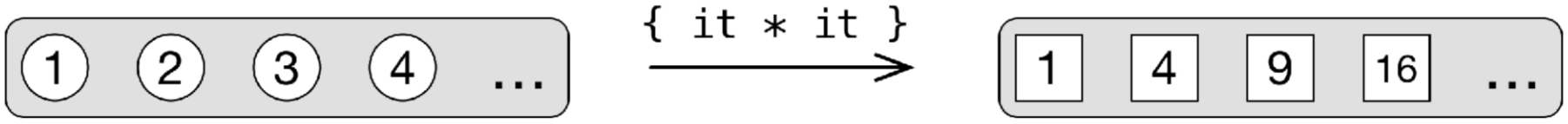
Keep elements that satisfy a condition



Map



Transform elements by applying a Lambda to each element



Reduce

Apply an accumulator function to each element of the list to reduce them to a single value

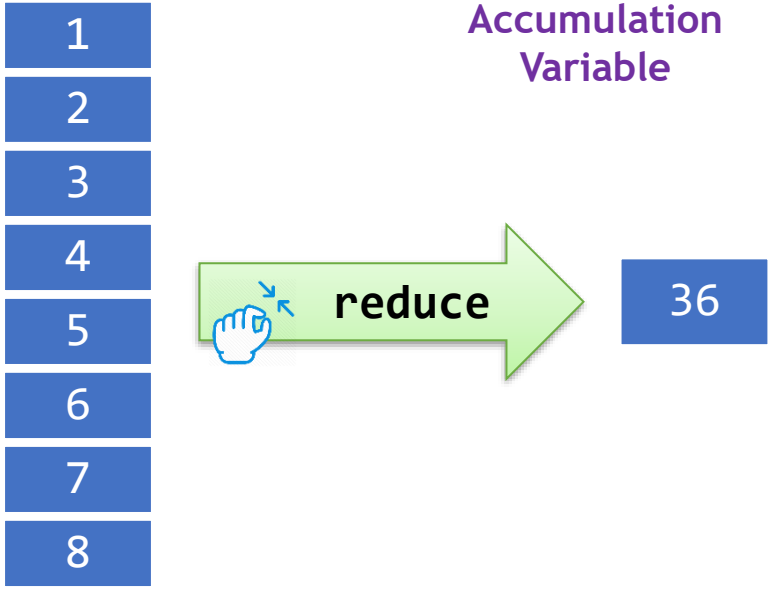
```
// Imperative
var sum = 0
for(n in numbers)
    sum += n
```

```
//Declarative
var total = numbers.reduce { sum, n -> sum + n }
//Another way with the ability to set the initial
value of sum
total = numbers.fold(0) { sum, n -> sum + n }
//Short form
total = numbers.sum()
```

