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## DevOps Shack

# 100 SonarQube Error, Cause, Solution and RCA

### 1. Duplicate Code (Code Smell)

**Cause:** Same code blocks repeated across the codebase.

**Solution:** Extract the repeated code into a reusable method/class.

**Root Cause Analysis:** Lack of modularization or reuse principles during development.

### 2. Unused Variables (Code Smell)

**Cause:** Declared variables that are not used in the code.

**Solution:** Remove unused variables or utilize them if necessary.

**Root Cause Analysis:** Over-declaration or leftover variables during debugging or refactoring.

### 3. Cognitive Complexity Too High (Code Smell)

**Cause:** Method or function is too complex to understand.

**Solution:** Break down the method into smaller, more manageable methods.

**Root Cause Analysis:** Poor design practices or lack of code reviews.

### 4. Deprecated API Usage (Bug)

**Cause:** Using outdated APIs that may not be supported in future versions.

**Solution:** Replace deprecated APIs with their modern counterparts.

**Root Cause Analysis:** Delay in updating the codebase with newer library versions.

### 5. Lack of Unit Tests (Vulnerability)

**Cause:** Code lacks sufficient unit test coverage.

**Solution:** Write unit tests to cover critical paths and edge cases.

**Root Cause Analysis:** Focus on development speed over quality assurance.

## 6. Hard-Coded Credentials (Vulnerability)

**Cause:** Sensitive information like passwords or API keys directly in the code.

**Solution:** Use environment variables or secure vaults like AWS Secrets Manager or HashiCorp Vault.

**Root Cause Analysis:** Ignorance of secure coding practices.

## 7. Unused Imports (Code Smell)

**Cause:** Imported modules or packages that are not used in the code.

**Solution:** Remove unused imports using tools like `eslint --fix` or IDE features.

**Root Cause Analysis:** Copy-paste coding or changes in requirements during development.

## 8. Open Connections Not Closed (Bug)

**Cause:** Database or file connections left open after usage.

**Solution:** Use `try-with-resources` (Java) or equivalent patterns to close resources.

**Root Cause Analysis:** Lack of proper exception handling or oversight during implementation.

## 9. Null Pointer Exception Risk (Bug)

**Cause:** Dereferencing objects without null checks.

**Solution:** Add null checks or use non-nullable types where supported.

**Root Cause Analysis:** Insufficient defensive programming.

## 10. SQL Injection Risk (Vulnerability)

**Cause:** Concatenating user inputs directly into SQL queries.

**Solution:** Use prepared statements or ORM frameworks.

**Root Cause Analysis:** Lack of awareness of secure database interaction techniques.

## 11. Inefficient Loops (Code Smell)

**Cause:** Loops performing redundant computations or iterating unnecessarily.



**Solution:** Optimize loop logic and eliminate redundant operations.

**Root Cause Analysis:** Oversight or lack of profiling during performance testing.

## 12. Empty Catch Blocks (Bug)

**Cause:** Exception handling blocks without any code or logging.

**Solution:** Log the exception and/or handle it properly.

**Root Cause Analysis:** Poor error handling practices.

## 13. Hardcoded IP Address (Vulnerability)

**Cause:** IP addresses directly embedded in the code.

**Solution:** Use configuration files or environment variables.

**Root Cause Analysis:** Ignorance of flexible deployment practices.

## 14. Public Methods Without Documentation (Code Smell)

**Cause:** Public methods lack comments or documentation explaining their behavior.

**Solution:** Add meaningful comments or API documentation.

**Root Cause Analysis:** Lack of emphasis on documentation during development.

## 15. Magic Numbers (Code Smell)

**Cause:** Using hardcoded numeric literals without explanation.

**Solution:** Replace with named constants or enums.

**Root Cause Analysis:** Shortcut practices during development.

## 16. Overloaded Constructor (Code Smell)

**Cause:** Constructor with too many parameters.

**Solution:** Use the builder pattern or encapsulate parameters in an object.

**Root Cause Analysis:** Poor class design or insufficient modularization.

## 17. Missing Access Modifiers (Vulnerability)

**Cause:** Methods or variables declared with default access without intentionality.

**Solution:** Explicitly specify **private**, **public**, or **protected** as required.

**Root Cause Analysis:** Lack of access control awareness during development.



## 18. Overly Permissive Cross-Origin Resource Sharing (CORS) Policy (Vulnerability)

**Cause:** Allowing all origins in CORS configurations.

**Solution:** Restrict CORS policies to trusted domains.

