**Practical 1: WRITE A SOLIDITY PROGRAM FOR VARIABLES AND DECISION MAKING.**

**Source Code:**

**// SPDX-License-Identifier: GPL-3.0**

**pragma solidity <0.9.0;**

**contract ForContract {**

**uint storedData;**

**function set(uint x) public {**

**storedData = x;**

**for (uint i = 0; i != 5; i++) {**

**storedData = storedData + i;**

**}**

**}**

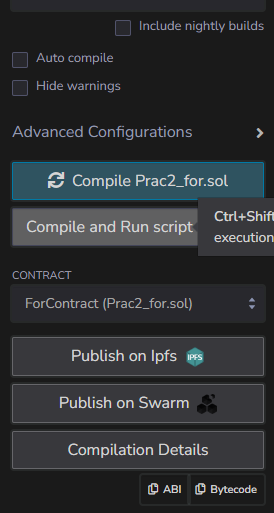
**function get() public view returns (uint) {**

**return storedData;**

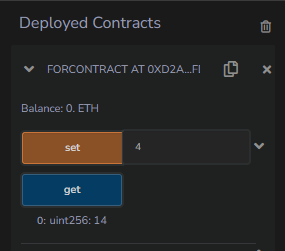
**}**

**}**

**Compile Contract:**

****

**Deploy Contract:**

****

**Source Code:**

**// SPDX-License-Identifier: GPL-3.0**

**pragma solidity <0.9.0;**

**contract Types {**

**uint i = 10;**

**bool even;**

**function decision\_making() public payable returns(bool) {**

**if (i % 2 == 0) {**

**even = true;**

**} else {**

**even = false;**

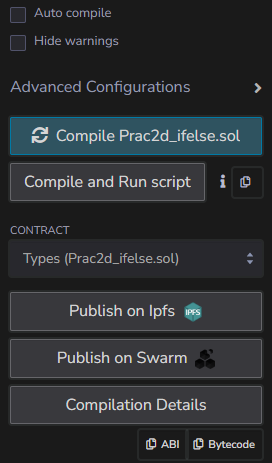
**}**

**return even;**

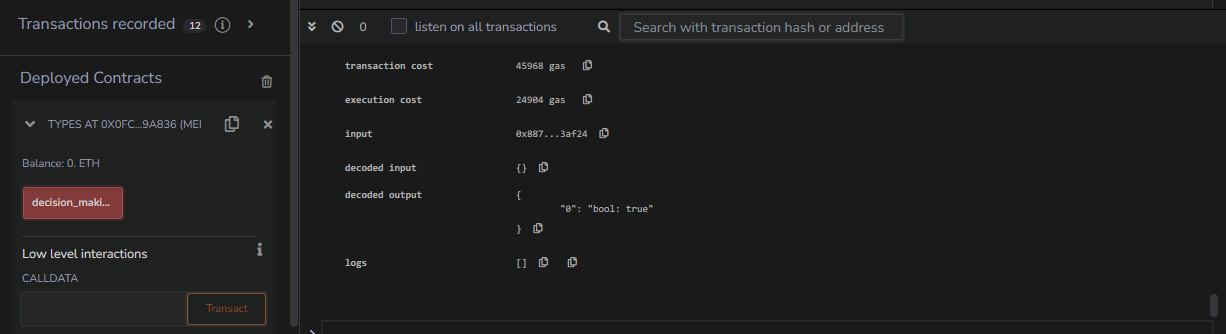
**}**

**}**

**Compile Contract:**

****

**Deploy Contract:**

****

**Practical 2: WRITE A SOLIDITY PROGRAM TO DEMONSTRATE LOOP STATEMENT.**

**Source Code:**

**// SPDX-License-Identifier: GPL-3.0**

**pragma solidity <0.9.0;**

**contract Loop {**

**function loop() pure public returns(uint result) {**

**for (uint i = 0; i < 10; i++){**

**if (i == 3){**

**continue;**

**}**

**if ( i == 5) {**

**break;**

**}**

**}**

**uint j;**

**while( j < 10 ) {**

**j++;**

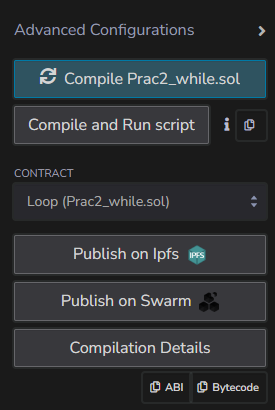
**}**

**return j;**

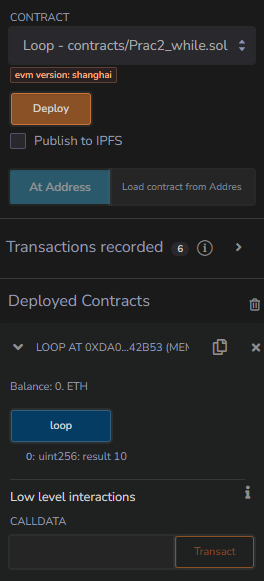
**}**

**}**

**Compile Contract:**

****

**Deploy Contract:**

****

**Source Code:**

**// SPDX-License-Identifier: GPL-3.0**

**pragma solidity <0.9.0;**

**contract IfElse {**

**function foo(uint \_x) public pure returns (uint) {**

**if (\_x < 10 ){**

**return 0;**

**} else if ( \_x < 20 ) {**

**return 1;**

**} else {**

**return 2;**

**}**

**}**

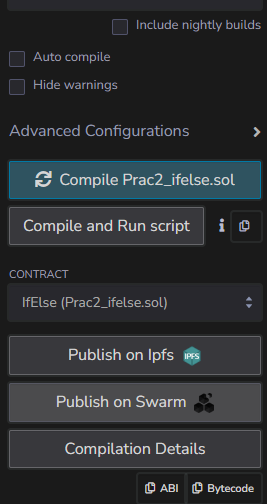
**function ternary(uint \_x ) public pure returns (uint) {**

