

# Senior Java Developer Interview Questions and Answers

## Core Java

**Q: What are the key differences between HashMap and ConcurrentHashMap?**

A: HashMap is not thread-safe, while ConcurrentHashMap is thread-safe with a segment-based locking. HashMap allows one null key; ConcurrentHashMap does not allow null keys or values.

**Q: Explain the difference between equals() and hashCode().**

A: equals() compares object contents; hashCode() returns an integer. If two objects are equal, their hashCodes must also be equal.

**Q: What is the difference between checked and unchecked exceptions?**

A: Checked exceptions must be declared or caught, e.g., IOException. Unchecked exceptions are runtime exceptions, e.g., NullPointerException.

## Multithreading & Concurrency

**Q: What is the difference between synchronized and ReentrantLock?**

A: synchronized is built-in and auto-unlocks. ReentrantLock offers features like tryLock(), fairness, and interruptibility.

**Q: What is a thread pool, and why is it used?**

A: Thread pools reuse threads to reduce overhead of thread creation and improve performance. Managed by ExecutorService.

**Q: What are deadlocks and how to avoid them?**

A: Deadlocks occur when threads wait on each other's locks indefinitely. Avoid with consistent lock ordering, tryLock(), and minimal lock usage.

## Spring & Microservices

**Q: What is the difference between @Component, @Service, and @Repository?**

A: @Component is generic. @Service indicates business logic. @Repository is for DAO and adds exception translation.

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**Q: Explain how Spring Boot's auto-configuration works.**

A: Spring Boot scans the classpath and auto-configures beans using `@EnableAutoConfiguration`. Properties can be customized in `application.properties`.

**Q: How do you secure REST APIs in Spring Boot?**

A: Use JWT, OAuth2, Spring Security with method-level annotations, and rate limiting with Bucket4j or API gateway.

## JPA & Hibernate

**Q: What is the difference between `fetchType.LAZY` and `fetchType.EAGER`?**

A: LAZY loads associations only when needed; EAGER loads immediately. LAZY is better for performance.

**Q: What are different caching levels in Hibernate?**

A: First-level (session), Second-level (shared across sessions), and Query cache.

## Design Patterns & Java 8+

**Q: What is the Singleton pattern in Java?**

A: Ensures a single instance. Use `enum Singleton { INSTANCE; }` for thread-safety and serialization.

**Q: What is the Factory pattern?**

A: Provides a way to create objects without exposing the instantiation logic.

**Q: What are functional interfaces in Java 8?**

A: Interfaces with one abstract method. Used with lambdas. Example: `Predicate`, `Consumer`.

**Q: What is the purpose of `Optional` in Java 8?**

A: To avoid `NullPointerException`. Example: `Optional.ofNullable(value).orElse(default)`.

## Performance

**Q: How would you improve performance in a high-load Java app?**

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A: Use thread pools, optimize queries, use efficient data structures, profile with JProfiler.

**Q: What tools do you use for profiling?**

A: VisualVM, JConsole for memory; JMeter/Gatling for load; Spring Actuator for monitoring.