**Root Cause Analysis:** Prioritizing convenience over security during setup.

## 19. Lack of Logging (Vulnerability)

**Cause:** Critical sections of code fail to log necessary information.

**Solution:** Implement structured logging at appropriate levels (e.g., info, error).

**Root Cause Analysis:** Neglecting maintainability and debugging aspects.

## 20. Recursive Calls Without Termination (Bug)

**Cause:** Recursive function lacks a proper base case for termination.

**Solution:** Add a termination condition or use an iterative approach.

**Root Cause Analysis:** Lack of testing for edge cases.

## 21. Overly Broad Catch Blocks (Vulnerability)

**Cause:** Catching general exceptions like **Exception** or **Throwable** instead of specific ones.

**Solution:** Catch and handle specific exceptions relevant to the context.

**Root Cause Analysis:** Lack of understanding of exception hierarchies or generic error handling practices.

## 22. Files Not Closed After Reading/Writing (Bug)

**Cause:** File streams are not closed after operations.

**Solution:** Use resource management patterns such as **try-with-resources** or explicitly close the streams.

**Root Cause Analysis:** Overlooking resource cleanup responsibilities.

## 23. Redundant **if** Conditions (Code Smell)



**Cause:** Conditions that are always true or false.

**Solution:** Remove redundant conditions after analyzing the logic.

**Root Cause Analysis:** Insufficient code reviews or careless copy-pasting of code.

## 24. String Comparison Using `==` (Bug)

**Cause:** Comparing strings using the `==` operator instead of `.equals()`.

**Solution:** Use `.equals()` or `.equalsIgnoreCase()` for string comparisons.

**Root Cause Analysis:** Misunderstanding of Java's string comparison semantics.

## 25. Ignoring `InterruptedException` (Bug)

**Cause:** Ignoring `InterruptedException` in multi-threaded applications.

**Solution:** Properly handle the exception by restoring the interrupted status or taking necessary actions.

**Root Cause Analysis:** Lack of thread safety awareness in multi-threaded environments.

## 26. Hardcoded Paths (Vulnerability)

**Cause:** File paths are hardcoded in the source code.

**Solution:** Use configuration files or environment variables for dynamic paths.

**Root Cause Analysis:** Ignorance of platform independence or flexible deployment practices.

## 27. Too Many Parameters in Methods (Code Smell)

**Cause:** Methods have excessive numbers of parameters, making them difficult to understand.

**Solution:** Refactor by grouping related parameters into objects.

**Root Cause Analysis:** Poor design and insufficient attention to readability.

## 28. Inconsistent Naming Conventions (Code Smell)

**Cause:** Variables, methods, or classes do not follow a consistent naming convention.

**Solution:** Use meaningful and consistent naming conventions based on project standards.



**Root Cause Analysis:** Lack of adherence to coding standards.

## **29. Overly Large Classes (Code Smell)**

**Cause:** A single class contains too many responsibilities or lines of code.

**Solution:** Apply the Single Responsibility Principle by splitting the class into smaller, focused classes.

**Root Cause Analysis:** Failure to design modular, maintainable code.

## **30. Potential Deadlock in Multi-threading (Bug)**

**Cause:** Improper synchronization leading to cyclic dependencies between threads.

**Solution:** Review locking mechanisms and avoid nested locks where possible.

**Root Cause Analysis:** Insufficient understanding of concurrency control mechanisms.

## **31. Excessive Logging (Code Smell)**

**Cause:** Logging too much information, leading to performance bottlenecks or log clutter.

**Solution:** Log only critical information and avoid logging in performance-critical sections.

**Root Cause Analysis:** Lack of logging level management and optimization.

## **32. Lack of Input Validation (Vulnerability)**

**Cause:** Failing to validate user input before processing it.

**Solution:** Validate and sanitize all inputs based on expected formats and constraints.

**Root Cause Analysis:** Over-reliance on trusted sources or overlooking edge cases.

## **33. Insecure Cryptography Algorithm (Vulnerability)**

**Cause:** Using weak or deprecated cryptographic algorithms such as MD5 or SHA1.

**Solution:** Use modern, secure algorithms like SHA256 or AES.

**Root Cause Analysis:** Lack of awareness of current security standards.

## **34. Empty Method (Code Smell)**



**Cause:** Methods that exist but do not contain any meaningful implementation.  
**Solution:** Remove unused methods or implement them with relevant functionality.  
**Root Cause Analysis:** Incomplete development or poor code cleanup practices.

