# Solidity programming

Karachi Institute of Technology and Entrepreneurship (KITE)

Session 3: ERC20 Basics

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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: ERC20 Basic Contract Example

<https://www.toptal.com/ethereum/create-erc20-token-tutorial>

<https://ethereumdev.io/using-safe-math-library-to-prevent-from-overflows/>

## Reading: Event

<https://www.geeksforgeeks.org/what-are-events-in-solidity/>

https://www.tutorialspoint.com/solidity/solidity\_events.htm

## Task 1: ER20 Basic Code

Step 1: Login to your MetaMask account using the google extension.

Step 2: Open remix.

Step 3: Type or Copy/Paste the code below.

Step 4: Compile the code.

Step 5: In the “Deploy & run” set and amount (e.g 100 tokens)in the field given next to the deploy button.

Step 6: In the “Deploy & run”, choose Inject Web3 options and then press “Deploy” button to see how the contract works.

Step 7: Below the “Deployed Contracts”, select your contract.

Step 8: Transfer tokens from one account to the other and check balance.

**Code**

//ref: https://www.toptal.com/ethereum/create-erc20-token-tutorial

//ref: <https://gist.github.com/giladHaimov/8e81dbde10c9aeff69a1d683ed6870be#file-basicerc20-sol>

pragma solidity ^0.4.19;

contract ERC20Test {

string public constant name = "ERC20Basic";

string public constant symbol = "ATC20";

uint8 public constant decimals = 18;

event Approval(address indexed tokenOwner, address indexed spender, uint tokens);

event Transfer(address indexed from, address indexed to, uint tokens);

mapping(address => uint256) balances;

mapping(address => mapping (address => uint256)) allowed;

uint256 totalSupply\_;

using SafeMath for uint256;

constructor(uint256 total) public {

totalSupply\_ = total;

balances[msg.sender] = totalSupply\_;

}

function totalSupply() public view returns (uint256) {

return totalSupply\_;

}

function balanceOf(address tokenOwner) public view returns (uint) {

return balances[tokenOwner];

}

function transfer(address receiver, uint numTokens) public returns (bool) {

require(numTokens <= balances[msg.sender]);

balances[msg.sender] = balances[msg.sender].sub(numTokens);

balances[receiver] = balances[receiver].add(numTokens);

emit Transfer(msg.sender, receiver, numTokens);

return true;

}

function approve(address delegate, uint numTokens) public returns (bool) {

allowed[msg.sender][delegate] = numTokens;

emit Approval(msg.sender, delegate, numTokens);

return true;

}

function allowance(address owner, address delegate) public view returns (uint) {

return allowed[owner][delegate];

}

function transferFrom(address owner, address buyer, uint numTokens) public returns (bool) {

require(numTokens <= balances[owner]);

**//This is to avoid gas estimation error which comes when we run it from a test environment where owner==msg.sender**

if (owner!=msg.sender)

{

require(numTokens <= allowed[owner][msg.sender]);

balances[owner] = balances[owner].sub(numTokens);

allowed[owner][msg.sender] = allowed[owner][msg.sender].sub(numTokens);

balances[buyer] = balances[buyer].add(numTokens);

}

else {

balances[owner] = balances[owner].sub(numTokens);

balances[buyer] = balances[buyer].add(numTokens);

}

emit Transfer(owner, buyer, numTokens);

return true;

}

}

library SafeMath {

function sub(uint256 a, uint256 b) internal pure returns (uint256) {

assert(b <= a);

return a - b;

}

function add(uint256 a, uint256 b) internal pure returns (uint256) {

uint256 c = a + b;

assert(c >= a);

return c;

}

}

## Task 2: Explore the Rinkeby Testnet FOR CONTRACTS AND TRANSACTIONS

Got to: https://rinkeby.etherscan.io/address/0x4ed7853321de989d025b222416ddfdaaec856b6d

This is a test contract and check the activity which I deployed using the code given above.

Go to: <https://rinkeby.etherscan.io/address/0x76c62eb54bec8132cff0bcbbb3aa1022f33fb9ac>

Check the activity. This is my public address.