**return \_x > 10 ? 1 : 2;**

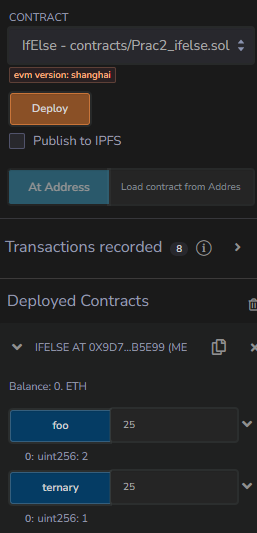
**}**

**}**

**Compile Contract:**

****

**Deploy Contract:**

****

**Source Code:**

**// SPDX-License-Identifier: GPL-3.0**

**pragma solidity <0.9.0;**

**contract ifelseif {**

**uint i = 12;**

**string result;**

**function decision\_making() public returns(string memory) {**

**if(i < 10){**

**result = "less than 10";**

**}**

**else if (i == 10){**

**result = "Equal to 10";**

**}**

**else {**

**result = "Greater than 10";**

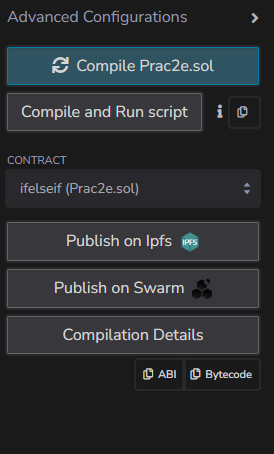
**}**

**return result;**

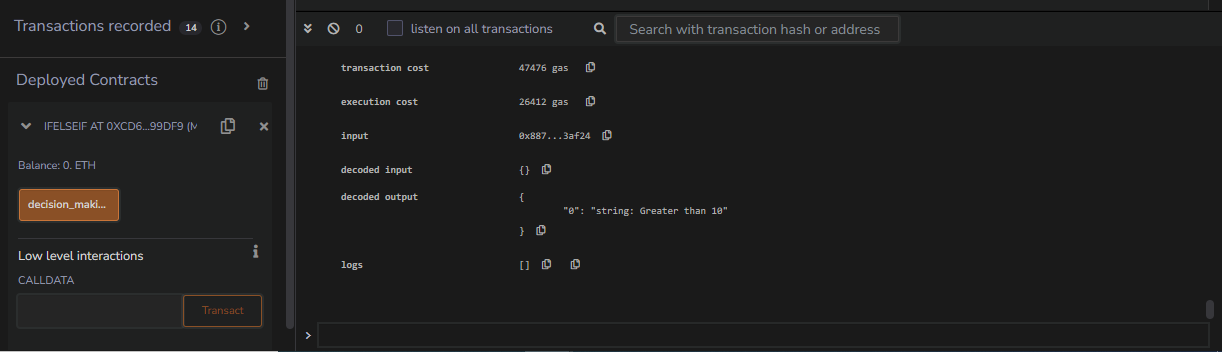
**}**

**}**

**Compile Contract:**

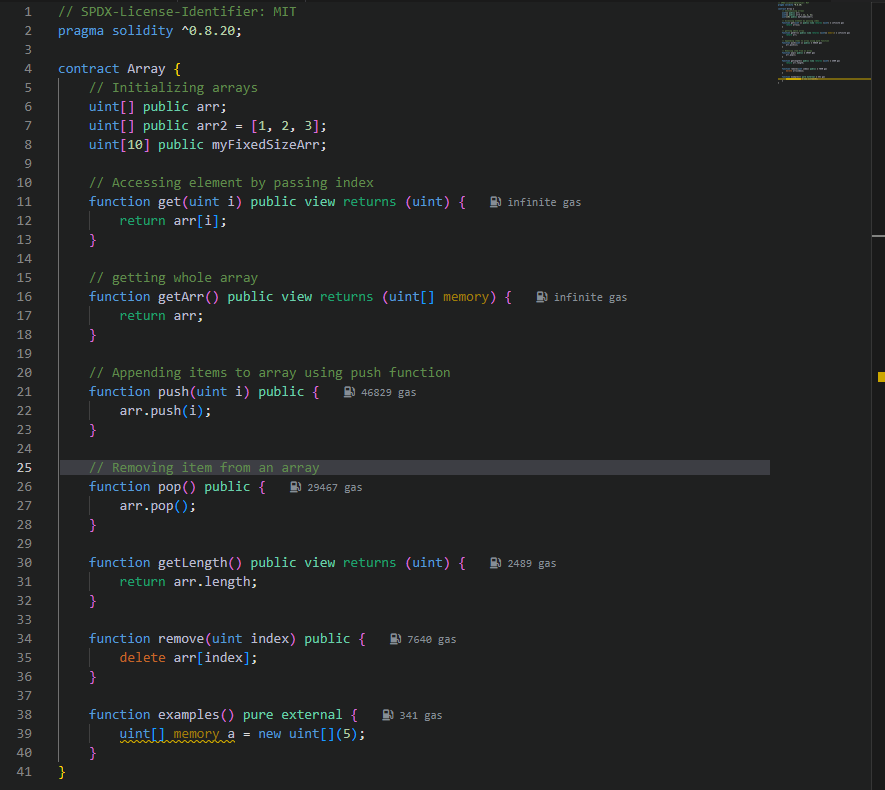
****

**Deploy Contract:**

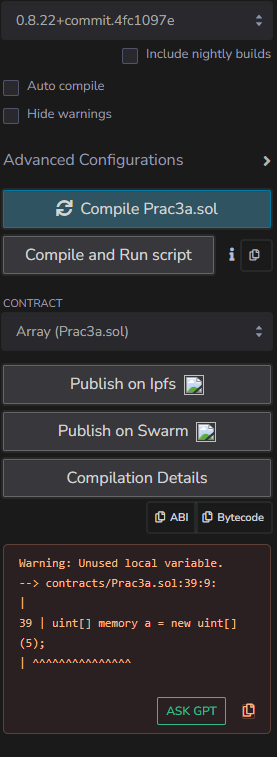
