

Software Research

This document aims to provide a summary of the areas of research, training and my general proficiencies within Java, Kotlin, Android and cloud technologies.

Java SE

Top Level	
Class	Abstract Class
Interface	Enum

Nested Types	
Types	Local Class Inner Class Static Nested Class Anonymous Class Lambda Expressions Method Reference
Members	Permitted Members Access to Outer Scopes Shadowing Final or Effective Final
Nesting Principles	Memory Depiction Instantiation From External Scopes

Static Nested Class	
Effective Top Level Class	Internal Memory Depiction
Permitted Access to Outer Scopes	Instantiation From External Scopes

Anonymous Class	
Header / Body Syntax	Anonymous Object
Extended Class	Inline Implementation
Access to Outer Scopes	

Lambda Expression	
Purpose / Intended Use	Functional Interface
Parameters / Body Syntax	Zero Parameters Multiple Parameters Explicit Parameters Implicit Target Type
Access to Outer Scopes	

Enum	
Declaration / Definition	Header / Body Syntax Enum Constants Enum Constructor Memory Composition
Instantiation	Declaration Referencing Restrictions

Blocks	
Permitted Usage	Permitted Members Unpermitted Members
Initialisation Blocks	Initialisation Blocks Labelled Blocks

Class	
Declaration / Definition	Header / Body Syntax Access Modifiers Memory Composition Static Non-Static Overloading Overriding Shadowing Fields Instance Class Constants Constructors Default No Argument Super Constructor Constructor Chaining Initialisation Blocks non-Static Static
Methods	Signature Parameter List Parameter Type [ByValue] Primitive Arrays VarArgs Object Variable Interface Variable Method Ref. Lambda Expression Ambiguity Scope / Access Covariant Return Type
Extending	Compatibility
Interface Implementation	Single Multiple Generic
Instantiation	Declaration Allocation Initialisation Variable Referencing Member Referencing Garbage Collection

Interface	
Declaration / Definition	Header / Body Structure Syntax Memory Composition Implicit Access Modifiers Members Permitted Unpermitted Fields Constants Only Methods Abstract Static Default Extending Multiple Inheritance non-Static Members Aggregation Non-Ambiguity Non-Clashing Consolidation
Class Implementation	Abstract Method Implementation Abstract Method Aggregation No Ambiguity
Interface Variables	Polymorphism Anonymous Objects Compatibility
Types	Normal Functional Semantic Annotation

Arrays	
Declaration / Allocation / Initialisation	Utility Methods
Utility Classes System java.util.Arrays	Sorting Collection Conversion Searching Copying Comparison

Annotations	
Declaration	Types
Elements	Annotation [Predefined] Annotation Type [Custom] Container Annotation Type Meta-Annotations Type Annotation
Deployment	Single Multiple / Repeated

Techniques and Data Structures

Dynamic Programming

1D
2D
Top-Down
Bottom-Up / Tabulation

Divide and Conquer
Greedy
Backtracking
Path / Level Tracking
Sliding / Dynamic Window
Binary Search
Big O (Time / Space)

Linked List
Stack
Queue
Deque
Heap

Min Heap
Max Heap
Priority Queue

Recursion

Recursive Method Structure
Preprocessing
Postprocessing
Base / Ongoing Case
Call Tree
Tail Recursion

Hash Table / Map
Prefix Array
Suffix Array
Disjoint Set / Union Find

Graphs / Trees

Binary Tree
Binary Search Tree
Balanced Binary Search Tree
Minimum Spanning Tree
n-ary Tree
Trie

Graph / Tree Traversal

Directed BFS / DFS
Undirected preOrder
Acyclic inOrder
Edge List postOrder
Adjacency List

Multithreading / Concurrency

Interface

Runnable
Callable
Future
Lock
Condition
ExecutorService
 ThreadPoolExecutor
 FixedThreadPool
ScheduledExecutorService
 ScheduledThreadPool
BlockingQueue<E>
ConcurrentMap<K,V>

Class

Thread
ReentrantLocks
Semaphore
Executors
CountDownLatch
CyclicBarrier
AtomicInteger
ConcurrentHashMap<K,V>
Exchanger<V>
PriorityBlockingQueue<E>
PriorityBlockingQueue<E> with Comparable Element

Fork / Join

Class
ForkJoinPool
RecursiveAction
RecursiveTask<V>
Sequential v Parallel (via Fork / Join)

