# Solidity programming

Karachi Institute of Technology and Entrepreneurship (KITE)

Session 2: Solidity (Functions and Contracts)

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## Readings

<https://www.tutorialspoint.com/solidity/index.htm>

<https://www.dappuniversity.com/articles/solidity-tutorial>

<https://101blockchains.com/solidity-tutorial/>

<https://www.geeksforgeeks.org/introduction-to-solidity/?ref=leftbar-rightbar>

<https://betterprogramming.pub/learn-solidity-functions-ddd8ea24c00d>

<https://www.bitdegree.org/learn/solidity-types>

<https://www.tutorialspoint.com/solidity/solidity_mappings.htm>

<https://medium.com/coinmonks/what-the-hack-is-memory-and-storage-in-solidity-6b9e62577305>

<https://www.ops.gov.ie/app/uploads/2021/01/Blockchain-Develop-Deploy-and-Test-Your-First-Smart-Contract.pdf>

<https://ethereumbuilders.gitbooks.io/guide/content/en/solidity_tutorials.html>

## Development environment

<https://remix.ethereum.org/>

## Reading: View and Pure Function

<https://www.geeksforgeeks.org/solidity-view-and-pure-functions/?ref=leftbar-rightbar>

## Task 1: Pure Function

Ref: <https://www.geeksforgeeks.org/solidity-view-and-pure-functions/?ref=leftbar-rightbar>

// Solidity program to demonstrate pure functions

pragma solidity ^0.5.0;

// Defining a contract

contract Test {

    // Defining pure function to calculate product and sum of numbers

   function getResult(

   ) public pure returns(

     uint product, uint sum){

      uint num1 = 2;

      uint num2 = 4;

      product = num1 \* num2;

      sum = num1 + num2;

   }

}

### Pure Function: Incorrect Use

Ref: <https://www.geeksforgeeks.org/solidity-view-and-pure-functions/?ref=leftbar-rightbar>

pragma solidity ^0.5.0;

// Defining a contract

contract Test {

//state variable

uint test=1;

// Defining pure function to calculate product and sum of numbers

function getResult(

) public pure returns(

uint product, uint sum){

uint num1 = 2;

uint num2 = 4;

product = num1 \* num2;

sum = num1 + num2 +test ;

}

}

## Task 2: View Function

If we want to access values from the environment or state variables then view function is needed.

Ref: <https://www.geeksforgeeks.org/solidity-view-and-pure-functions/?ref=leftbar-rightbar>

pragma solidity ^0.5.0;

// Defining a contract

contract Test {

uint test =1;

// Defining view function to calculate product and sum of numbers

function getResult(

) public view returns(

uint product, uint sum){

uint num1 = 2;

uint num2 = 4;

product = num1 \* num2;

sum = num1 + num2 + test ;

}

}

## Reading: Payable Function

<https://rangesh.medium.com/6-payable-functions-in-solidity-smartcontract-ethereum-d2535e346dc1>

## Task 3: Payable Function

//ref: https://rangesh.medium.com/6-payable-functions-in-solidity-smartcontract-ethereum-d2535e346dc1

pragma solidity ^0.4.4;

contract Sample {

uint amount =1;

function payme() payable{

amount += msg.value;

}

}

## Task 4: Solidity contract to find Owner Address and balance

//ref: https://www.geeksforgeeks.org/creating-a-smart-contract-that-returns-address-and-balance-of-owner-using-solidity/

// Solidity program to retrieve address and balance of owner

pragma solidity ^0.6.8;

// Creating a contract

contract MyContract

{

// Private state variable

address private owner;

// Defining a constructor

constructor() public{

owner=msg.sender;

}

// Function to get address of owner

function getOwner(

) public view returns (address) {

return owner;

}

// Function to return current balance of owner

function getBalance(

) public view returns(uint256){

return owner.balance;

}

}

## Reading: Contract Visibility Quantifiers

<https://www.tutorialspoint.com/solidity/solidity_contracts.htm>

## Reading: Function Overloading and Overriding

<https://www.tutorialspoint.com/solidity/solidity_function_overloading.htm>

<https://medium.com/upstate-interactive/solidity-override-vs-virtual-functions-c0a5dfb83aaf>