****

**Practical 3: Write a solidity program to demonstrate arrays and constructor.**

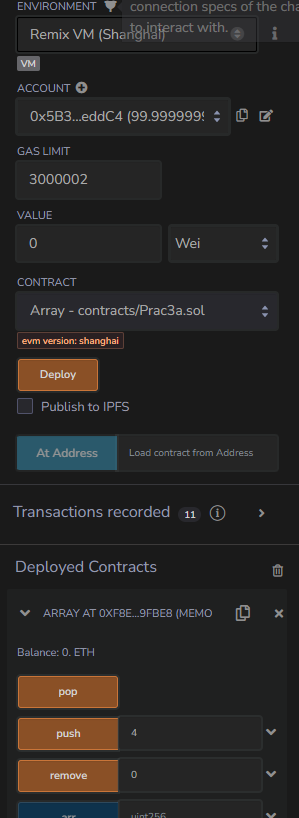
**Source Code:**

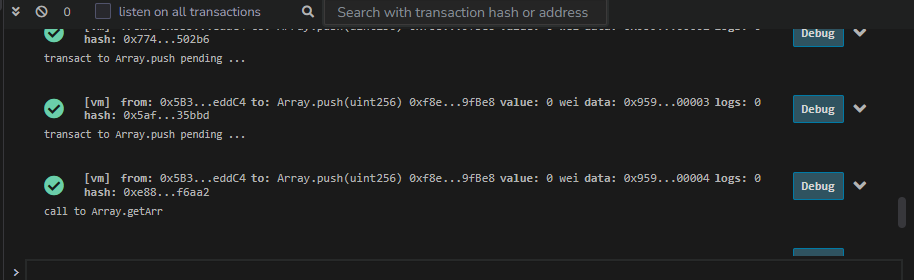
****

**Compile contract:**

****

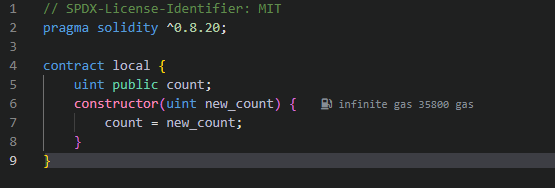
**Deploy contract:**

****

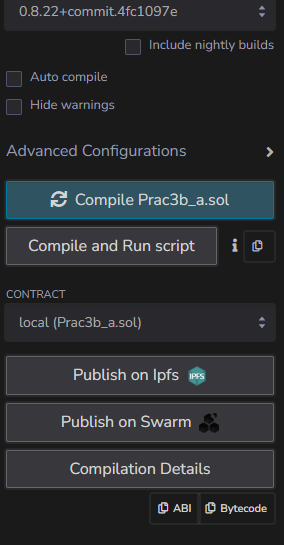
****

**Constructor Implmentation:**

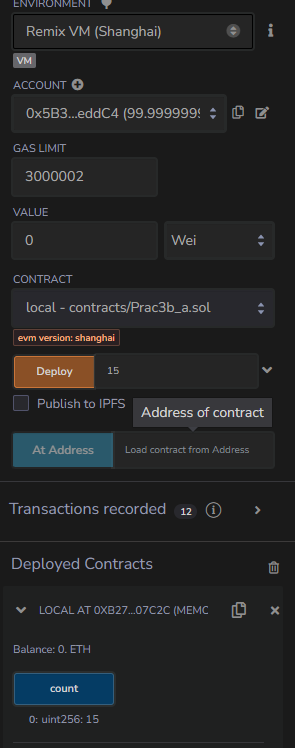
**Source Code:**

****

**Compile Contract:**

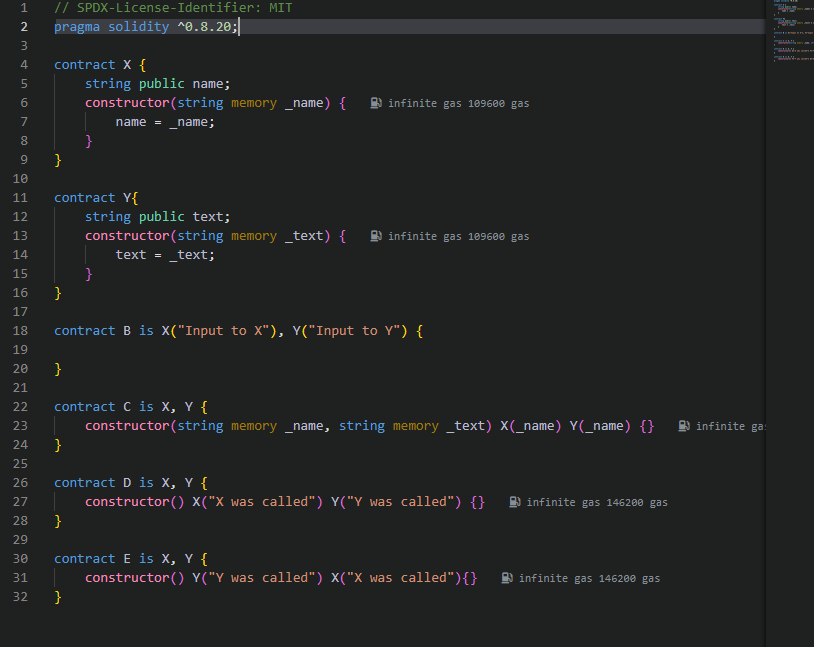
****

**Deploy Contract:**

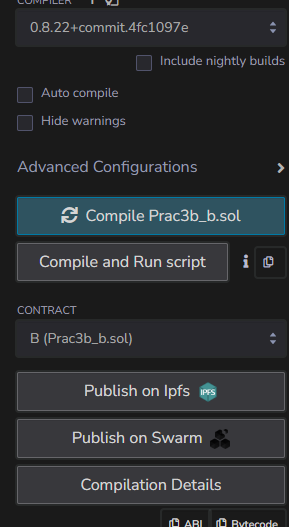
****

**Inheritance**

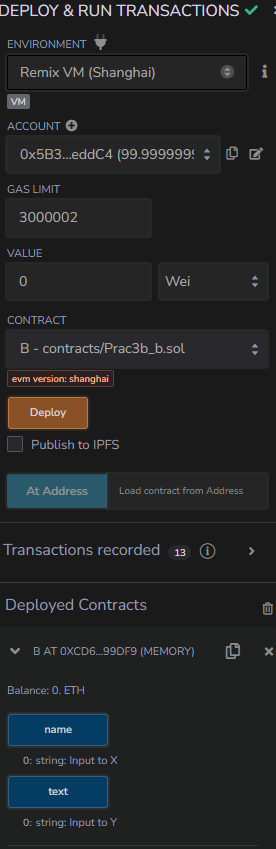
**Source Code:**

****

**Compile Contract:**

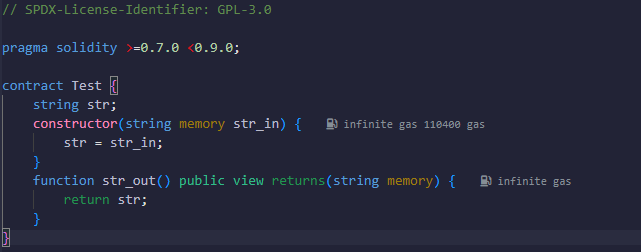
