More Scala

Data Structures

Lecture Task

- This is Lecture Task 3 from the Pale Blue Dot project -

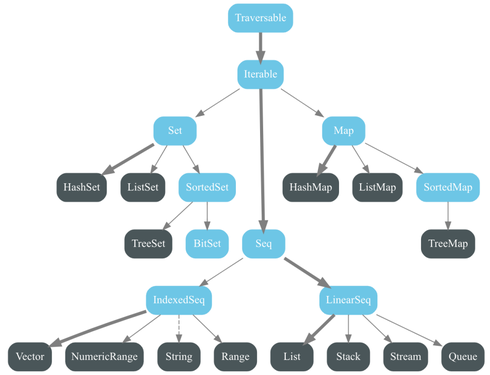
- In the pbd.PaleBlueDot object, write a method named "cityPopulations" which:
  - Takes three Strings as parameters representing:
    - The name of a file containing city data. ex. "data/cities.csv"
    - A two character country code. This input may be a mix of upper/lower case letters
    - A region code in the same format as they appear in the cities file
  - Returns a Map of Strings to Ints mapping city names to their population
    - The city names should appear exactly as the do in the cities file
- Note: All the Strings will be in the same format as they appear in the cities file. You don't not have to do anything with upper/lower case for this objective

Data Structures

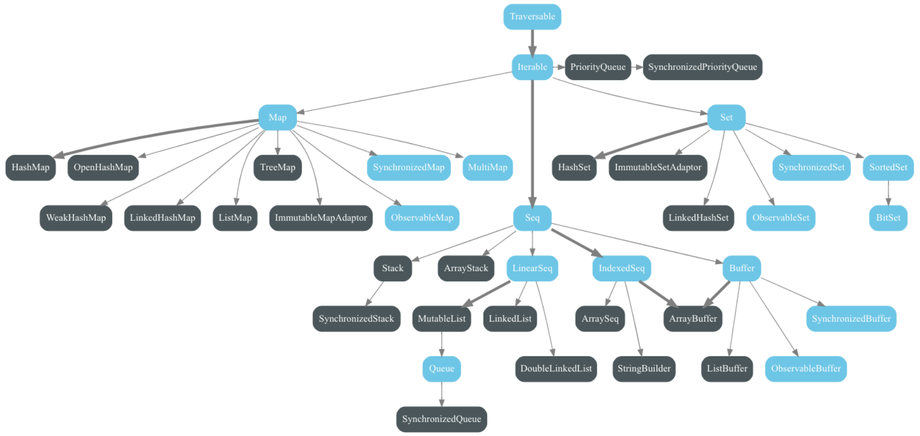
Data Structures

- Wide variety of Data Structures in Scala

Graph for immutable hierarchy:



Graph for mutable hierarchy:



https://docs.scala-lang.org/tutorials/FAQ/collections.html

Data Structures

- Let's keep it simple and focus on 3 for now
- Array
  - Sequential
  - Fixed Size
- List
  - Sequential
- Map
  - Key-Value Store

Array

- Sequential
  - One continuous block of memory
  - Random access based on memory address
    - address = first_address + (element_size * index)
- Fixed Size

Array

```
def arrayMethods(): Unit = {
  // Create new Array of Ints
  val arr: Array[Int] = Array(2, 3, 4)

  // Change a value by index
  arr(1) = 20

  // Access a value by index
  val x: Int = arr(1)

  // Iterate over elements
  for (element <- arr) {
    println(element)
  }

  // Iterate over indices
  for (index <- 0 to (arr.length - 1)) {
    println(index)
  }

  // Iterate over indices - alternate
  for (index <- arr.indices) {
    println(index)
  }

}
```

List

- Sequential
  - Spread across memory
  - Each element knows the memory address of the next element
    - Follow the addresses to find each element
- Variable Size
- Values cannot change [In Scala]

List

```scala
def listMethods(): Unit = {
  // Create new Array of Int
  var list: List[Int] = List(2, 3, 4)

  // Access the first element
  val x: Int = list.head

  // Access a value by position
  val y: Int = list.apply(1)

  // Add an element to the end of the list (append)
  list = list :+ 50

  // Add an element to the beginning of the list (prepend)
  list = 70 :: list

  // Iteration
  for(element <- list){
    println(element)
  }
}
```

Map

- Key-Value Store
  - Values stored at keys instead of indices
  - Multiple different implementations
    - Default is HashMap (CSE250 topic)
- Variable Size
- Variable Values
- Cannot have duplicate keys

Map

```
def mapMethods(): Unit = {
  // Create new Map of Ints to Ints
  var myMap: Map[Int, Int] = Map(2 -> 4, 3 -> 9, 4 -> 16)

  // Add a key-value pair
  myMap = myMap + (5 -> 25)

  // Access a value by key (Crashes if key not in map)
  val x: Int = myMap(3)

  // Access a value by key with default value if key not in map
  val y: Int = myMap.getOrElse(100, -1)

  // Iteration
  for((key, value) <- myMap){
    println("value " + value + " stored at key " + key)
  }
}
```

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