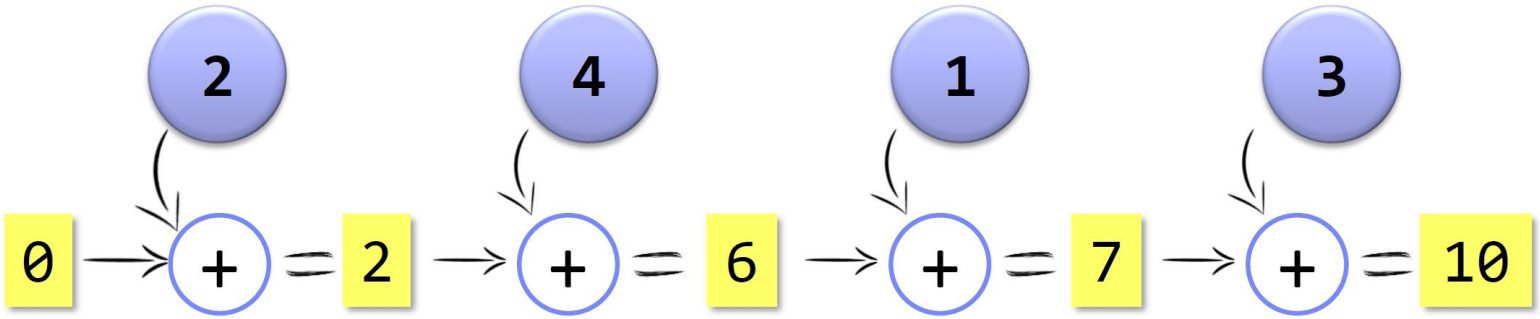
Accumulation Variable

Accumulation Lambda

Collapse the multiple elements of a list into a single element



Reduce




```
.reduce { sum, n -> sum + n }
```

Reduce is **terminal** operation that yields a single value

Convenience Reducers

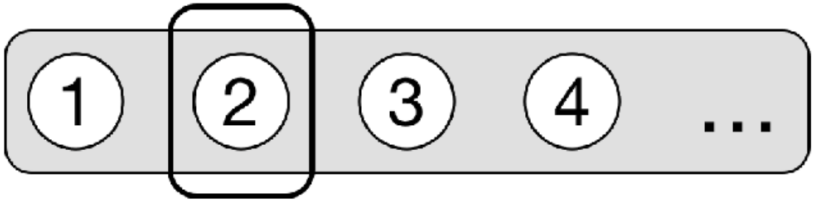
sum, average, count, min, max

- They are **terminal** operations that yield a single value

```
val nums = listOf(1, 2, 3, 4, 5, 6, 7, 8, 9, 10)
val sum = nums.sum()
val count = nums.count()
val average = nums.average()
val max = nums.maxOrNull()
val min = nums.minOrNull()
```

any (all, none)

- **any** returns true if it finds an element that satisfies the lambda condition
- **all** returns false if it finds an element that fails the lambda condition
- **none** returns false if it finds an element that satisfies the lambda condition

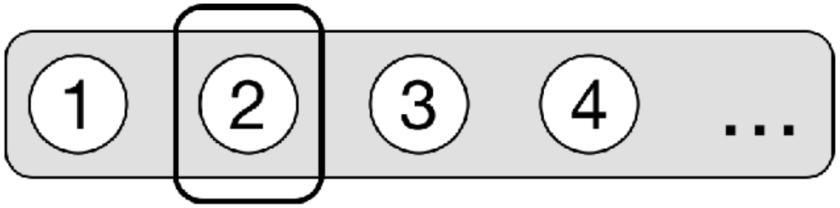



```
{ it % 2 == 0 }
```

true

find / firstOrNull

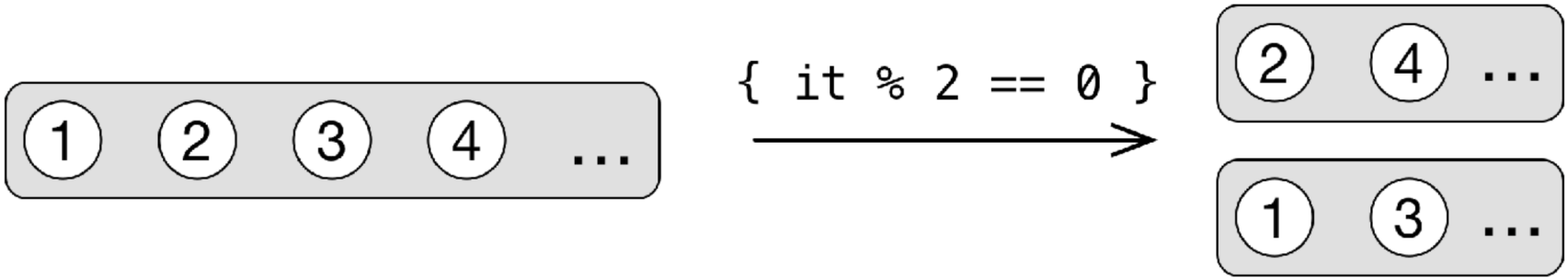
Return first element satisfying a condition




```
{ it % 2 == 0 }
```

2

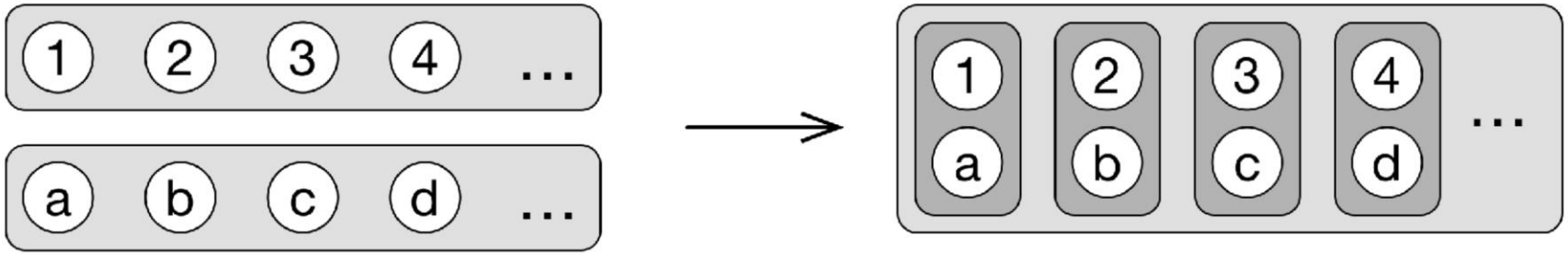
partition




```
val (even, odd) = listOf(1, 2, 3, 4).partition { it % 2 == 0 }
```