****

**Deploy Contract:**

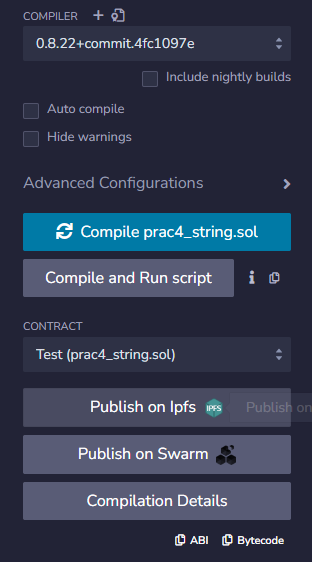
****

**Practical 4: Write a solidity program to demonstrate strings**

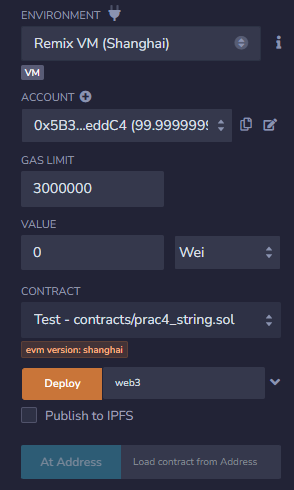
**Source Code:**

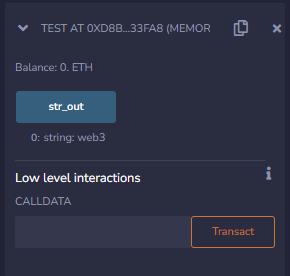
****

**Compile Contract:**

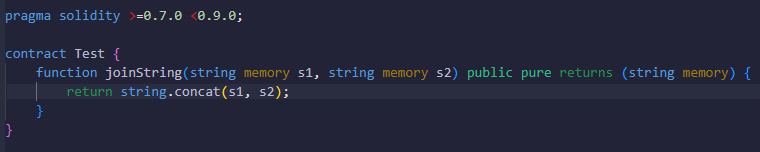
****

**Deploy Contract:**

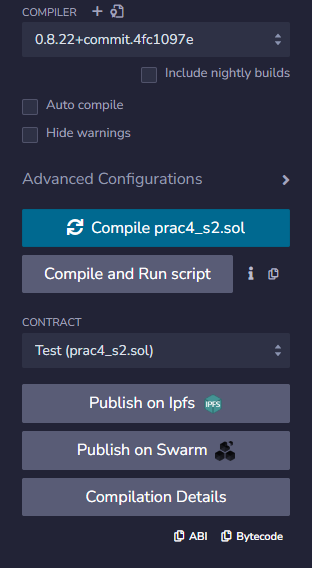
****

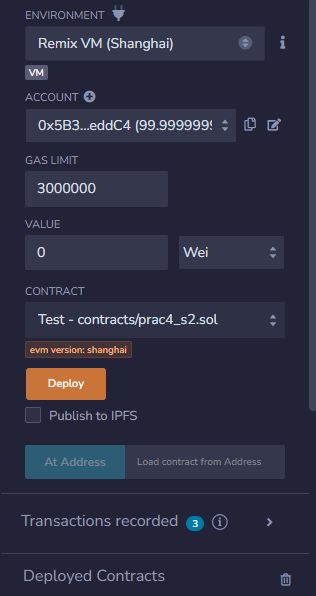
****

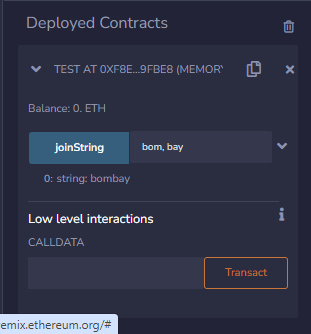
**Concatenate String:**

****

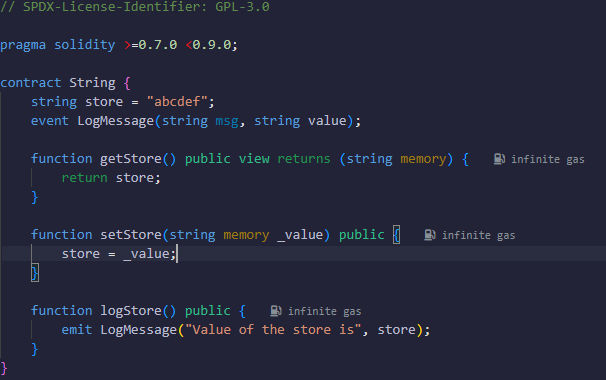
**Deploy Contract:**

****

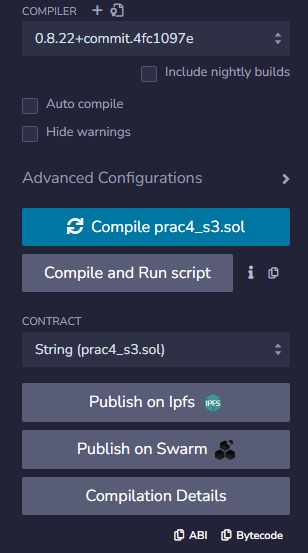
****

****

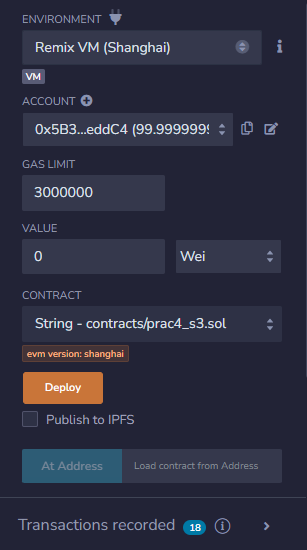
**Code:**

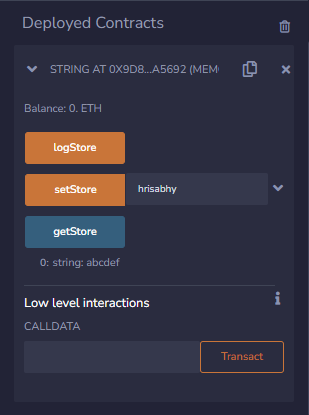