### 35. Misconfigured Timeout for Network Calls (Bug)

**Cause:** Network calls lack proper timeout configurations, leading to potential hangs.  
**Solution:** Define reasonable timeout values for all network requests.  
**Root Cause Analysis:** Overlooking failure scenarios in distributed systems.

### 36. Inconsistent Equals and hashCode Implementation (Bug)

**Cause:** `equals()` and `hashCode()` are not implemented consistently.  
**Solution:** Ensure both methods align with the contract and maintain consistency.  
**Root Cause Analysis:** Misunderstanding of object equality contracts in collections.

### 37. Code Not Covered by Unit Tests (Vulnerability)

**Cause:** Significant portions of the codebase lack test coverage.  
**Solution:** Increase unit test coverage, focusing on critical and high-risk areas.  
**Root Cause Analysis:** Lack of emphasis on testing during development.

### 38. Overuse of Static Methods (Code Smell)

**Cause:** Excessive reliance on static methods, reducing flexibility and testability.  
**Solution:** Refactor to use instance methods or dependency injection where appropriate.  
**Root Cause Analysis:** Lack of understanding of object-oriented principles.

### 39. Memory Leak Due to Listeners (Bug)

**Cause:** Listeners or observers not being removed properly after usage.  
**Solution:** Deregister listeners or use weak references to avoid memory leaks.  
**Root Cause Analysis:** Poor lifecycle management of objects.

