Lab: Error Handling in Solidity

Prerequisites

1. Chrome or Firefox browser.
2. An Internet connection
3. Open Remix with the following Smart Contract:

```
pragma solidity >=0.5.11 <0.7.0;

contract ExceptionExample {

    mapping(address => uint) public balanceReceived;

    function receiveMoney() public payable {
        balanceReceived[msg.sender] += msg.value;
    }

    function withdrawMoney(address payable _to, uint _amount) public {
        if(_amount <= balanceReceived[msg.sender]) {
            balanceReceived[msg.sender] -= _amount;
            _to.transfer(_amount);
        }
    }
}
```

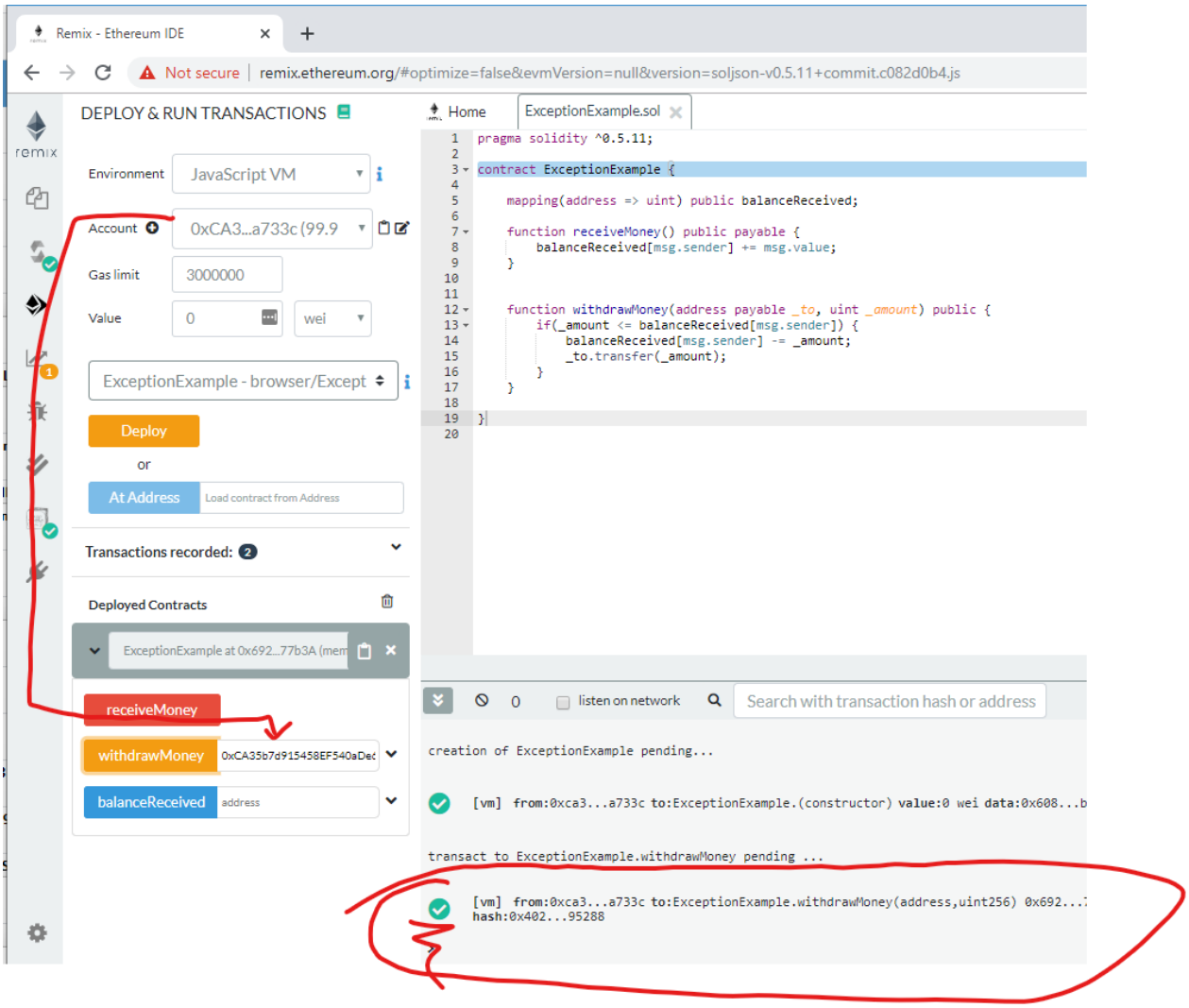
Step by Step Instruction

Deploy the Smart Contract in the JavaScript VM

Open the “Deploy and Run Transactions” view in Remix with the smart contract

Try to withdraw more than you have

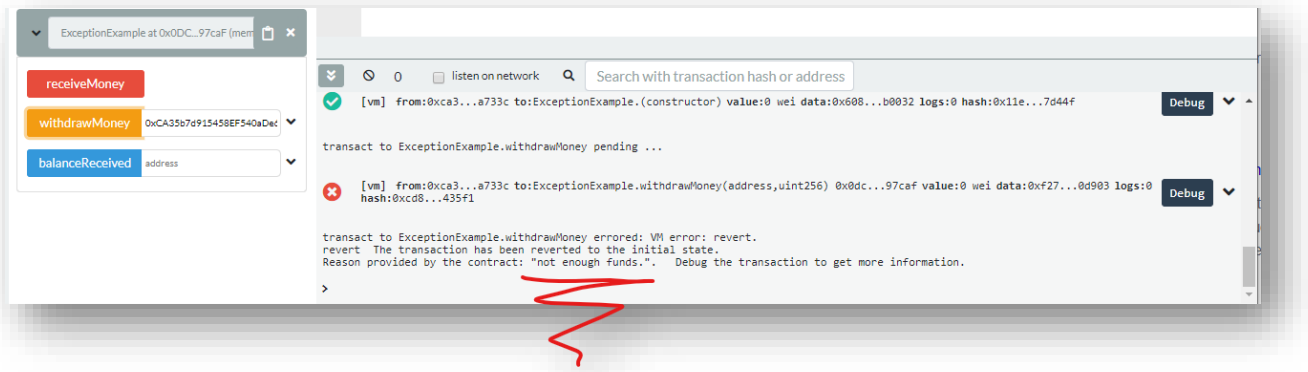
At the beginning you have 0 Ether. When we try to withdraw some then simply nothing happens.



Replace the if with a Require


```
pragma solidity >=0.5.11 <0.7.0;

contract ExceptionExample {

    mapping(address => uint) public balanceReceived;

    function receiveMoney() public payable {
        balanceReceived[msg.sender] += msg.value;
    }

    function withdrawMoney(address payable _to, uint _amount) public {
        require(_amount <= balanceReceived[msg.sender], "not enough funds.");
        balanceReceived[msg.sender] -= _amount;
        _to.transfer(_amount);
    }
}
```

And try to withdraw again. It should throw an error!