****

**Compile Contract:**

****

**Deploy Code:**

****

****

**Practical 5: Write a solidity program to demonstrate structure and enumerator**

**Code:**

**// SPDX-License-Identifier: GPL-3.0**

**pragma solidity <0.9.0;**

**contract Types{**

**enum week\_days{**

**Monday,**

**Tuesday,**

**Wednesday,**

**Thrusday,**

**Friday,**

**Saturday,**

**Sunday**

**}**

**week\_days week;**

**week\_days choice;**

**week\_days constant default\_value = week\_days.Sunday;**

**function set\_value() public {**

**choice = week\_days.Thrusday;**

**}**

**function get\_choice() public view returns(week\_days){**

**return choice;**

**}**

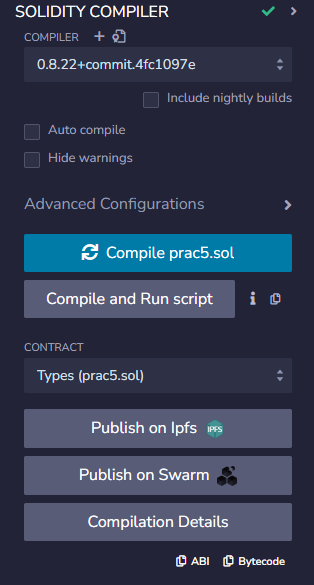
**function getdefaultvalu() public pure returns(week\_days) {**