### 40. Overly Permissive File Permissions (Vulnerability)



**Cause:** Files or directories have broad permissions like **777**.

**Solution:** Restrict file permissions to the minimum necessary.

**Root Cause Analysis:** Lack of security-focused configuration practices.

#### 41. Long Methods

**Cause:** A method performs too many operations and spans several lines.

**Solution:** Break the method into smaller, reusable methods for better readability and maintainability.

**Root Cause Analysis:** Failure to follow clean coding principles during development.

#### 42. Unnecessary Type Casting

**Cause:** Redundant type casting operations in the code.

**Solution:** Remove unnecessary casts or use generics to avoid explicit casting.

**Root Cause Analysis:** Lack of type safety or over-cautious programming.

#### 43. Using **System.out.println** for Logging

**Cause:** Directly printing logs to the console instead of using a logging framework.

**Solution:** Use proper logging frameworks like Log4j, SLF4J, or Java Util Logging.

**Root Cause Analysis:** Lack of standardized logging practices.

#### 44. Ignored Return Values

**Cause:** A method's return value is ignored or not used.

**Solution:** Utilize the return value where needed, or refactor the code to avoid unnecessary calls.

**Root Cause Analysis:** Oversight during implementation or debugging.

#### 45. Inconsistent Line Breaks

**Cause:** Different line break styles (e.g., CRLF vs. LF) used in the codebase.

**Solution:** Configure the editor to enforce a consistent line break style.

**Root Cause Analysis:** Lack of coding standards across team members.

#### 46. Improper Exception Logging





**Cause:** Logging only the exception message without the stack trace.

**Solution:** Always log the full stack trace to debug issues effectively.

**Root Cause Analysis:** Lack of comprehensive error-handling practices.

## 47. Hardcoded Error Messages

**Cause:** Static error messages written directly in the code.

**Solution:** Externalize error messages into resource files or configuration.

**Root Cause Analysis:** Ignoring internationalization and reusability requirements.

## 48. Lack of Defensive Copying

**Cause:** Returning mutable objects directly from methods.

**Solution:** Return a defensive copy or immutable version of the object.

**Root Cause Analysis:** Insufficient understanding of immutability and defensive coding.

## 49. Use of Reflection

**Cause:** Excessive use of reflection APIs, which can bypass compile-time checks.

**Solution:** Minimize the use of reflection and prefer direct method calls.

**Root Cause Analysis:** Overuse of dynamic programming practices.

## 50. Missing Default Case in Switch Statements

**Cause:** Switch statements lack a default case.

**Solution:** Add a default case to handle unexpected inputs.

**Root Cause Analysis:** Overlooking edge cases in control flow.

## 51. Logging Sensitive Data

**Cause:** Logging confidential information such as passwords or credit card details.

**Solution:** Mask or redact sensitive data in logs.

**Root Cause Analysis:** Lack of awareness of secure logging practices.

## 52. Circular Dependencies



**Cause:** Two or more modules depend on each other directly or indirectly.

**Solution:** Refactor the design to remove cyclic dependencies.

**Root Cause Analysis:** Poor modularization and interdependency planning.

### 53. Overlapping Catch Blocks

**Cause:** Catch blocks overlap, making specific ones unreachable.

**Solution:** Ensure catch blocks are ordered from specific to general exceptions.

**Root Cause Analysis:** Misunderstanding exception hierarchy.

### 54. Use of Weak Hashing Algorithms

**Cause:** Employing outdated or weak hashing algorithms like MD5.

**Solution:** Use strong, modern algorithms such as SHA-256 or Argon2.

**Root Cause Analysis:** Failure to update cryptographic practices.

### 55. Missing HTTPS in URLs

**Cause:** Using plain HTTP instead of HTTPS for secure communication.

**Solution:** Use HTTPS for all external communication.

**Root Cause Analysis:** Ignorance of secure communication standards.

### 56. Incorrect Use of Lazy Initialization

**Cause:** Lazy initialization leading to performance bottlenecks or thread safety issues.

**Solution:** Use double-checked locking or other safe initialization patterns.

**Root Cause Analysis:** Mismanagement of performance optimization.

### 57. Excessive Public APIs

**Cause:** Too many public methods exposing internal functionality.

**Solution:** Limit the scope of methods and variables to only what's necessary.

**Root Cause Analysis:** Failure to encapsulate implementation details.

### 58. Overly Deep Nesting



**Cause:** Excessive levels of nested loops or conditionals.  
**Solution:** Refactor the code to flatten logic where possible.  
**Root Cause Analysis:** Lack of readability considerations during implementation.

## 59. Inefficient String Concatenation

**Cause:** Using **+** in loops for string concatenation in languages like Java.  
**Solution:** Use **StringBuilder** or equivalent optimized classes.  
**Root Cause Analysis:** Lack of performance profiling or awareness.

## 60. Static Fields Without Final Modifier

**Cause:** Declaring static fields without making them final when they are constants.  
**Solution:** Add the **final** modifier to static fields intended to be constants.  
**Root Cause Analysis:** Carelessness in declaring immutable constants.

## 61. Use of Deprecated Methods

**Cause:** Outdated methods are used in the code, which may not be supported in future versions.  
**Solution:** Replace deprecated methods with recommended alternatives provided in the library or framework.  
**Root Cause Analysis:** Delay in updating the codebase to newer library versions.

## 62. Overuse of Global Variables

**Cause:** Excessive reliance on global variables, leading to tight coupling and poor maintainability.  
**Solution:** Use local variables or encapsulate data within classes or methods.  
**Root Cause Analysis:** Lack of modular design and proper scoping practices.

## 63. Poor Thread Synchronization

**Cause:** Shared resources are not synchronized correctly, causing race conditions.  
**Solution:** Use proper synchronization mechanisms like locks, semaphores, or thread-safe collections.



**Root Cause Analysis:** Insufficient understanding of multi-threading and concurrency.

## **64. Not Using Constants for Repeated Values**

**Cause:** Repeated use of hardcoded values instead of defining constants.

**Solution:** Define and use constants for repeated values.

**Root Cause Analysis:** Overlooking reusability and maintainability.

## **65. Ignoring Compiler Warnings**

**Cause:** Ignored warnings about potential issues during compilation.

**Solution:** Address all compiler warnings and enable strict checks where possible.

**Root Cause Analysis:** Carelessness or lack of time to resolve issues during development.

## **66. Inefficient Database Queries**

**Cause:** Poorly written SQL queries causing performance issues.

**Solution:** Optimize queries by using indexing, joins, or query restructuring.

**Root Cause Analysis:** Lack of database optimization skills or testing.

## **67. Unnecessary Object Creation**

**Cause:** Creating new objects repeatedly instead of reusing existing ones.

**Solution:** Use object pools or reuse objects where possible.

**Root Cause Analysis:** Lack of optimization during resource-intensive operations.

## **68. Overuse of Exceptions for Flow Control**

**Cause:** Using exceptions as a mechanism for normal program flow.

**Solution:** Use conditional checks or proper logic to control program flow.

**Root Cause Analysis:** Misunderstanding the purpose of exceptions.

## **69. Missing Security Headers in Web Applications**



**Cause:** Essential HTTP security headers like **X-Content-Type-Options** or **Strict-Transport-Security** are missing.

**Solution:** Add required security headers in HTTP responses.

**Root Cause Analysis:** Lack of focus on web application security.

## 70. Memory Leaks Due to Static Collections

**Cause:** Static collections holding references, preventing garbage collection.

**Solution:** Clear collections when objects are no longer needed or use weak references.

**Root Cause Analysis:** Improper memory management in long-running applications.

## 71. Lack of Boundary Checks

**Cause:** Arrays or lists are accessed without validating indices or boundaries.

**Solution:** Add boundary checks before accessing data structures.

**Root Cause Analysis:** Oversight during implementation of data handling.

## 72. Overly Long Lines of Code

**Cause:** Code lines that exceed standard width, reducing readability.

**Solution:** Break long lines into smaller ones adhering to coding style guidelines.

**Root Cause Analysis:** Ignoring style guide recommendations for readability.

## 73. Missing Validation on APIs

**Cause:** API inputs are not validated, leading to potential vulnerabilities or errors.

**Solution:** Validate all inputs to APIs, ensuring they meet expected criteria.

**Root Cause Analysis:** Overlooking defensive programming principles.

## 74. Using Default Error Messages in APIs

**Cause:** Returning default error responses like stack traces in APIs.

**Solution:** Customize error messages and responses to avoid exposing internal implementation.

**Root Cause Analysis:** Lack of attention to user experience and security in API design.



## 75. Hardcoded Time Zones

**Cause:** Time zone information is hardcoded instead of being configurable.

**Solution:** Use libraries like `java.time` (Java) or `pytz` (Python) to handle time zones dynamically.

**Root Cause Analysis:** Ignorance of time zone complexities in global applications.

## 76. Ignoring Resource Limits in Kubernetes

**Cause:** Pods lack resource limits for CPU and memory, potentially leading to overuse.

**Solution:** Define proper resource requests and limits in Kubernetes manifests.

**Root Cause Analysis:** Insufficient attention to resource management in containerized environments.

## 77. Excessive Use of Inline Styles in HTML

**Cause:** Using inline CSS styles instead of external stylesheets.

**Solution:** Move styles to a dedicated CSS file for better maintainability.

**Root Cause Analysis:** Lack of adherence to front-end best practices.

## 78. Overuse of Singletons

**Cause:** Singleton patterns used excessively, causing tight coupling and reduced testability.

**Solution:** Limit the use of singletons to scenarios where they are genuinely required.

**Root Cause Analysis:** Misuse of design patterns without understanding trade-offs.

## 79. Hardcoded Ports in Configurations

**Cause:** Application ports are hardcoded, reducing flexibility.

**Solution:** Use environment variables or configuration files to define ports.

**Root Cause Analysis:** Overlooking deployment and environment variability.

## 80. Too Many Nested Try-Catch Blocks

**Cause:** Excessive nesting of try-catch blocks, reducing readability.

**Solution:** Refactor error handling to simplify and flatten the logic.



Root Cause Analysis: Poor error management strategy.

## 81. Lack of Pagination in APIs

Cause: Returning large datasets in API responses without pagination.

Solution: Implement pagination mechanisms like limit-offset or cursors in API responses.

Root Cause Analysis: Oversight in designing scalable APIs.

## 82. Missing Rate Limiting in APIs

Cause: APIs allow unlimited requests from a single client, causing potential abuse.

Solution: Add rate-limiting mechanisms to APIs to restrict excessive requests.

Root Cause Analysis: Ignorance of API security best practices.

## 83. Inefficient Use of Regular Expressions

Cause: Complex or poorly written regular expressions causing performance issues.

Solution: Optimize regular expressions and test their performance on large inputs.

Root Cause Analysis: Lack of testing or understanding of regex efficiency.

## 84. Catching NullPointerException Directly

Cause: Using a **catch** block to handle **NullPointerException** instead of preventing it.

