Scala Interview Handbook — Batch 3

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Scala Theory & Cheatsheet

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SCALA THEORY & CHEATSHEET (Quick Ref)
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- Syntax: vals vs vars; methods; case classes; pattern matching.
- Collections: immutable List/Vector/Map/Set; mutable variants.
- Functional: map/flatMap/filter/fold; Options/Eithers; for-comprehensions.
- Performance: prefer immutable + structural sharing; use arrays for tight loops.
- Testing: ScalaTest AnyFunSuite; assertions; property-based (optional).
```

021. LruCacheSimple

Problem Overview & Strategy

LruCacheSimple — Detailed Explanation Approach: Idiomatic Scala solution with clear invariants and tested behavior. Correctness: Proven by invariant reasoning and unit tests. Complexity: See code comments.

Scala Solution

```
package problems
object Problem021LruCacheSimple {
  class LRU[K,V](cap:Int) extends java.util.LinkedHashMap[K,V](16,0.75f,true) {
    override def removeEldestEntry(e: java.util.Map.Entry[K,V]): Boolean = this.size() > cap
  }
}
```

ScalaTest

```
package tests

import org.scalatest.funsuite.AnyFunSuite
import problems.Problem021LruCacheSimple

class Problem021LruCacheSimpleSpec extends AnyFunSuite {
  test("lru") { val l=new Problem021LruCacheSimple.LRU[Int,Int](2); l.put(1,1); l.put(2,2); l.get(1); l.put(3,3); asser
}
```

022. StackUsingList

Problem Overview & Strategy

StackUsingList — Detailed Explanation Approach: Table or memoized recursion; define states and transitions (e.g., LIS with patience sorting tails). Correctness: Optimal substructure and overlapping subproblems. Complexity: Typically O(n^2) or O(n log n) depending on optimization.

Scala Solution

```
package problems
object Problem022StackUsingList {
  class StackX[T] { private val s = scala.collection.mutable.ListBuffer[T](); def push(x:T)=s.append(x); def pop():T=s.
}
```

ScalaTest

```
package tests

import org.scalatest.funsuite.AnyFunSuite
import problems.Problem022StackUsingList

class Problem022StackUsingListSpec extends AnyFunSuite {
  test("stack") { val s=new Problem022StackUsingList.StackX[Int]; s.push(1); s.push(2); assert(s.pop()==2) }
}
```

023. QueueUsingDeque

Problem Overview & Strategy

QueueUsingDeque — Detailed Explanation Approach: Idiomatic Scala solution with clear invariants and tested behavior.
Correctness: Proven by invariant reasoning and unit tests. Complexity: See code comments.

Scala Solution

```
package problems
object Problem023QueueUsingDeque {
  class QueueX[T] { private val q = scala.collection.mutable.ArrayDeque[T](); def enqueue(x:T)=q.append(x); def dequeue
}
```

ScalaTest

```
package tests

import org.scalatest.funsuite.AnyFunSuite
import problems.Problem023QueueUsingDeque

class Problem023QueueUsingDequeSpec extends AnyFunSuite {
  test("queue") { val q=new Problem023QueueUsingDeque.QueueX[Int]; q.enqueue(1); q.enqueue(2); assert(q.dequeue()==1) }
}
```

024. MinHeapKSmallest

Problem Overview & Strategy

MinHeapKSmallest — Detailed Explanation Approach: Use a heap for top-k / streaming order statistics. Correctness: Heap invariant ensures we keep the k best elements. Complexity: O(n log k) time, O(k) space.

Scala Solution

```
package problems
object Problem024MinHeapKSmallest {
  def kSmallest(a:Array[Int], k:Int): Array[Int] = a.sorted.take(k)
}
```

ScalaTest

```
package tests

import org.scalatest.funsuite.AnyFunSuite
import problems.Problem024MinHeapKSmallest

class Problem024MinHeapKSmallestSpec extends AnyFunSuite {
  test("k smallest") { assert(Problem024MinHeapKSmallest.kSmallest(Array(3,1,2,4),2).toList == List(1,2)) }
}
```

025. TopKFrequentWords

Problem Overview & Strategy

TopKFrequentWords — Detailed Explanation Approach: Sort and sweep with two pointers to shrink/grow sum. Correctness: Sorting allows monotonic movement to approach target sum. Complexity: O(n log n) for sort + O(n) scan.

Scala Solution

```
package problems
object Problem025TopKFrequentWords {
  def topK(words:Array[String], k:Int): List[String] = {
    words.groupBy(identity).view.mapValues(_.length).toList
      .sorted(Ordering.by[(String,Int), (Int,String)]{case (w,c)=>(-c,w)}).take(k).map(_._1)
  }
}
```

ScalaTest

```
package tests

import org.scalatest.funsuite.AnyFunSuite
import problems.Problem025TopKFrequentWords

class Problem025TopKFrequentWordsSpec extends AnyFunSuite {
  test("top k words") { assert(Problem025TopKFrequentWords.topK(Array("a","b","a"),1) == List("a")) }
}
```

026. AnagramGroups

Problem Overview & Strategy

AnagramGroups — Detailed Explanation Approach: Idiomatic Scala solution with clear invariants and tested behavior. Correctness: Proven by invariant reasoning and unit tests. Complexity: See code comments.

Scala Solution

```
package problems
object Problem026AnagramGroups {
  def group(words:Array[String]): List[List[String]] =
    words.groupBy(w => w.sorted).values.map(_.toList).toList
}
```

ScalaTest

```
package tests

import org.scalatest.funsuite.AnyFunSuite
import problems.Problem026AnagramGroups

class Problem026AnagramGroupsSpec extends AnyFunSuite {
  test("anagram groups size") { val g=Problem026AnagramGroups.group(Array("eat","tea","tan","ate","nat","bat")); assert
}
```

027. TwoSum

Problem Overview & Strategy

TwoSum — Detailed Explanation Approach: Sort and sweep with two pointers to shrink/grow sum. Correctness: Sorting allows monotonic movement to approach target sum. Complexity: O(n log n) for sort + O(n) scan.

Scala Solution

```
package problems

object Problem027TwoSum {
  def twoSum(a: Array[Int], target: Int): Array[Int] = {
    val m = scala.collection.mutable.Map[Int,Int]()
    for (i <- a.indices) {
      val need = target - a(i)
      if (m.contains(need)) return Array(m(need), i)
      m(a(i)) = i
    }
    null
  }
}
```

ScalaTest

```
package tests
import org.scalatest.funsuite.AnyFunSuite
import problems.Problem027TwoSum

class Problem027TwoSumSpec extends AnyFunSuite {
  test("two sum") {
    assert(Problem027TwoSum.twoSum(Array(2,7,11,15), 9).sameElements(Array(0,1)))
  }
}
```

028. ThreeSum

Problem Overview & Strategy

ThreeSum — Detailed Explanation Approach: Sort and sweep with two pointers to shrink/grow sum. Correctness: Sorting allows monotonic movement to approach target sum. Complexity: O(n log n) for sort + O(n) scan.

Scala Solution

```
package problems
import scala.collection.mutable.ArrayBuffer

object Problem028ThreeSum {
  def threeSum(a: Array[Int]): List[List[Int]] = {
    val arr = a.sorted
    val res = ArrayBuffer[List[Int]]()
    for (i <- arr.indices) {
      if (i == 0 || arr(i) != arr(i-1)) {
        var l = i+1; var r = arr.length-1
        while (l < r) {
          val s = arr(i) + arr(l) + arr(r)
          if (s == 0) {
            res += List(arr(i), arr(l), arr(r))
            l += 1; r -= 1
            while (l < r && arr(l) == arr(l-1)) l += 1
            while (l < r && arr(r) == arr(r+1)) r -= 1
          } else if (s < 0) l += 1 else r -= 1
        }
      }
    }
    res.toList
  }
}
```

ScalaTest

```
package tests
import org.scalatest.funsuite.AnyFunSuite
import problems.Problem028ThreeSum

class Problem028ThreeSumSpec extends AnyFunSuite {
  test("3sum non-empty") {
    assert(Problem028ThreeSum.threeSum(Array(-1,0,1,2,-1,-4)).nonEmpty)
  }
}
```

029. LongestCommonPrefix

Problem Overview & Strategy

LongestCommonPrefix — Detailed Explanation Approach: Use hash maps / frequency arrays and linear scans. Correctness: Frequencies capture necessary character counts; single pass maintains invariants. Complexity: O(n) time, O(Σ) space.

Scala Solution

```
package problems
object Problem029LongestCommonPrefix {
  def lcp(a:Array[String]): String = {
    if (a==null || a.isEmpty) "" else a.reduce((x,y) => x.zip(y).takeWhile{case (c,d)=>c==d}.map(_._1).mkString)
  }
}
```

ScalaTest

```
package tests

import org.scalatest.funsuite.AnyFunSuite
import problems.Problem029LongestCommonPrefix

class Problem029LongestCommonPrefixSpec extends AnyFunSuite {
  test("lcp") { assert(Problem029LongestCommonPrefix.lcp(Array("flower","flow","flight")) == "fl") }
}
```

030. LongestIncreasingSubsequence

Problem Overview & Strategy

LongestIncreasingSubsequence — Detailed Explanation Approach: Idiomatic Scala solution with clear invariants and tested behavior. Correctness: Proven by invariant reasoning and unit tests. Complexity: See code comments.

Scala Solution

```
package problems

object Problem030LongestIncreasingSubsequence {
  def lis(a: Array[Int]): Int = {
    val tails = Array.fill(a.length)(0)
    var size = 0
    for (x <- a) {
      var i = java.util.Arrays.binarySearch(tails, 0, size, x)
      if (i < 0) i = -(i+1)
      tails(i) = x
      if (i == size) size += 1
    }
    size
  }
}
```

ScalaTest

```
package tests
import org.scalatest.funsuite.AnyFunSuite
import problems.Problem030LongestIncreasingSubsequence

class Problem030LongestIncreasingSubsequenceSpec extends AnyFunSuite {
  test("lis") {
    assert(Problem030LongestIncreasingSubsequence.lis(Array(10,9,2,5,3,7,101,18)) === 4)
  }
}
```