School: .... Campus: ....

Academic Year: .... Subject Name: .... Subject Code: ....

Semester: .... Program: .... Branch: .... Specialization: ....

Date: ....

Applied and Action Learning

(Learning by Doing and Discovery)

Name of the Experiement : Security First – Understanding Blockchain Attacks

Objective/Aim:

To study and understand the major security threats and attack vectors in blockchain systems, their causes, and possible preventive mechanisms to ensure secure blockchain operation.

Apparatus/Software Used:

- Blockchain demo simulations (e.g., Anders Brownworth Blockchain Demo)
- Remix IDE (for smart contract vulnerability demos)
- Test blockchain networks (Ethereum Testnet / Ganache)
- MetaMask Wallet

Theory/Concept:

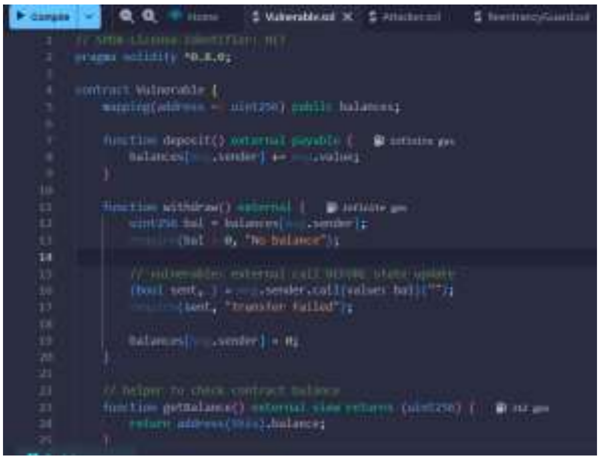
Blockchain provides decentralized trust through cryptographic security, but it is still vulnerable to various **attacks** that exploit its design, consensus mechanism, or smart contract logic.

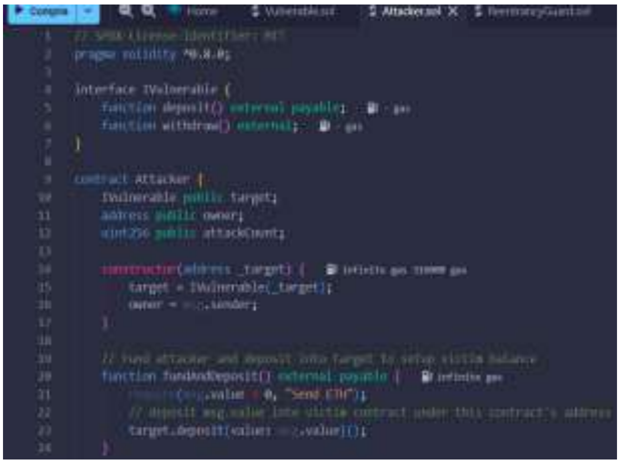
Common Types of Blockchain Attacks:

1. **51% Attack:**
   - Occurs when a single entity controls more than 50% of the network's hash power.
   - Allows attackers to reverse transactions and double-spend.
   - Example: Attack on Ethereum Classic in 2020.
2. **Sybil Attack:**
   - An attacker creates multiple fake nodes to influence consensus or network communication.
   - Prevented using proof-of-work or proof-of-stake mechanisms.
3. **Double-Spending Attack:**
   - The same cryptocurrency is spent twice by broadcasting two conflicting transactions.
   - Prevented through confirmations and consensus.
4. **Smart Contract Vulnerabilities:**
   - Poorly written smart contracts can be exploited.
   - Example: **The DAO Hack (2016)** due to re-entrancy bug.
5. **Phishing Attacks:**
   - Attackers trick users into revealing private keys or seed phrases using fake wallet sites.
6. **Routing and Eclipse Attacks:**
   - Target the P2P communication layer to isolate nodes and manipulate network data.

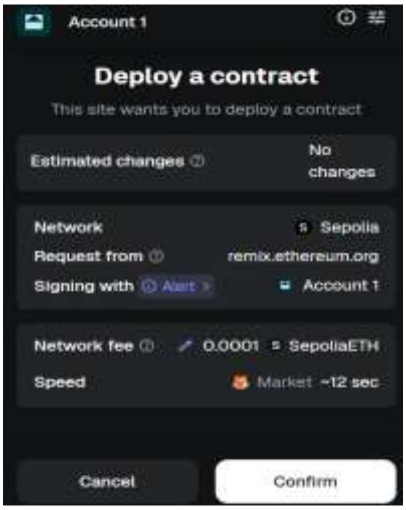
Procedure:

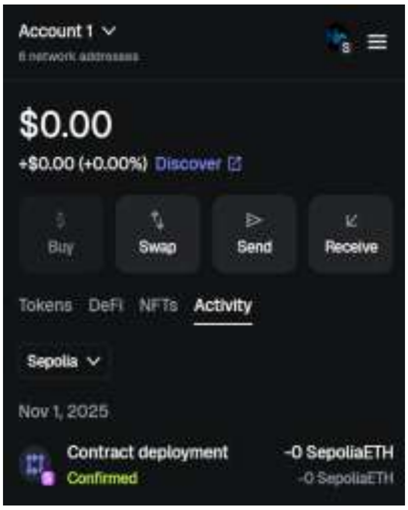
- ☐ Open Anders Brownworth Blockchain Demo.
- ☐ Modify data in an existing block → observe how it invalidates subsequent blocks.
- ☐ Demonstrates **data tampering** and the **immutability** principle.
- ☐ Explore a **Proof-of-Work demo** and attempt to alter a mined block → notice difficulty in rematching the hash.
- ☐ Simulates the **computational cost of attacks**.
- ☐ Use **Remix IDE** → write a simple vulnerable smart contract:





- ☐ Deploy and test using two accounts on a testnet → simulate **re-entrancy attack**
- ☐ Discuss mitigations (use of `ReentrancyGuard` or updating state before transfer)





Observation Table:

Attack Type	Description / Simulation Result	Prevention Mechanism
Data Tampering	Changing block data broke hash linkage	Cryptographic hash & consensus verification
51% Attack	Hypothetical control over majority hash power	Decentralization, PoS mechanism
Smart Contract Bug	Vulnerable withdraw enabled re-entrancy simulation	Secure coding, auditing, reentrancy guard
Phishing Attack	Users tricked into fake MetaMask login	Verify URLs, never share seed phrase
Double-Spend (Concept)	Two conflicting transactions tested on testnet	Confirmations, strong consensus

ASSESSMENT

Rubrics	Full Mark	Marks Obtained	Remarks
Concept	10		
Planning and Execution/ Practical Simulation/ Programming	10		
Result and Interpretation	10		
Record of Applied and Action Learning	10		
Viva	10		
Total	**50**		

Signature of the Student:

Name :

Regn. No. :

Signature of the Faculty: