

Kotlin 快速参考

空安全、协程、数据类、函数式编程要点

基础

Hello World

```
fun main() {  
    println("Hello, World!")  
}
```

变量

```
val name = "Kotlin" // immutable (prefer)  
var count = 0 // mutable  
val pi: Double = 3.14159 // explicit type  
const val MAX = 100 // compile-time constant
```

基本类型

Int, Long	32 位/64 位有符号整数
Double, Float	64 位/32 位浮点数
Boolean	true / false
Char	单个 Unicode 字符
String	不可变文本, 支持字符串模板
Unit	等同于 void (单一值)
Nothing	函数永不返回 (如抛出异常)

字符串模板

```
val name = "World"  
println("Hello, $name!")  
println("Length: ${name.length}")  
val raw = """line 1  
|line 2""".trimMargin()
```

函数

函数声明

```
fun add(a: Int, b: Int): Int {  
    return a + b  
}  
fun add(a: Int, b: Int) = a + b // single expression
```

默认参数与具名参数

```
fun greet(name: String, greeting: String = "Hello") {  
    println("$greeting, $name!")  
}  
greet("Alice") // Hello, Alice!  
greet("Bob", greeting = "Hi") // Hi, Bob!
```

高阶函数

```
fun operate(a: Int, b: Int, op: (Int, Int) -> Int): Int {  
    return op(a, b)  
}  
val sum = operate(3, 4) { a, b -> a + b }
```

可变参数

```
fun sum(vararg nums: Int): Int = nums.sum()  
sum(1, 2, 3)  
val arr = intArrayOf(1, 2, 3)  
sum(*arr) // spread operator
```

类

类定义

```
class Person(val name: String, var age: Int) {  
    fun greet() = "Hi, I'm $name"  
}  
val p = Person("Alice", 30)  
println(p.name)
```

继承

```
open class Shape(val sides: Int) { open fun area(): Double = 0.0 }  
class Circle(val r: Double) : Shape(0) {  
    override fun area() = Math.PI * r * r  
}
```

可见性修饰符

public	任何地方可见 (默认)
private	仅在类/文件内可见
protected	类及其子类可见
internal	仅同一模块内可见

抽象类与接口

```
interface Drawable { fun draw() }  
abstract class Widget : Drawable { abstract val label: String }  
class Button(override val label: String) : Widget() {  
    override fun draw() = println("Drawing $label")  
}
```

空安全

可空类型

```
var name: String? = null // nullable  
val len = name?.length // safe call: null  
val len2 = name?.length ?: 0 // Elvis operator: 0  
val len3 = name!!.length // assert non-null (throws)
```

安全操作符

?.	安全调用——接收者为 null 时返回 null
?:	Elvis——null 时使用默认值
!!	非空断言 (为 null 时抛出异常)
?..let { }	仅在非 null 时执行代码块
as?	安全转型——失败时返回 null

智能转型

```
if (obj is String) println(obj.length) // auto-cast  
when (obj) {  
    is Int -> println(obj + 1)  
    is String -> println(obj.uppercase())  
}
```

集合

创建集合

```
val list = listOf(1, 2, 3) // immutable  
val mList = mutableListOf(1, 2, 3) // mutable  
val map = mapOf("a" to 1, "b" to 2)  
val set = setOf("x", "y", "z")
```

集合操作

```
val nums = listOf(1, 2, 3, 4, 5)  
nums.filter { it > 2 } // [3, 4, 5]  
nums.map { it * 2 } // [2, 4, 6, 8, 10]  
nums.firstOrNull { it > 3 } // 4  
nums.sumOf { it } // 15
```

常用操作

.filter { }	保留满足谓词的元素
.map { }	转换每个元素
.flatMap { }	映射并展平
.groupBy { }	按键分组为 Map
.sortedBy { }	按选择器排序
.associate { }	转换为 Map (键值对)
.any { } / .all { }	检查是否有任何/全部元素满足谓词
.fold(initial) { }	带初始值的归约

协程

基础协程

```
import kotlinx.coroutines.*  
fun main() = runBlocking {  
    launch { delay(1000); println("World") }  
    println("Hello")  
}
```

Async / Await

```
val deferred = async { fetchData() }  
val result = deferred.await()  
// parallel: launch multiple async, await all  
val (a, b) = awaitAll(async { fetchA() }, async { fetchB() })
```

协程构建器

launch { }	即发即忘协程 (返回 Job)
async { }	返回带结果的 Deferred<T>
runBlocking { }	桥接阻塞与挂起代码
withContext(dispatcher)	切换协程上下文
coroutineScope { }	结构化并发作用域

调度器

Dispatchers.Default	CPU 密集型任务 (线程池)
Dispatchers.IO	阻塞 I/O 操作
Dispatchers.Main	主线程/UI 线程 (Android、Swing)
Dispatchers.Unconfined	在调用线程启动, 在任意线程恢复

扩展

扩展函数

```
fun String.isPalindrome(): Boolean {  
    return this == this.reversed()  
}  
println("racecar".isPalindrome()) // true
```

扩展属性

```
val String.wordCount: Int  
get() = this.split("\\s+").toRegex().size  
println("hello world".wordCount) // 2
```

运算符重载

```
data class Vec(val x: Double, val y: Double) {  
    operator fun plus(other: Vec) = Vec(x + other.x, y + other.y)  
}  
val v = Vec(1.0, 2.0) + Vec(3.0, 4.0) // Vec(4.0, 6.0)
```

数据类

数据类

```
data class User(val name: String, val age: Int)  
val u1 = User("Alice", 30)  
val u2 = u1.copy(age = 31) // non-destructive copy  
val (name, age) = u1 // destructuring
```

Kotlin 快速参考

自动生成的成员

equals()	基于属性的结构相等
hashCode()	与 equals() 一致
toString()	User(name=Alice, age=30)
copy()	创建修改后的副本
componentN()	解构支持

枚举类

```
enum class Direction { NORTH, SOUTH, EAST, WEST }
val dir = Direction.NORTH
when (dir) { Direction.NORTH -> "up"; else -> "other" }
```

密封类

密封类层级

```
sealed class Result<out T> {
    data class Success<T>(val data: T) : Result<T>()
    data class Error(val message: String) : Result<Nothing>()
    data object Loading : Result<Nothing>()
}
```

穷举 When

```
fun handle(result: Result<String>): String = when (result) {
    is Result.Success -> result.data
    is Result.Error -> "Error: ${result.message}"
    is Result.Loading -> "Loading..."
} // no else needed - compiler checks exhaustiveness
```

密封类 vs 枚举

Sealed class	子类可持有不同状态
Sealed interface	允许多重继承
Enum class	固定的单例实例集合
data object	带 toString() 重写的单例

作用域函数

作用域函数对比

let	上下文为 it , 返回 lambda 结果
run	上下文为 this , 返回 lambda 结果
with(obj)	上下文为 this , 返回 lambda 结果
apply	上下文为 this , 返回上下文对象
also	上下文为 it , 返回上下文对象

let 与 apply

```
val name: String? = "Alice"
name?.let { println("Name is $it") }
val person = Person("Bob", 25).apply {
    age = 26 // configure object
}
```

run 与 with

```
val result = "Hello".run { uppercase() + " WORLD" }
val info = with(person) { "$name is $age years old" }
```

also

```
val numbers = mutableListOf(1, 2, 3)
    .also { println("Original: $it") }
    .also { it.add(4) }
// also is useful for side effects (logging, validation)
```