Solution: Add null checks or use optional handling mechanisms.

Root Cause Analysis: Poor defensive programming practices.

## 85. Direct Database Queries in Loops

Cause: Database queries executed repeatedly within a loop.

Solution: Fetch required data in a single query or batch processing.

Root Cause Analysis: Lack of optimization and awareness of database interaction costs.

## 86. Lack of Logging in Critical Sections



**Cause:** Critical sections of the code do not log any events or errors.

**Solution:** Add meaningful logs to critical paths to aid debugging.

**Root Cause Analysis:** Neglecting maintainability and troubleshooting during development.

## 87. Excessive Object Cloning

**Cause:** Unnecessary cloning of objects, increasing memory usage.

**Solution:** Clone only when necessary and consider using immutable objects.

**Root Cause Analysis:** Mismanagement of object lifecycle and memory.

## 88. Ignoring Warnings from Dependency Checkers

**Cause:** Ignored security vulnerabilities reported by dependency analysis tools.

**Solution:** Regularly update dependencies and address reported vulnerabilities.

**Root Cause Analysis:** Lack of attention to dependency management.

## 89. Incorrect Usage of Locks in Multi-threading

**Cause:** Using locks without proper granularity, causing deadlocks or contention.

**Solution:** Use fine-grained locks and avoid holding locks for extended periods.

**Root Cause Analysis:** Lack of understanding of synchronization mechanisms.

## 90. Lack of Retry Mechanisms in APIs

**Cause:** API calls fail without any retry logic for transient errors.

**Solution:** Implement retry logic with exponential backoff for API calls.

**Root Cause Analysis:** Overlooking fault tolerance in distributed systems.

## 91. Overloading Web Pages with Too Many Scripts

**Cause:** Web pages include excessive JavaScript files, causing slow load times.

**Solution:** Minimize and bundle scripts using tools like Webpack or Gulp.

**Root Cause Analysis:** Ignorance of front-end optimization techniques.





## 92. Using Blocking Code in Asynchronous Environments

**Cause:** Blocking code executed in non-blocking environments like Node.js.

**Solution:** Refactor blocking code to use asynchronous patterns or APIs.

**Root Cause Analysis:** Misunderstanding of event-driven programming paradigms.

## 93. Not Using Dependency Injection

**Cause:** Dependencies are hardcoded instead of being injected.

**Solution:** Use dependency injection frameworks like Spring, Guice, or Dagger.

**Root Cause Analysis:** Lack of modular design practices.

## 94. Overlapping CSS Selectors

**Cause:** Multiple CSS selectors conflict, causing unpredictable styling.

**Solution:** Organize CSS and use specific selectors to avoid conflicts.

**Root Cause Analysis:** Poor styling structure and lack of testing.

## 95. Ignoring Error Codes in API Responses

**Cause:** Ignoring HTTP error codes like 4xx or 5xx in API responses.

**Solution:** Handle error codes appropriately and provide fallback mechanisms.

**Root Cause Analysis:** Insufficient error-handling practices.

## 96. Excessive Use of Annotations in Code

**Cause:** Overloading classes and methods with too many annotations.

**Solution:** Limit annotations to essential use cases and simplify configuration.

**Root Cause Analysis:** Misuse of frameworks and overcomplication of configurations.

## 97. Inefficient Use of Caching

**Cause:** Caching implemented poorly, causing cache misses or inefficiencies.

**Solution:** Optimize caching strategies and use tools like Redis or Memcached effectively.

**Root Cause Analysis:** Lack of understanding of caching mechanisms.



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## 98. Missing Default Timeout in API Calls

**Cause:** API calls do not define a default timeout, potentially causing hangs.

**Solution:** Set reasonable default timeout values for all outgoing requests.

**Root Cause Analysis:** Oversight in handling failure scenarios in distributed systems.

## 99. Directly Using System Clock

**Cause:** Directly calling system clock APIs instead of using abstracted time management.

**Solution:** Use time abstraction libraries or services for better control and testing.

**Root Cause Analysis:** Ignorance of testability and flexibility in time-dependent logic.

## 100. Overuse of Breakpoints for Debugging

**Cause:** Over-reliance on breakpoints instead of logging or unit tests for debugging.

**Solution:** Use structured logging and increase test coverage for debugging.

**Root Cause Analysis:** Lack of systematic debugging practices.