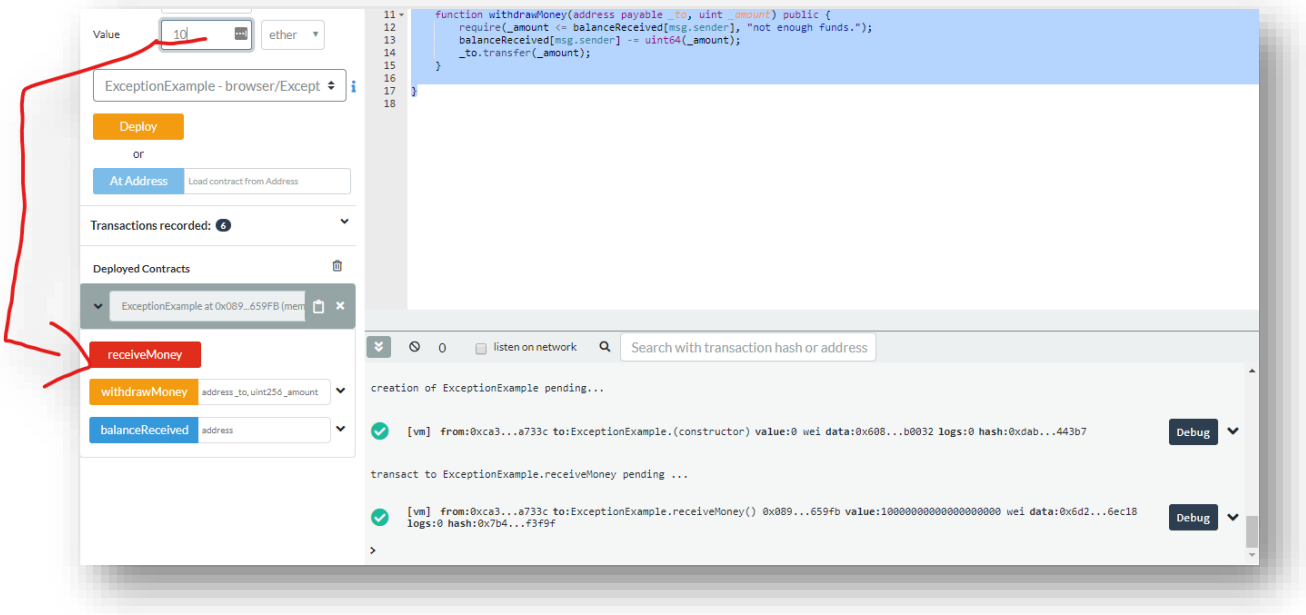


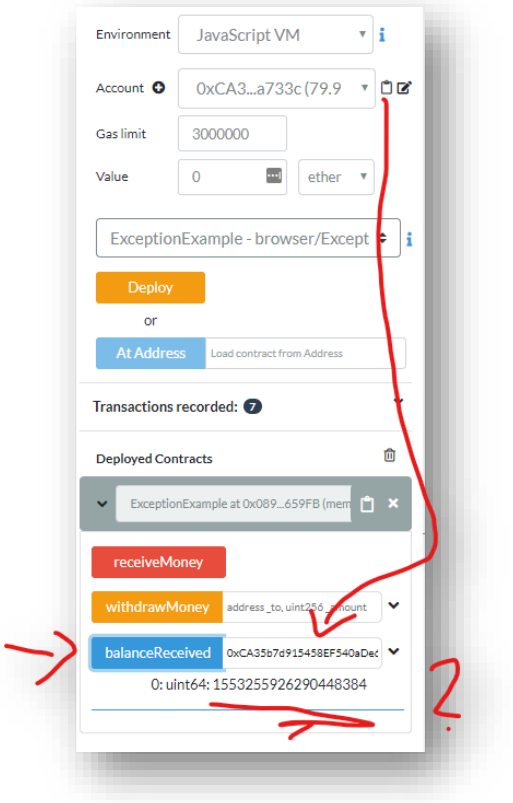
Add an Assert

Imagine your balance is not of the type uint256, but of the type uint64 – to save some storage costs.

If you send two times 10 Ether to your smart contract it will automatically roll over to 0:


```
pragma solidity >=0.5.11 <0.7.0;

contract ExceptionExample {

    mapping(address => uint64) public balanceReceived;

    function receiveMoney() public payable {
        balanceReceived[msg.sender] += uint64(msg.value);
    }

    function withdrawMoney(address payable _to, uint _amount) public {
        require(_amount <= balanceReceived[msg.sender], "not enough funds.");
        balanceReceived[msg.sender] -= uint64(_amount);
        _to.transfer(_amount);
    }
}
```





It is lower, because the uint64 rolls over to 0 after reaching the maximum value of 18446744073709551616 – that's around 18.44 Ether

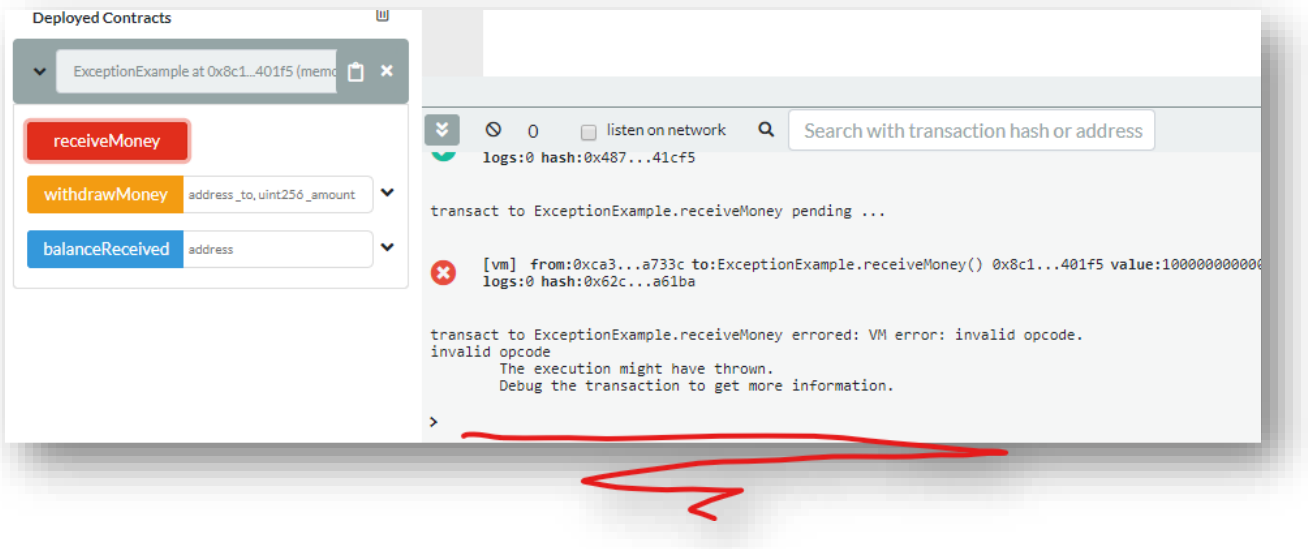
Here we could use asserts to make sure we don't roll over – in both directions! When withdrawals happen, we don't suddenly have more balance available than before and when deposits happen that the balance after depositing is really higher than before.

Add an assert, to make sure the balance can only grow larger


```
pragma solidity >=0.5.11 <0.7.0;

contract ExceptionExample {

    mapping(address => uint64) public balanceReceived;

    function receiveMoney() public payable {
        assert(balanceReceived[msg.sender] + uint64(msg.value) >= balanceReceived[msg.sender]);
        balanceReceived[msg.sender] += uint64(msg.value);
    }

    function withdrawMoney(address payable _to, uint _amount) public {
        require(_amount <= balanceReceived[msg.sender], "not enough funds.");
        assert(balanceReceived[msg.sender] >= balanceReceived[msg.sender] - _amount);
        balanceReceived[msg.sender] -= uint64(_amount);
        _to.transfer(_amount);
    }
}
```

Test again

Send again 2 times 10 Ether to the smart contract. It will end in an error.



Congratulations, LAB is completed