Serial v Parallel

Mergesort
Find Sum
Streams

States

Livelock
Deadlock

Techniques

Synchronisation Blocks
Wait / Notify
Volatile Memory
Object Locks
Object Locks with Conditions
Producer / Consumer

Packages

Management / Organisation
Naming Conventions
Referencing

Importing Static Members
Import Wildcards
Importing Top Level Components

SOLID Principles

Single Responsibility
Open-Closed
Liskov Substitution
Interface Segregation
Dependency Inversion

Infrastructure

JDK
 SE: Standard Edition
 EE: Enterprise Edition
 ME: Micro Edition
JRE / JVM
 JIT Compiler
 CLASSPATH
 Source Directory
 Java API Library
Class Loaders
 Bootstrap
 Extension
 System / Application
Memory Allocation
 Heap
 Stack
 Program Counter

Miscellaneous

final instanceof
null .equals()
super .hashCode()
this
Constructor Chaining
Local Reference
Method Argument / Return
Statements / Expressions / Blocks
Composition Hierachy
Types Concatenation
Composition v Aggregation

Spring

Projects

Spring Boot Spring Batch / Integration
Spring MVC Spring Security
Spring Validation Spring Security For OAuth
Spring Data Spring Security Authorisation Server

Bean Declaration / Definition

via XML
via Annotation
via Bean Method (@Bean)
via Component Scanning (@Component)
via Configuration Classes (@Configuration)

Dependency / Bean Injection

via Constructor
via Setter
via Field
via Autowiring

Spring Initializr

Project Creation / Structure
 Source Code Manifest File
 Resources Executable *.jar / *.war
 Test Mavern / Gradle Build
 application.properties
 application.yml
Starter Dependency Selection

Spring Tool Suite

IDE Plugin
Spring Boot Dashboard

Configuration

DSL Configuration
Configuration Properties
Profiles

Spring MVC Web Application / REST Endpoint Embedded Tomcat Server Thymeleaf Templates		Lombok @Data (Data Class) Getter / Setter Auto Populate	
@Controller @RestController		Logging @Slf4j Logback	
@RequestMapping @GetMapping @PostMapping @PutMapping		Persistence Spring Data JDBC/JPA/... JdbcTemplate Schema (via *.sql) SpEL	
RestTemplate ResponseEntity Object Mapping JSON / XML Payload Pagination Cross Origin Resource Sharing Path Variables HATEOAS		@DeleteMapping @PatchMapping @SessionAttributes @ModelAttribute @ResponseBody @ResponseStatus @Repository @Table @Data @Id @Query	
Testing @SpringBootTest @WebMvcTest @Test		Security User Authentication Security Filter Chains 3rd Party Authentication OAuth2	
Dev Tools Auto Restart Auto Refresh No Caching H2 Console		Messaging Asynchronous Brokers JMS RabbitMQ Kafka Push / Pull Models Message Converters Message Header / Payload Message Listeners	
		JWT OpenIDConnect Cross Site Request Forgery Client Repositories JMSTemplate RabbitMQTemplate KafkaTemplate	

XML HTTP REST

XML Purpose Standards XML Document Prologue Elements Tags Attributes Root Siblings Entity Reference Well Formed Comments Namespaces XMLHttpRequest XML Parser XML DOM XPath XSLT XQuery XLink XPointer DTD / XML Schema		HTTP Purpose Properties Connectionless Media Independent Stateless Versions	
		MIME Type Format Components Type Tree / Subtype Suffix Parameters	
		Registration Trees Standards Tree Vendor / Producer Tree Personal / Vanity Tree Unregistered Tree	
		REST API Purpose Client / Server Stateless Uniform Interface Resource Identification: Resource Manipulation: Resource Description:	
		URI GET, PUT, POST, DELETE... Content-Type: application/json	

Workflows

Continuous Integration > Continuous Delivery / Deployment Low Risk Progress Automation User Feedback		DevOps Purpose Advantages Pipeline Idea > Code > Build > Deploy > Manage > Learn > Idea... Velocity Quality Value Stream Map	
Test Automation Unit Test Suite Regression Test Suite Performance Test Suite			
Scrum Purpose Team / Roles Product Owner Scrum Master Developers Sprint Events / Workflow Plan Development Review Retrospective		Artifacts Product Goal Product Backlog Increment (of Value) Sprint Backlog Sprint Goal Items Plan of Delivery Burndown Chart	
Maven / Gradle Purpose Project Structure *.pom / build.gradle Modules Dependencies Plugins Maven WAR Maven Cargo Build Lifecycle mvnrepository.com Goals / Tasks		TDD Cycle: Red > Green > Refactor > Red... Unit Tests Solution Space Output Space Constraint Certainty / Flexibility Uncertainty Principle Value / Property Testing Test Doubles Dummy Stub Spy Test Patterns Self Shunt Humble Object Mock Fake	