**return default\_value;**

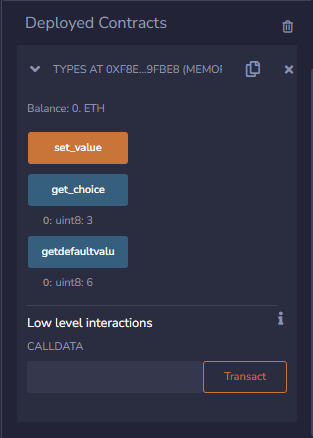
**}**

**}**

**Compile contract:**

****

**Deployed contract:**

****

**2nd Program**

**// SPDX-License-Identifier: GPL-3.0**

**pragma solidity <0.9.0;**

**contract test{**

**struct Book{**

**string name;**

**string writer;**

**uint id;**

**bool available;**

**}**

**Book book1;**

**Book book2 = Book("Building Etherium DApps", "Roberto Infante", 2, false);**

**function set\_book\_detail() public{**

**book1 = Book("Introducing Etherium & Solidity", "Chris Damen", 1, true);**

**}**

**function book\_info() public view returns(string memory, string memory, uint, bool){**

**return(book2.name, book2.writer, book2.id, book2.available);**

**}**

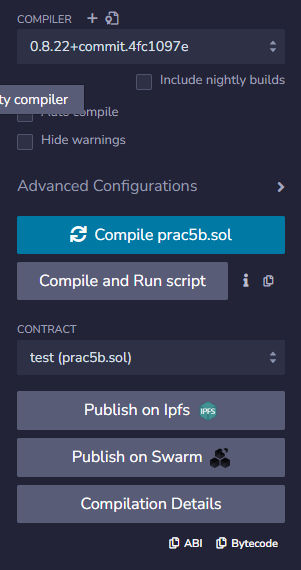
**function get\_details() public view returns(string memory, uint) {**

**return (book1.name, book1.id);**

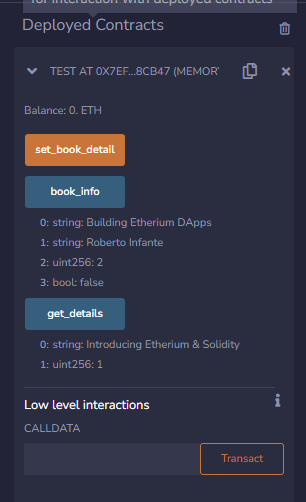
**}**

**}**

**Compile Code:**

****

**Deploy Code:**

****

**Practical 6: Write the following programs for Blockchain in Python :**

1. A Simple client class that generates the private and public keys by using the built in Python RSA algorithm and test it.
2. A transaction class to send and receive money and test it.

**Code :-**

# import libraries

import hashlib

import random

import string

import json

import binascii

import numpy as np

import pandas as pd

import pylab as pl

import logging

import datetime

import collections

pip install pycryptodome

# following imports are required by PKI

import Crypto

import Crypto.Random

from Crypto.Hash import SHA

from Crypto.PublicKey import RSA

from Crypto.Signature import PKCS1\_v1\_5

import binascii

class Client:

   def \_\_init\_\_(self):

      random = Crypto.Random.new().read

      self.\_private\_key = RSA.generate(1024, random)

      self.\_public\_key = self.\_private\_key.publickey()

      self.\_signer = PKCS1\_v1\_5.new(self.\_private\_key)

   @property

   def identity(self):

      return binascii.hexlify(self.\_public\_key.exportKey(format='DER')).decode('ascii')

class Transaction:

   def \_\_init\_\_(self, sender, recipient, value):

    self.sender = sender

    self.recipient = recipient

    self.value = value

    self.time = datetime.datetime.now()

   def to\_dict(self):

    if self.sender == "Genesis":

      identity = "Genesis"

    else:

      identity = self.sender.identity

    return collections.OrderedDict({

      'sender': identity,

      'recipient': self.recipient,

      'value': self.value,

      'time' : self.time})

   def sign\_transaction(self):

    private\_key = self.sender.\_private\_key

    signer = PKCS1\_v1\_5.new(private\_key)

    h = SHA.new(str(self.to\_dict()).encode('utf8'))

    return binascii.hexlify(signer.sign(h)).decode('ascii')

Dinesh = Client()

Ramesh = Client()

t = Transaction(Dinesh,Ramesh.identity,5.0)

signature = t.sign\_transaction()

print (signature)

**Output**

c7415d065e0aa074c24cb95b6684d6bc9f1bdee3af07277e323ac26c0f789ad6a2c52f9e802b1f739206d545fea8944e1c330c5b5a11e2cc880e67070bc742bc25a156a3228e4317e5dc818f92a5de2cef82f22a1b8638f57f7591cb43fb86b16223183771c69656b3f27c1918832e39860fb2f1c33cb1d6866d0bb67c3da45c

**Output Screenshot**

**A screenshot of a computer

Description automatically generated**

**A white screen with text

Description automatically generated with medium confidence**

**A white screen with a white background

Description automatically generated with medium confidence**

**Practical 7: Write the following programs for Blockchain in Python :**

1. Create multiple transactions and display them.
2. Create a blockchain, a genesis block and execute it.

**Code: -**

def display\_transaction(transaction):

   #for transaction in transactions:

   dict = transaction.to\_dict()

   print ("sender: " + dict['sender'])

   print ('-----')

   print ("recipient: " + dict['recipient'])

   print ('-----')

   print ("value: " + str(dict['value']))

   print ('-----')

   print ("time: " + str(dict['time']))

   print ('-----')

transactions = []

Dinesh = Client()

Ramesh = Client()

Seema = Client()