zip

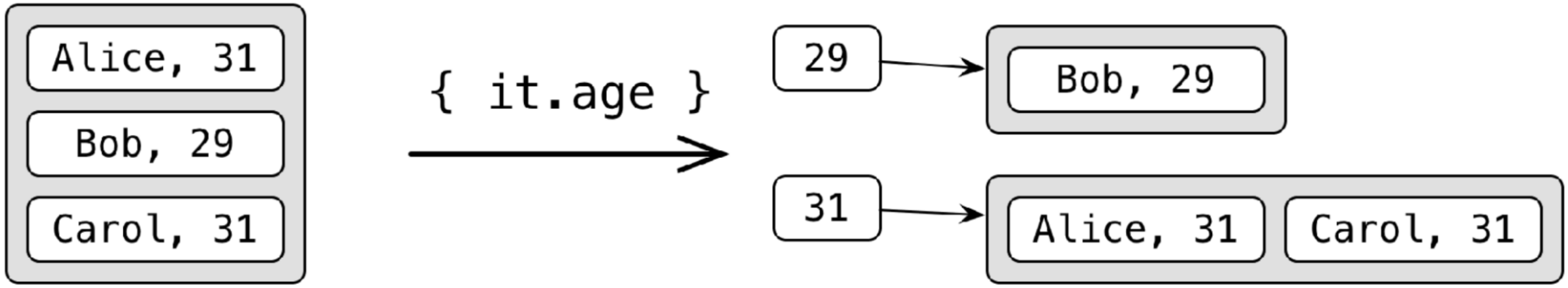
Returns a list from the elements from 2 lists having the same index. The resulting list ends as soon as the shortest input list ends




```
val nums = listOf(1, 2, 3, 4)
val letters = listOf("a", "b", "c", "d")
val result = nums.zip(letters)
```

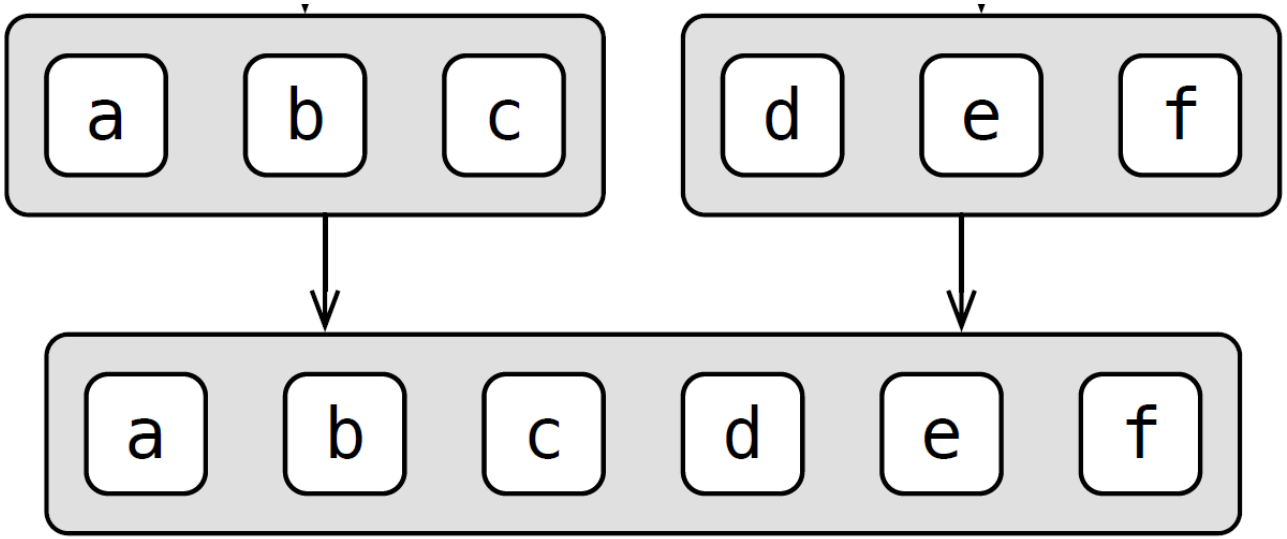
groupBy

- groupBy is used to split a list into groups




```
people.groupBy { it.age }
```

flatMap




```
val listOfList = listOf(
    listOf("a", "b", "c"),
    listOf("d", "e", "f")
)
val singleList = listOfList.flatMap { it }
```