Kotlin

Class			Collections		
Declaration / Definition		Data Class			
Constructors		Purpose	List		
Primary		Creation	Map		
Secondary		Built-In Implementations	Set		
Init Block		.toString()	Mutable / Read-Only		
Properties		.equals / ==	Casting		
Member Functions		.hashCode()	Extension Functions		
		.copy()	.filter()		
Extension		.println()	.any()		
Interface Implementation		.component1()...	.map()		
Delegation (by)			.mapNotNull()		
Operator Overloading			.none()		
		Copying	.find()		
		Destruction Declarations	.associate()		
			.first()		
			.associateBy()		
			.firstOrNull()		
			.count()		
			.flatten()		
			.partition()		
			.flatMap()		
			.groupBy()		
			.groupingBy()		
			.zip		
			.maxBy()		
			.zipWithNext()		
			.minBy()		
			.getOrPut()		
			.sortByDescending()		
Properties		Enum Class			
		Sealed Class			
		Nested / Inner Class			
		Generics			
		Classes			
		Interfaces			
		Functions			
		Extension Functions			
		Type Arguments / Parameters			
		Bound / Unbounded			
		Nullable / non-Nullable			
Extension Properties					
Creating					
Referencing					
Receiver (via this)					
Collections					
			Objects		
			Purpose		
			Singleton / static		
			Object Expressions		
			Declaration		
			Referencing		
			Companion		
Language					
History		OOP / Functional Styling	equals() / == / ===	Inlining	
Purpose		Statically Typed	Constants	Arrays	
Java / JVM Interoperability		Concision	Pairs		
Java Interpretation		Modules / Packages			
Java Equivalents		Top Level			
Access Modifiers		Loops	Types		
private	internal	in	Type Inference	Type Casting	Unit / Nothing
protected	public	until	is / as / as?	Smart Casting	val / var
		downTo	.let()	?	Any
		Range			
		..			
Conditionals		Strings	Common Library Functions		
Expressions		Templates	.takeIf()	.use()	.withLock()
Comparisons		Multiline	.takeUnless()	.with()	.apply() / .also()
when		Data Type Conversion	.repeat()		
if-else chain		Concatenation			
Type Checking		Exceptions	Common Annotations		
Ranges		Structure / Form / @Throws	@JvmName	@JvmStatic	
Enum		try catch	@JvmOverloads	@JvmField	
Pairs		Assignable			
		Function Wrappers			
		.require()			
Nullable / non-Nullable					
Purpose	Elvis Operator				
Safe Call	non-Null Assertion !!				
Language					
Java / Kotlin Interoperability					
via Annotation					
via Explicit Type Specification					
via Intrinsic Checks					
NPE Safety					
Platform Types					
Functions			Sequences		
Top-Level	Anonymous	Extending	Purpose		
Member	Local	Overriding	Stream Equivalent		
			Collection Alternative		
Forms		Member References	Intermediate Operations		
As Variable	Named Parameters	Bound / Unbound	Terminal Operations		
As Parameter	Default Arguments				
As Return	Function Expressions	Extension Functions	Lazy		
		Purpose	Yield		
Function Types		Creating	.asSequence()		
Implicit / Explicit	nullable / non-nullable	Managing	.generateSequence()		
		Limitations			
		Invocation from Java			
		infix			