Vijay = Client()

t1 = Transaction(

   Dinesh,

   Ramesh.identity,

   15.0

)

t1.sign\_transaction()

transactions.append(t1)

t2 = Transaction(

   Dinesh,

   Seema.identity,

   6.0

)

t2.sign\_transaction()

transactions.append(t2)

t3 = Transaction(

   Ramesh,

   Vijay.identity,

   2.0

)

t3.sign\_transaction()

transactions.append(t3)

t4 = Transaction(

   Seema,

   Ramesh.identity,

   4.0

)

t4.sign\_transaction()

transactions.append(t4)

t5 = Transaction(

   Vijay,

   Seema.identity,

   7.0

)

t5.sign\_transaction()

transactions.append(t5)

t6 = Transaction(

   Ramesh,

   Seema.identity,

   3.0

)

t6.sign\_transaction()

transactions.append(t6)

t7 = Transaction(

   Seema,

   Dinesh.identity,

   8.0

)

t7.sign\_transaction()

transactions.append(t7)

t8 = Transaction(

   Seema,

   Ramesh.identity,

   1.0

)

t8.sign\_transaction()

transactions.append(t8)

t9 = Transaction(

   Vijay,

   Dinesh.identity,

   5.0

)

t9.sign\_transaction()

transactions.append(t9)

t10 = Transaction(

   Vijay,

   Ramesh.identity,

   3.0

)

t10.sign\_transaction()

transactions.append(t10)

for transaction in transactions:

   display\_transaction (transaction)

   print ('--------------')

class Block:

   def \_\_init\_\_(self):

      self.verified\_transactions = []

      self.previous\_block\_hash = ""

      self.Nonce = ""

last\_block\_hash = ""

Dinesh = Client()

t0 = Transaction (

   "Genesis",

   Dinesh.identity,

   500.0

)

block0 = Block()

block0.previous\_block\_hash = None

Nonce = None

block0.verified\_transactions.append (t0)

digest = hash (block0)

last\_block\_hash = digest

TPCoins = []

def dump\_blockchain (self):

   print ("Number of blocks in the chain: " + str(len (self)))

   for x in range (len(TPCoins)):

      block\_temp = TPCoins[x]

      print ("block # " + str(x))

      for transaction in block\_temp.verified\_transactions:

         display\_transaction (transaction)

         print ('--------------')

      print ('=====================================')

TPCoins.append (block0)

dump\_blockchain(TPCoins)

**Output: -**

sender: 30819f300d06092a864886f70d010101050003818d0030818902818100b4bf0f68ec1170e4bdd44659c4dccae4057e6f3eb7740bd356122b447d23f87da0e6f6d3d9676ed216fac01062ab4b2b19f5aa594d1ed57e95c268f21ed412e96620fa4a98ee2b7601a3f5f172d72973fa54da3d9e101d7b0d090caaa1d6cd7e760c11f8995518940c7ebfef56ad704e03156d0e5b4add8ffdfbf26b80f1e5dd0203010001

-----

recipient: 30819f300d06092a864886f70d010101050003818d0030818902818100ad78d8fdf3889e6768d1212d891392037521efaabf5e58886be8506d44dc26c36052e8c194cf4e42702d79c36b8414d68751834bf3c0a370f3f3f861bf0cc5f78fd4e5222f7d7b32932c4c81ba43d4161b04646283424683c18988f9fc9c2df1011444ab558003111659d32edeb7c8a110755fdef2ac5711695a562bddcf704b0203010001

-----

value: 15.0

-----

time: 2022-06-04 07:45:52.825748

-----

--------------

sender: 30819f300d06092a864886f70d010101050003818d0030818902818100b4bf0f68ec1170e4bdd44659c4dccae4057e6f3eb7740bd356122b447d23f87da0e6f6d3d9676ed216fac01062ab4b2b19f5aa594d1ed57e95c268f21ed412e96620fa4a98ee2b7601a3f5f172d72973fa54da3d9e101d7b0d090caaa1d6cd7e760c11f8995518940c7ebfef56ad704e03156d0e5b4add8ffdfbf26b80f1e5dd0203010001

-----

recipient: 30819f300d06092a864886f70d010101050003818d0030818902818100b9cc25fbf0d2f143de59aa73284e798e16a0d15432d2c6502da30a6073712f01f38160fd14057c28a1430d7748e35e28b854b3cc5103b7655aa00e3dd8e39362eea5ca371a601b4f0d064d37c041ce9dfb0b7c2dc9c0c4b4a49d3e8ef465bd33237d4ee2d63de8dacf186b1ee6a1c752ebe9341bbbda52defe664901a8baef970203010001

-----

value: 6.0

-----

time: 2022-06-04 07:47:48.379335

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sender: 30819f300d06092a864886f70d010101050003818d0030818902818100ad78d8fdf3889e6768d1212d891392037521efaabf5e58886be8506d44dc26c36052e8c194cf4e42702d79c36b8414d68751834bf3c0a370f3f3f861bf0cc5f78fd4e5222f7d7b32932c4c81ba43d4161b04646283424683c18988f9fc9c2df1011444ab558003111659d32edeb7c8a110755fdef2ac5711695a562bddcf704b0203010001

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recipient: 30819f300d06092a864886f70d010101050003818d003081890281810089daf44544ffeeab212814f023e3f4d3c1c9a2b090ca9a6457b677decec75ae95bb9d7e8c43869f2491b6f45af9f6acc11c345ad877c8d399cfd200c3941458a33ee03982a712e6f19b8aa6950dbffd591b60a4d18ac95c71179d96b85a24b77e4ed8e70582530f83d4366044ae692edd485da20344b169db3e281ba0be810690203010001

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value: 2.0

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time: 2022-06-04 07:47:48.381359

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sender: 30819f300d06092a864886f70d010101050003818d0030818902818100b9cc25fbf0d2f143de59aa73284e798e16a0d15432d2c6502da30a6073712f01f38160fd14057c28a1430d7748e35e28b854b3cc5103b7655aa00e3dd8e39362eea5ca371a601b4f0d064d37c041ce9dfb0b7c2dc9c0c4b4a49d3e8ef465bd33237d4ee2d63de8dacf186b1ee6a1c752ebe9341bbbda52defe664901a8baef970203010001

