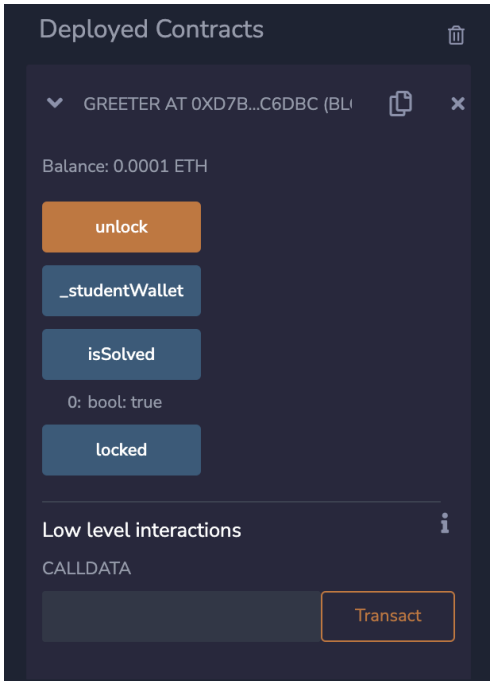
DeFi HW3

Metamask Wallet Address

- Wallet Address :

Challenge 1 : Greeter

- Address:
- Is locked: False



- My approach:
    a. MetaMask
        - switch to Sepolia network
        - Send 0.00001 SepoliaETH to Greeter Address
    b. Remix
        - Compile + Deploy Greeter.sol
        - Paste Greeter Address at “At Address”
    c. Find “ Greeter AT <Address>” under “Deployed Contracts”
    d. Click on “unlock” and “isSolved“
    e. See if “isSolved“ shows “bool: true”
- Components in Contracts:
    a. Greeter.sol

- modifier onlyStudent()
  - This modifier can only be called by _studentWallet.
  - It's used to check if msg.sender is the same as _studentWallet, which also means that the wallet sent ether is the student's wallet.

```
modifier onlyStudent() {
    require(
        msg.sender == _studentWallet,
        "only one student wallet can call"
    );
    _;
}
```

- function unlock()
  - This function can only be called by _studentWallet because it uses the modifier onlyStudent() that can only be called by _studentWallet.
  - It's used to check if there are more than 0.0001 ether in the wallet. If there is, then it will unlock the contract and turn locked to false。

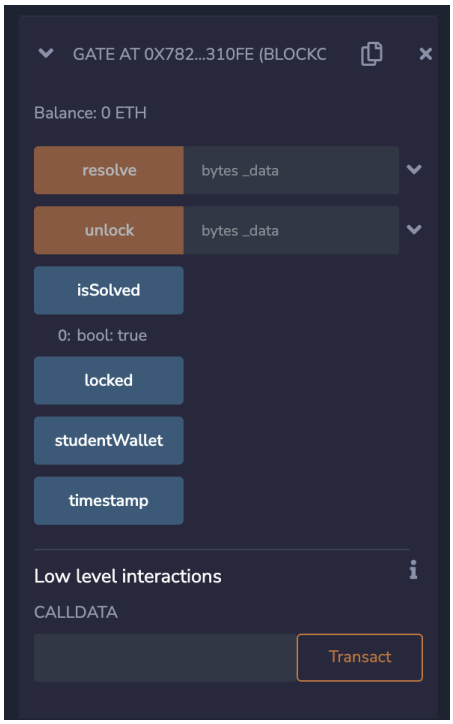
```
function unlock() public onlyStudent {    26678 gas
    require(
        address(this).balance >= 100000000000000,
        "please send 0.0001 ether to unlock"
    );
    locked = false;
}
```

- function isSolved()
  - isSolved() is a view function that checks if the challenge is solved.

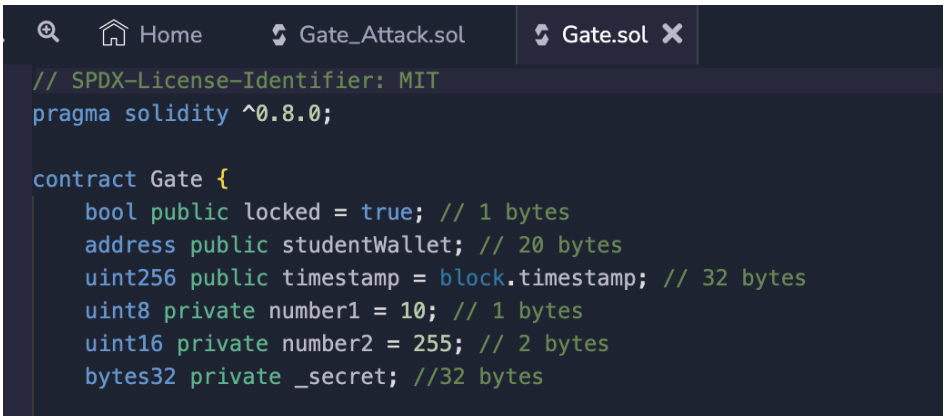
```
function isSolved() public view returns (bool) {    2532 gas
    return !locked;
}
```