Android Studio			
Project Structure / Files		UI	
Source Code	Gradle	Layout XML	Composable
Resources	Manifest File	LinearLayout	CoordinatorLayout
Libraries	APK file	FrameLayout	AppBarLayout
		ScrollView	CollapsingToolbarLayout
UI / Layouts	Emulation	Padding/Margin	Blueprints
Code Editor	USB Direct	Weighting	Layout Inflation
Design Editor	AVD	Gravity	Layout Nesting
		Themes	Collapsing Toolbar
Architectures	Intents	AppBar	Scrolling Toolbar
	Broadcasts	Toolbar	Material Design
	Services		Navigation Bar
	Work Manager		Navigation Drawer
		Activity	
		Lifecycle State / Methods	Save / Restore State
		Lifecycle (Visibility)	Bundle
		Lifecycle (Foreground)	Device Rotation
Views		Multiscreen	
TextView	Radio Button/Groups	Fragments	FragmentManager
Button	Floating Action Button	Fragment Lifecycle	Actions
Checkbox	Toast	Navigation Component	Safe Args / Directions / Args
Chip/Groups	Snackbars	Navigation Graphs	Back Stack
Spinner	View Groups	Navigation Host	
		Navigation Controller	
View Binding	Compose		
View Models	Live Data		
View Model Factories	Mutable Live Data		
View Model Provider	Data Binding		

Architectures			Cloud Architectures		
Monolith	Advantages		Compute Models	On-Prem	FaaS
	Disadvantages			IaaS	SaaS
Microservices				PaaS	
	Advantages		Cloud Service Providers		
	Disadvantages			Amazon	
	Characteristics				AWS
	Inter-Communication	Request / Response			AWS Elastic Beanstalk
		Event Driven			AWS Lambda
		Event Messaging		Microsoft	
		Event Streaming			Azure
	Design Patterns				Microsoft Windows Azure
					Azure Functions
Serverless				Google	
					Google Cloud / GCP
					Google App Engine
					Google Cloud Functions
				IBM	
					IBM Cloud
					IBM Cloud Code Engine
				Oracle	
					Heroku
					VMWare

6

Kubernetes	
Cluster	
Control Plane	cloud-controller-manager kube-controller-manager kube-apiserver kube-scheduler etcd
Node(s)	kubelet k-proxy Container Runtime Docker Engine CRI-O Containerd Mirantis Container Runtime
Objects	Configuration: *.yaml Pod Deployment Pod Template StatefulSet ReplicaController Volume PersistentVolume PersistentVolumeClaim Secret Service ClusterIP NodePort Load Balancer Ingress
	Label Selector System Environment Variables Role Based Access Control
Cluster Administration:	kubectl kubeadm minikube
Controller(s)	Node Controller Job Controller Endpoints Controller Service Account Controller Token Controller
Cloud Integration	CI / CD Workflow Local > GitHub > Test Suite > DockerHub > Cloud Service Provider Travis CI .travis.yml Cloud Service Provider Configuration Integration Account Verification Environment Variables Logs / Monitoring Declarative / Imperative

Research Materials

Please find a summary of the primary resources used to conduct the research and study of the subject areas listed above:

Primary Online Resources

Java SE	Oracle Java Tutorials	https://docs.oracle.com/javase/tutorial/index.html
	Oracle Java API	https://docs.oracle.com/javase/8/docs/api/index.html
Kotlin	Online Documentation	https://kotlinlang.org/docs/home.html
Android	Online Documentation	https://developer.android.com/
Spring	Online Documentation	https://docs.spring.io/spring-framework/docs/current/reference/
Kubernetes	Online Documentation	https://kubernetes.io/docs/home/
Docker	Online Documentation	https://docs.docker.com/

Udemy Courses

Docker and Kubernetes: The Complete Guide
 Java Spring Tutorial Masterclass – Spring Framework 5
 Java Programming Masterclass
 Design Patterns in Java
 Concurrency, Multithreading and Parallel Computing in Java
 Java Memory Management
 Java Application Performance and Memory Management
 Java Reflection
 The Complete Oracle SQL Bootcamp
 Dynamic Programming and Data Structures
 Test Driven Development

Coursera Courses

Kotlin for Java Developers by JetBrains

Bibliography

Java The Complete Reference	8th Ed.	Herbert Schildt	Oracle Press
Java Cookbook	4th Ed.	Ian F Darwin	O'Reilly
Android Development	3rd Ed.	Dawn and David Griffiths	O'Reilly
Spring in Action	6th Ed.	Craig Walls	Manning
Cloud Native Java	1st Ed.	Josh Long and Kenny Bastani	O'Reilly
Pro Git	2nd Ed.	S.Chacon B.Straub	Apress
Design Patterns	1st Ed.	E.Gamma R.Helm R.Johnson J.Vlissides	Addison Wesley
Clean Architecture	1st Ed.	R.C.Martin	Prentice Hall
Clean Craftsmanship	1st Ed.	R.C.Martin	Prentice Hall
The Clean Coder	1st Ed.	R.C.Martin	Prentice Hall