Blockchain Study Notes Day 10:

Module 2 - Solidity Basics
Chapter 6 - Function Modifiers in Solidity

Introduction to Function Modifiers

Function modifiers in Solidity allow developers to modify the behavior of functions. They are reusable pieces of code that can add preconditions, postconditions, or other logic to functions, enhancing code organization and readability.

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1. What Are Function Modifiers?

- **Definition**:
  Function modifiers are keywords in Solidity that change the behavior of a function.
- **Purpose**:
  - Enforce access control.
  - Validate input or contract state before executing the function logic.
  - Reduce code duplication by reusing common checks or conditions.

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2. Syntax of a Modifier

General Structure:

```
modifier modifierName() {
    // Precondition code
    _;  // Placeholder for the function body
    // Postcondition code (optional)
}
```

Explanation:

- The _ represents the function being modified.
- Code before _ runs **before** the function.
- Code after _ runs **after** the function.

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3. Example of Function Modifiers (Using Munawar)

```
// SPDX-License-Identifier: MIT
```

```
pragma solidity ^0.8.0;

contract FunctionModifiers {
    address public owner;
    bool public isContractActive = true;

    // Modifier to restrict access to the contract owner
    modifier onlyOwner() {
        require(msg.sender == owner, "You are not the owner!");
        _;
    }

    // Modifier to ensure the contract is active
    modifier contractIsActive() {
        require(isContractActive, "Contract is not active!");
        _;
    }

    // Constructor to set the owner
    constructor() {
        owner = msg.sender;
    }

    // Function to deactivate the contract, restricted to owner
    function deactivateContract() public onlyOwner {
        isContractActive = false;
    }

    // Function to update some state, only when the contract is active
    function updateState() public contractIsActive {
        // Update logic here
    }

    // Function to demonstrate multiple modifiers
    function restrictedFunction() public onlyOwner contractIsActive {
        // Restricted function logic here
    }
}
```

Explanation:

1. **`onlyOwner` Modifier**:
   - Ensures that only the contract owner can call certain functions.
2. **`contractIsActive` Modifier**:
   - Ensures the function is called only when the contract is active.
3. **Function with Multiple Modifiers**:
   - `restrictedFunction` uses both `onlyOwner` and `contractIsActive` to enforce multiple conditions.

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4. Benefits of Using Modifiers

- **Code Reusability**:
  - Common checks can be reused across multiple functions.
- **Improved Readability**:
  - Separates conditional logic from the main function body.
- **Security**:
  - Enforces rules like access control and contract state validation.

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5. Custom Use Cases for Modifiers

- **Access Control**: Restrict function access to specific users (e.g., admin, owner).
- **State Validation**: Ensure specific contract states before executing functions (e.g., contract active).
- **Timed Execution**: Allow functions to be executed only after a certain time.

```
solidity
Copy code
modifier onlyAfter(uint _time) {
    require(block.timestamp >= _time, "Function not available yet!");
    _;
}
```

Home Task

1. **Add a Timed Modifier**:
   - Write a modifier `onlyAfter` to restrict function calls until a specific timestamp.
2. **Create a New Contract**:
   - Implement a contract with modifiers for pausing/unpausing the contract.
3. **Experiment with Modifier Order**:
   - Change the order of modifiers in functions and observe how behavior changes.

Conclusion

Function modifiers in Solidity are a powerful tool for enforcing conditions and improving code structure. By mastering modifiers, developers can write more secure and efficient smart contracts, reducing the potential for bugs and vulnerabilities.

Day 10 Notes

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