Challenge 2 : Gate

- Address:
- Is locked: False



- My approach:
  a. Gate.sol
     - Calculate the slot number to save secret



       - locked (1 byte) & studentWallet (20 bytes) ➔ slot 0
       - timestamp (32 bytes) ➔ slot 1
       - number1 (1 byte) & number2 (2 bytes) ➔ slot 2
       - **_secret** (32 bytes) ➔ **slot 3**

  b. index.js

- Log in to https://replit.com/~
- Install web3@1.10.0 in shell

```
~/indexjs$ npm install web3@1.10.0

up to date, audited 348 packages in 8s

59 packages are looking for funding
  run `npm fund` for details

7 moderate severity vulnerabilities

To address all issues (including breaking changes), run:
  npm audit fix --force

Run `npm audit` for details.
~/indexjs$ npm list
nodejs@1.0.0 /home/runner/indexjs
├── @types/node@18.0.6
├── node-fetch@3.3.0
└── web3@1.10.0
```

- Create index.js to solve “secret”

```
index.js
index.js > contractAddress
1  rpc_url = "https://rpc.sepolia.org"
2  const Web3 = require("web3");
3  const web3 = new Web3(rpc_url)
4
5  let contractAddress = '0x782f789b449A96a62c8A3A83000EdB86e42310Fe'
6
7
8  web3.eth.getStorageAt(contractAddress, 0).then(console.log);
9  web3.eth.getStorageAt(contractAddress, 1).then(console.log);
10 web3.eth.getStorageAt(contractAddress, 3).then(console.log);
```

- Input Gate Address as contractAddress
- Use web3.eth.getStorageAt to get secret of the slot numbered “3”
-

```
Run
0x0000000000000000000000000000000000000000000000000000000065328a50
0x000000000000000000000b1e9431033369204184c69ead064e2e3369e536a00
0x00000000000000000000000000000000000000007465737490aa7465737490aa
```

- Secret: **0x00000000000000000000000000000000000000007465737490aa7465737490aa**
- Copy this secret and return to Remix

c. Gate_Attack.sol
    - Create Smart Contract - Gate_Attack.sol
    - Compile + Deploy Gate_Attack.sol
    - Find “GATEATTACK AT <Address>” under “Deployed Contracts”
    - Paste the secret that calculated from index.js in “crackGate” under GATEATTACK
    - Click on “crackGate”
d. Gate.sol
    - Compile
    - Paste Gate Address at “At Address” and Click “At Address”
    - Click on “isSolved“ and see if “isSolved“ shows “bool: true”

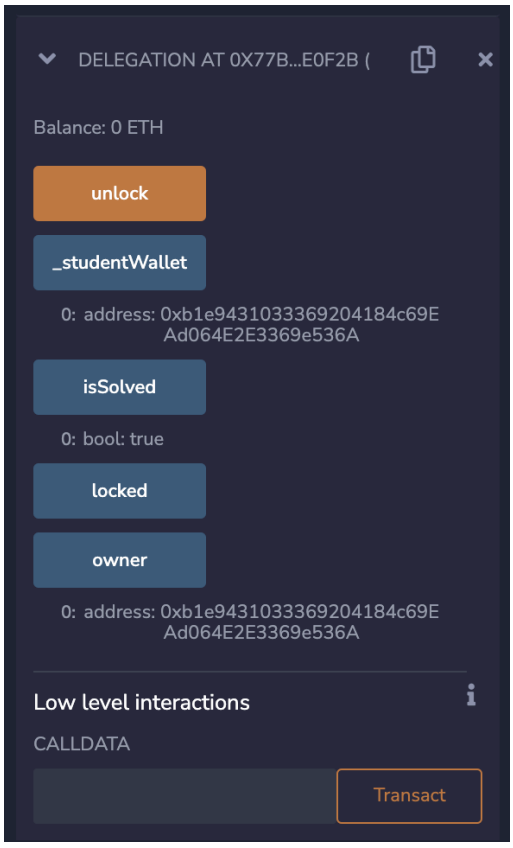
- Components in Contracts:
    a. Gate_Attack.sol

    - Interface IGate
        - The components contained within the interface represent the elements that allow users to interact with the contract.

        - Here it contains two functions, resolve() and isSloved(). We only use isSolved().
    - Function crackGate()
        - It's used to check if the secret retrieved from index.js is correct. If it's correct, then the Gate can be cracked.
    - Function check()
        - It's used to check if the "gate" function is solved.

Challenge 3 : Delegation

- Address:
- Is locked: False



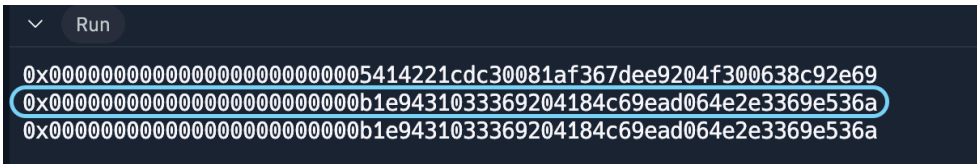
owner = _studentWallet

- My approach:
    a. Delegation.sol
        - Calculate the slot number to save secret

- 

  - Owner (20 bytes) ➔ slot 0
  - **_secret** (32 bytes) ➔ **slot 1**

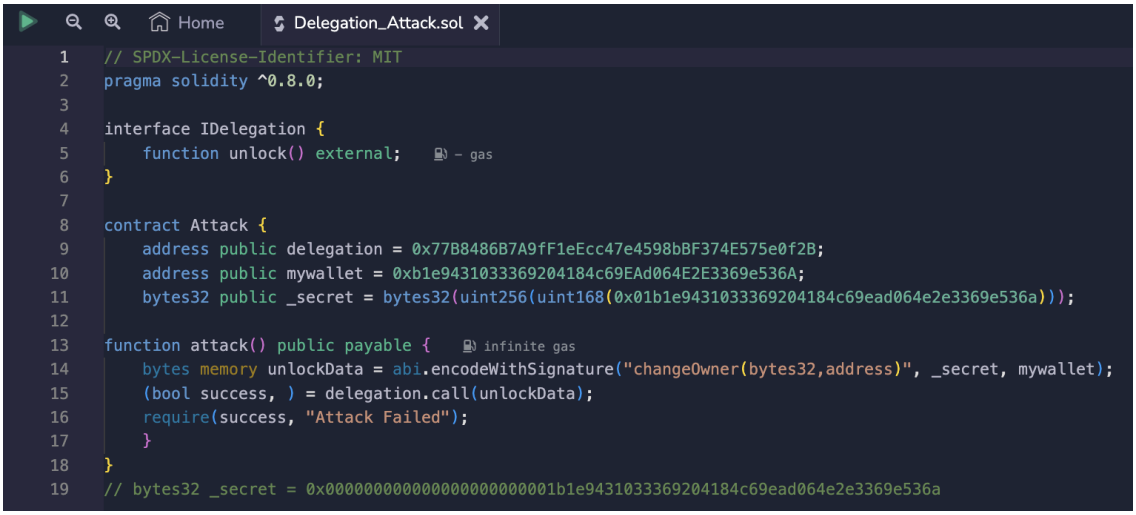
b. Index.js
  - Log in to https://replit.com/~
  - Create index.js to solve “secret”
  - 

  - Input Gate Address as contractAddress
  - Use web3.eth.getStorageAt to get secret of the slot numbered “1”
  - 

  - Secret: **0x000000000000000000000000b1e9431033369204184c69ead064e2e3369e536a**
  - Copy this secret and return to Remix

c. Delegation_Attack.sol
  - Create Smart Contract - Delegation_Attack.sol
  - Compile + Deploy Delegation_Attack.sol

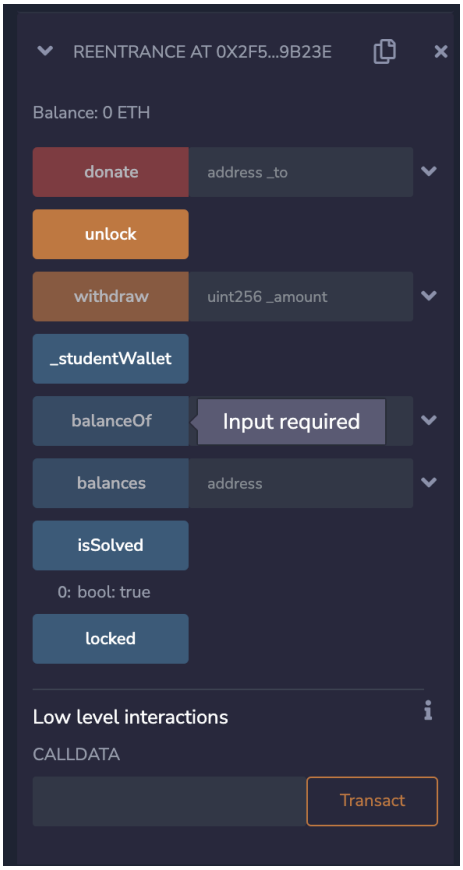
        - Find “ATTACK AT <Address>” under “Deployed Contracts”
        - Click on “attack”
    d. Delegation.sol
        - Compile
        - Paste Delegation Address at “At Address” and Click “At Address”
        - Click on “unlock” and “isSolved“
        - See if “isSolved“ shows “bool: true”
- Components in Contracts:
    a. Delegation_Attack.sol



        - Interface IDelegation
            - The components contained within the interface represent the elements that allow users to interact with the contract.
            - Here it contains one functions, unlock().
        - Function attack()
            - It’s used to check if the secret retrieved from index.js is correct. If it’s correct, then the attack succeeds.