Flat Map

Do a map and flatten the results into 1 list

```
books = students.flatMap { it.getBooks() }
```

Each student has a list of books. **flatMap** combines them to produce a single list of **all** books

Sort a List using Lambda

Sort strings by length (shortest to longest)

```
val names = listOf("Abderahame", "Abdelkarim", "Ali", "Sarah", "Samira", "Farida")
println(">Sorted by length:")
var sorted = names.sortedBy { it.length }
println(sorted)

println("\n>Sorted by length and then alphabetically:")
//Sort strings by length (shortest, longest) and then alphabetically
sorted = names.sortedWith( compareBy( { it.length }, { it }) )
println(sorted)
```

Use compareBy for multi-step comparisons

```
class Person(val name: String,
             val age: Int)
```

```
fun sortPersons(persons: List<Person>) =
    persons.sortedWith(
        compareBy(Person::name,
                  Person::age))
```

Use `apply` for object initialization

```
fun createLabel(): JLabel {
  val label = JLabel("Foo")
  label.foreground = Color.RED
  label.background = Color.BLUE
  return label
}
```

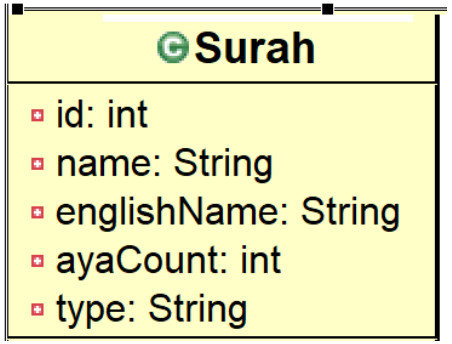
```
fun createLabel() =
    JLabel("Foo").apply {
      foreground = Color.RED
      background = Color.BLUE
    }
```

{ ; }
JSON

JSON Data Format

- **JSON** (JavaScript Object Notation) is a very popular lightweight data format to transform an object to a **text** form to ease storing and transporting data
- **Json** class could be used to transform an object to json or transform a json string to an object

Transform an instance of Surah class to a JSON string:




```
val fatiha = Surah(1, "الفاتحة", "Al-Fatiha", 7, "Meccan")
val surahJson = Json.encodeToString(fatiha)

// Converting a json string to an object
val surah = Json.decodeFromString<Surah>(surahJson)
```

```
{    "id": 1,
     "name": "الفاتحة",
     "englishName": "Al-Fatiha",
     "ayaCount": 7,
     "type": "Meccan"
 }
```

@Serializable

- To use Json sterilization the class must be annotated with **@Serializable**

```
@Serializable
data class Surah (
    val id : Int,
    val name: String,
    val englishName : String,
    val ayaCount : Int,
    val type: String
)
```

Read JSON file

- Read a JSON file and convert its content to objects

```
val filePath = "data/surahs.json"
// Read file content
val bufferedReader = File(filePath).bufferedReader()
val fileContent = bufferedReader.readText()

val surahs = Json.decodeFromString<List<Surah>>(fileContent)
```

You may use https://plugins.jetbrains.com/plugin/10054-generate-kotlin-data-classes-from-json Android Studio plugin to generate a Kotlin class from a json string!

Dependencies to use Kotlin Serialization

- To be able use **@Serializable** and **Json** class you need to add these dependencies then sync:

1) Add to dependencies of the 1st (Project) build.gradle:

```
classpath "org.jetbrains.kotlin:kotlin-serialization:$kotlin_version"
```

2) Add to dependencies of the 2nd (Module) build.gradle

```
implementation "org.jetbrains.kotlinx:kotlinx-serialization-core:1.0.0-RC"
```

3) Add this apply plugin to the 2nd build.gradle before line "android {"

```
apply plugin: 'kotlinx-serialization'
```