Lab Session: Security Audit

BSc Blockchain, Crypto Economy & NFTs

Course Instructor

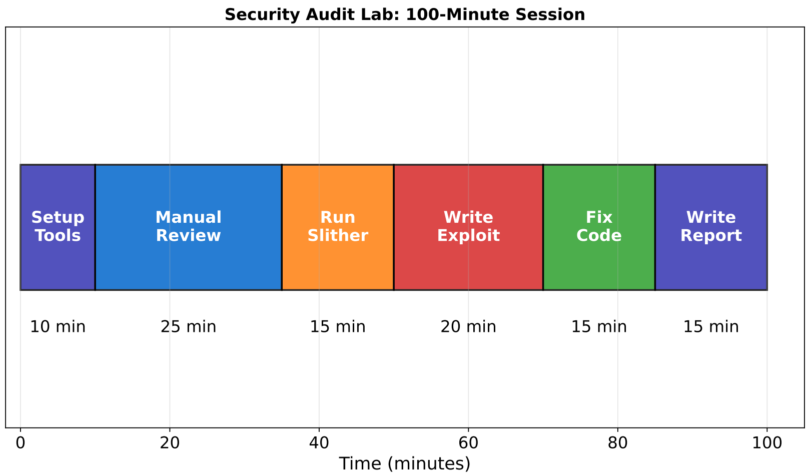
Module F: Advanced Topics

Learning Objectives

By the end of this lab session, you will be able to:

- Perform manual security code review
- Use automated tools (Slither, Mythril)
- Write exploit contracts demonstrating vulnerabilities
- Implement secure fixes using best practices
- Create professional audit reports

Lab Session Structure



Complete security audit workflow from review to report

Lab Overview

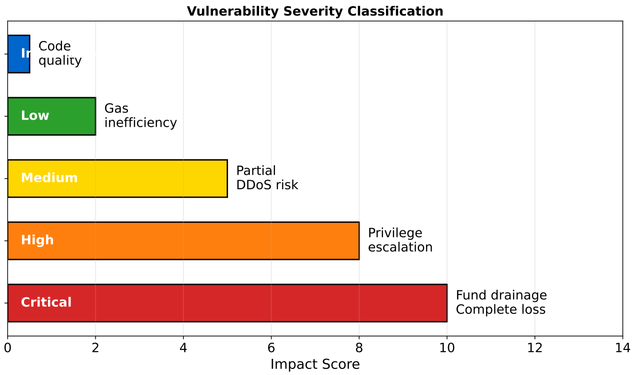
Contracts to Audit:

1. **VulnerableBank**: Reentrancy vulnerability
2. **InsecureToken**: Integer overflow, access control
3. **BadOracle**: Oracle manipulation

Deliverables:

- Audit report with severity classifications
- Exploit contracts demonstrating vulnerabilities
- Secure implementations with fixes

Vulnerability Severity Classification



Critical and High severity issues require immediate fixes

Exercise 1: VulnerableBank (Reentrancy)

Manual Review Tasks:

1. Read the withdraw function carefully
2. Identify external call before state update
3. Classify as Critical severity

Fix with Checks-Effects-Interactions:

- Update balance BEFORE external call
- Or use OpenZeppelin ReentrancyGuard

Exercise 2: InsecureToken (Multiple Issues)

Vulnerabilities to Find:

- Integer overflow (Solidity ¡ 0.8)
- Missing access control on mint
- Unprotected selfdestruct

Fix:

- Upgrade to Solidity 0.8.0+
- Add onlyOwner modifier
- Initialize owner in constructor

Exercise 3: BadOracle (Price Manipulation)

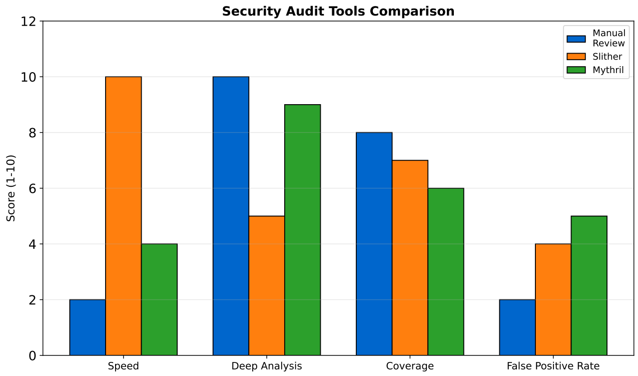
Vulnerability:

- Instant spot price from Uniswap
- Manipulable via flash loans

Secure Alternatives:

- Uniswap V2 TWAP oracle (time-weighted)
- Chainlink price feeds (decentralized oracle)
- Hybrid approach with multiple sources

Audit Tools Comparison



Combine manual review with automated tools for best coverage

Automated Analysis

Slither (Static Analysis):

- Fast pattern-based detection
- Run: `slither contracts/VulnerableBank.sol`

Mythril (Symbolic Execution):

- Deep path analysis
- Run: `myth analyze contracts/VulnerableBank.sol`

Key Detectors:

- SWC-107: Reentrancy
- SWC-101: Integer overflow
- SWC-105: Unprotected withdrawal

Audit Report Template

For Each Finding:

1. **Title**: Descriptive vulnerability name
2. **Severity**: Critical / High / Medium / Low
3. **Location**: Contract, function, line numbers
4. **Description**: What is the vulnerability
5. **Impact**: What can attacker achieve
6. **Recommendation**: How to fix

Lab Deliverables

Submit:

1. **Audit Report (PDF):**
   - Findings for all three contracts
   - Severity classifications
   - Fix recommendations with code
2. **Code Submissions:**
   - Exploit contracts (AttackBank.sol, etc.)
   - Secure implementations
   - Test suite proving fixes work

Key Takeaways

- Security audit combines manual review and automated tools
- Reentrancy is critical - use Checks-Effects-Interactions
- Solidity 0.8.0+ provides built-in overflow protection
- Never trust spot prices - use TWAP or Chainlink
- Exploit writing proves vulnerability severity
- Professional reports follow structured template