Challenge 4 : Reentrance

- Address:
- Is locked: False



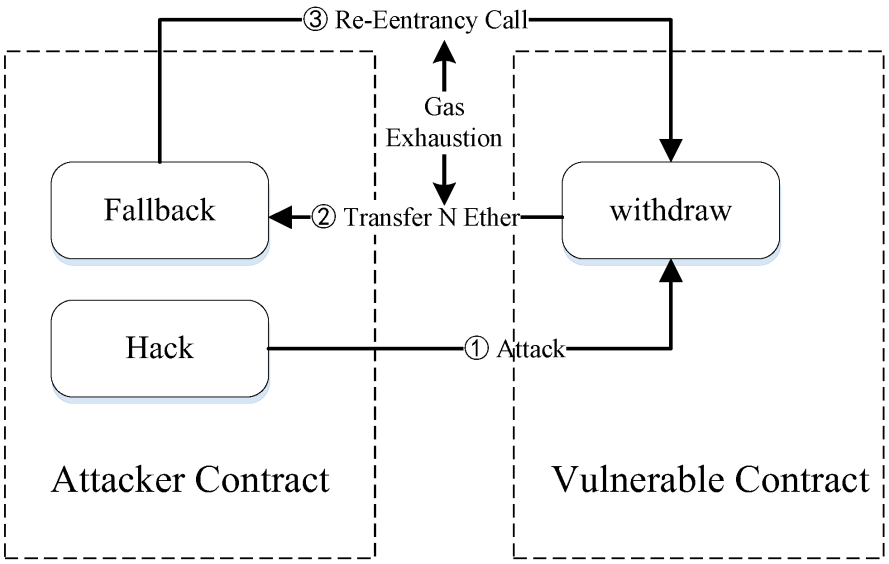
- My approach:
    a. Reentrance_Attack.sol
        - Create Smart Contract - Reentrance_Attack.sol
        - Compile + Deploy Reentrance_Attack.sol
    b. MetaMask
        - After deploying Reentrance_Attack.sol , find “ATTACKREENTRANCE AT <Address>” under “Deployed Contracts”.
        - Copy the Address of “ATTACKREENTRANCE AT <Address>”
        - Switch to Sepolia network
        - Send 0.001 SepoliaETH to the Address
    c. Reentrance_Attack.sol
        - Return to Reentrance_Attack.sol and find “ATTACK AT <Address>” under “Deployed Contracts”.
        - Click on “attack”

d. Reentrance.sol
    - Compile
    - Paste Reentrance Address at “At Address” and Click “At Address”
    - Click on “unlock” and “isSolved“
    - See if “isSolved“ shows “bool: true”

- Components in Contracts:
    a. Reentrance_Attack.sol
        - Interface ITargetContract

            - The components contained within the interface represent the elements that allow users to interact with the contract.

        - It contains four functions, withdraw(), donate(), unlock(), and isSolved(). We only use unlock() and isSolved() here. After we finish the withdrawal, we then unlock the contract and see if the challenge is solved.
- Function unlock()
    - It’s used to unlock the challenge.
- Function attack()
    - There are several actions within this function.
    - Firstly, donate() represents the “Transfer N Ether” action in the figure below.
    - Secondly, The line “emit Start(address(reentrance), address(this).balance);” triggers the “Start” event. Also, “this” represents a "contract instance" object for the current contract. However, the “balance” function is part of the "address" object. Therefore, we need to use address(this) to convert “this” to an "address" object to call the “balance” function.
    - Last but not least, withdraw() represents the “Attack” action in the figure below.
- receive()
    - It triggers the “Reenter” event that represents the “Re-Entrancy Call” action in the figure below.



Addresses in array form (convenient for TAs)

[0xb1e9431033692041 84c69EAd064E2E3369e536A,
0xd7B071BC0d44FC5bc6b6f9d9914661bb20DC6dbC,
0x782f789b449A96a62c8A3A83000EdB86e42310Fe,
0x77B8486B7A9fF1eEcc47e4598bBF374E575e0f2B,
0x2F5f9184B8724C46187721a68Ba7ACe70D19b23E]