Go to: <https://rinkeby.etherscan.io/tx/0xf390f13382a465cd48b9fb5d582443b12689551950a955638c2587a943533249>

This is a test transaction using the ERC20 token (ASC20).

Go to: <https://rinkeby.etherscan.io/token/0x4ed7853321de989d025b222416ddfdaaec856b6d>

This is the test token we created.

## Task 3: ERC20 using Interface

//ref: https://www.toptal.com/ethereum/create-erc20-token-tutorial

//ref: <https://gist.github.com/giladHaimov/8e81dbde10c9aeff69a1d683ed6870be#file-basicerc20-sol>

// https://github.com/OpenZeppelin/openzeppelin-contracts/blob/v3.0.0/contracts/token/ERC20/IERC20.sol

pragma solidity ^0.4.19;

interface IERC20 {

function totalSupply() external view returns (uint);

function balanceOf(address account) external view returns (uint);

function transfer(address recipient, uint amount) external returns (bool);

function allowance(address owner, address spender) external view returns (uint);

function approve(address spender, uint amount) external returns (bool);

function transferFrom(

address sender,

address recipient,

uint amount

) external returns (bool);

event Transfer(address indexed from, address indexed to, uint value);

event Approval(address indexed owner, address indexed spender, uint value);

}

contract MyERC20 is IERC20 {

string public constant name = "ERC20Basic";

string public constant symbol = "ATC20";

uint8 public constant decimals = 18;

event Approval(address indexed tokenOwner, address indexed spender, uint tokens);

event Transfer(address indexed from, address indexed to, uint tokens);

mapping(address => uint256) balances;

mapping(address => mapping (address => uint256)) allowed;

uint256 totalSupply\_;

using SafeMath for uint256;

constructor(uint256 total) public {

totalSupply\_ = total;

balances[msg.sender] = totalSupply\_;

}

function totalSupply() public view returns (uint256) {

return totalSupply\_;

}

function balanceOf(address tokenOwner) public view returns (uint) {

return balances[tokenOwner];

}

function transfer(address receiver, uint numTokens) public returns (bool) {

require(numTokens <= balances[msg.sender]);

balances[msg.sender] = balances[msg.sender].sub(numTokens);

balances[receiver] = balances[receiver].add(numTokens);

emit Transfer(msg.sender, receiver, numTokens);

return true;

}

function approve(address delegate, uint numTokens) public returns (bool) {

allowed[msg.sender][delegate] = numTokens;

emit Approval(msg.sender, delegate, numTokens);

return true;

}

function allowance(address owner, address delegate) public view returns (uint) {

return allowed[owner][delegate];

}

function transferFrom(address owner, address buyer, uint numTokens) public returns (bool) {

require(numTokens <= balances[owner]);

**//This is to avoid gas estimation error which comes when we run it from a test environment where owner==msg.sender**

if (owner!=msg.sender)

{

require(numTokens <= allowed[owner][msg.sender]);

balances[owner] = balances[owner].sub(numTokens);

allowed[owner][msg.sender] = allowed[owner][msg.sender].sub(numTokens);

balances[buyer] = balances[buyer].add(numTokens);

}

else

{

balances[owner] = balances[owner].sub(numTokens);

balances[buyer] = balances[buyer].add(numTokens);

}

emit Transfer(owner, buyer, numTokens);

return true;

}

}

library SafeMath {

function sub(uint256 a, uint256 b) internal pure returns (uint256) {

assert(b <= a);

return a - b;

}

function add(uint256 a, uint256 b) internal pure returns (uint256) {

uint256 c = a + b;

assert(c >= a);

return c;

}

}

## Reading: ERC20 Continue

<https://solidity-by-example.org/app/erc20/>

<https://ethereum.org/en/developers/tutorials/transfers-and-approval-of-erc-20-tokens-from-a-solidity-smart-contract/>

<https://dev.to/stermi/how-to-create-an-erc20-token-and-a-solidity-vendor-contract-to-sell-buy-your-own-token-4j1m>

<https://docs.appery.io/docs/eth-app-example-part1>

<https://www.quicknode.com/guides/solidity/how-to-create-and-deploy-an-erc20-token>