## Reading: Inheritance, Abstract, Interface

<https://www.tutorialspoint.com/solidity/solidity_inheritance.htm>

<https://solidity-by-example.org/super/>

<https://solidity-by-example.org/inheritance/>

<https://solidity-by-example.org/shadowing-inherited-state-variables/>

<https://www.bitdegree.org/learn/solidity-inheritance>

<https://www.geeksforgeeks.org/solidity-inheritance/?ref=leftbar-rightbar>

<https://www.tutorialspoint.com/solidity/solidity_abstract_contracts.htm>

<https://www.geeksforgeeks.org/solidity-abstract-contract/?ref=lbp>

<https://www.geeksforgeeks.org/solidity-basics-of-interface/?ref=leftbar-rightbar>

<https://www.tutorialspoint.com/solidity/solidity_interfaces.htm>

<https://solidity-by-example.org/interface/>

## Task 5: Inheritance and Function OVERRiding

//ref: https://solidity-by-example.org/inheritance/

// SPDX-License-Identifier: MIT

pragma solidity ^0.8.3;

/\* Graph of inheritance

A

/ \

B C

/ \ /

F D,E

\*/

contract A {

function foo() public pure virtual returns (string memory) {

return "A";

}

}

// Contracts inherit other contracts by using the keyword 'is'.

contract B is A {

// Override A.foo()

function foo() public pure virtual override returns (string memory) {

return "B";

}

}

contract C is A {

// Override A.foo()

function foo() public pure virtual override returns (string memory) {

return "C";

}

}

// Contracts can inherit from multiple parent contracts.

// When a function is called that is defined multiple times in

// different contracts, parent contracts are searched from

// right to left, and in depth-first manner.

contract D is B, C {

// D.foo() returns "C"

// since C is the right most parent contract with function foo()

function foo() public pure override(B, C) returns (string memory) {

return super.foo();

}

}

contract E is C, B {

// E.foo() returns "B"

// since B is the right most parent contract with function foo()

function foo() public pure override(C, B) returns (string memory) {

return super.foo();

}

}

// Inheritance must be ordered from “most base-like” to “most derived”.

// Swapping the order of A and B will throw a compilation error.

contract F is A, B {

function foo() public pure override(A, B) returns (string memory) {

return super.foo();

}

}

## Task 6: Shadowing Inherited state varibles

// ref: https://solidity-by-example.org/shadowing-inherited-state-variables/

// SPDX-License-Identifier: MIT

pragma solidity ^0.8.3;

contract A {

string public name = "Contract A";

function getName() public view returns (string memory) {

return name;

}

}

// Shadowing is disallowed in Solidity 0.6

// This will not compile

// contract B is A {

// string public name = "Contract B";

// }

contract C is A {

// This is the correct way to override inherited state variables.

constructor() {

name = "Contract C";

}

// C.getName returns "Contract C"

}

## Task 7: Interface

//ref: https://www.tutorialspoint.com/solidity/solidity\_interfaces.htm

pragma solidity ^0.5.0;

interface Calculator {

function getResult() external view returns(uint);

}

contract Test is Calculator {

constructor() public {}

function getResult() external view returns(uint){

uint a = 1;

uint b = 2;

uint result = a + b;

return result;

}

}

## Reading: Metamask, Rinkeby testnet and contract deployment

<https://metamask.io/>

<https://remix-ide.readthedocs.io/en/latest/run.html>

<https://rinkeby.etherscan.io/>

<https://medium.com/compound-finance/the-beginners-guide-to-using-an-ethereum-test-network-95bbbc85fc1d>

## Task 8: Deploy a contract on Rinkeby testnet

1. Create an account using Metamask using its Google chrome extension: <https://metamask.io/>
2. Login to your Metamask account and select Rinkeby testnet.
3. Open remix in the same browser which has your Metamask account logged in.
4. Write a sample contract.
5. Compile it as usual.
6. In the “Deploy & run” part, instead of using Javascript VM, use: Injected Web3.
7. This will deploy your contract on Rinkeby testnet.

## Task 9: explore the rinkeby testnet:

Got to: <https://rinkeby.etherscan.io/>

Search: 0x10b9E144DE89B118a27fdf16577888CdC59f6ad5

This is just a test contract which I deployed.

This will also show my public address: 0x76C62EB54bEc8132Cff0bCBBB3aA1022f33Fb9AC