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recipient: 30819f300d06092a864886f70d010101050003818d0030818902818100ad78d8fdf3889e6768d1212d891392037521efaabf5e58886be8506d44dc26c36052e8c194cf4e42702d79c36b8414d68751834bf3c0a370f3f3f861bf0cc5f78fd4e5222f7d7b32932c4c81ba43d4161b04646283424683c18988f9fc9c2df1011444ab558003111659d32edeb7c8a110755fdef2ac5711695a562bddcf704b0203010001

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value: 4.0

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time: 2022-06-04 07:47:48.383274

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sender: 30819f300d06092a864886f70d010101050003818d003081890281810089daf44544ffeeab212814f023e3f4d3c1c9a2b090ca9a6457b677decec75ae95bb9d7e8c43869f2491b6f45af9f6acc11c345ad877c8d399cfd200c3941458a33ee03982a712e6f19b8aa6950dbffd591b60a4d18ac95c71179d96b85a24b77e4ed8e70582530f83d4366044ae692edd485da20344b169db3e281ba0be810690203010001

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recipient: 30819f300d06092a864886f70d010101050003818d0030818902818100b9cc25fbf0d2f143de59aa73284e798e16a0d15432d2c6502da30a6073712f01f38160fd14057c28a1430d7748e35e28b854b3cc5103b7655aa00e3dd8e39362eea5ca371a601b4f0d064d37c041ce9dfb0b7c2dc9c0c4b4a49d3e8ef465bd33237d4ee2d63de8dacf186b1ee6a1c752ebe9341bbbda52defe664901a8baef970203010001

-----

value: 7.0

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time: 2022-06-04 07:47:48.385176

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sender: 30819f300d06092a864886f70d010101050003818d0030818902818100ad78d8fdf3889e6768d1212d891392037521efaabf5e58886be8506d44dc26c36052e8c194cf4e42702d79c36b8414d68751834bf3c0a370f3f3f861bf0cc5f78fd4e5222f7d7b32932c4c81ba43d4161b04646283424683c18988f9fc9c2df1011444ab558003111659d32edeb7c8a110755fdef2ac5711695a562bddcf704b0203010001

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recipient: 30819f300d06092a864886f70d010101050003818d0030818902818100b9cc25fbf0d2f143de59aa73284e798e16a0d15432d2c6502da30a6073712f01f38160fd14057c28a1430d7748e35e28b854b3cc5103b7655aa00e3dd8e39362eea5ca371a601b4f0d064d37c041ce9dfb0b7c2dc9c0c4b4a49d3e8ef465bd33237d4ee2d63de8dacf186b1ee6a1c752ebe9341bbbda52defe664901a8baef970203010001

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value: 3.0

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time: 2022-06-04 07:47:48.387071

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sender: 30819f300d06092a864886f70d010101050003818d0030818902818100b9cc25fbf0d2f143de59aa73284e798e16a0d15432d2c6502da30a6073712f01f38160fd14057c28a1430d7748e35e28b854b3cc5103b7655aa00e3dd8e39362eea5ca371a601b4f0d064d37c041ce9dfb0b7c2dc9c0c4b4a49d3e8ef465bd33237d4ee2d63de8dacf186b1ee6a1c752ebe9341bbbda52defe664901a8baef970203010001

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recipient: 30819f300d06092a864886f70d010101050003818d0030818902818100b4bf0f68ec1170e4bdd44659c4dccae4057e6f3eb7740bd356122b447d23f87da0e6f6d3d9676ed216fac01062ab4b2b19f5aa594d1ed57e95c268f21ed412e96620fa4a98ee2b7601a3f5f172d72973fa54da3d9e101d7b0d090caaa1d6cd7e760c11f8995518940c7ebfef56ad704e03156d0e5b4add8ffdfbf26b80f1e5dd0203010001

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value: 8.0

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time: 2022-06-04 07:47:48.388983

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sender: 30819f300d06092a864886f70d010101050003818d0030818902818100b9cc25fbf0d2f143de59aa73284e798e16a0d15432d2c6502da30a6073712f01f38160fd14057c28a1430d7748e35e28b854b3cc5103b7655aa00e3dd8e39362eea5ca371a601b4f0d064d37c041ce9dfb0b7c2dc9c0c4b4a49d3e8ef465bd33237d4ee2d63de8dacf186b1ee6a1c752ebe9341bbbda52defe664901a8baef970203010001

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recipient: 30819f300d06092a864886f70d010101050003818d0030818902818100ad78d8fdf3889e6768d1212d891392037521efaabf5e58886be8506d44dc26c36052e8c194cf4e42702d79c36b8414d68751834bf3c0a370f3f3f861bf0cc5f78fd4e5222f7d7b32932c4c81ba43d4161b04646283424683c18988f9fc9c2df1011444ab558003111659d32edeb7c8a110755fdef2ac5711695a562bddcf704b0203010001

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value: 1.0

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time: 2022-06-04 07:47:48.390846

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sender: 30819f300d06092a864886f70d010101050003818d003081890281810089daf44544ffeeab212814f023e3f4d3c1c9a2b090ca9a6457b677decec75ae95bb9d7e8c43869f2491b6f45af9f6acc11c345ad877c8d399cfd200c3941458a33ee03982a712e6f19b8aa6950dbffd591b60a4d18ac95c71179d96b85a24b77e4ed8e70582530f83d4366044ae692edd485da20344b169db3e281ba0be810690203010001

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recipient: 30819f300d06092a864886f70d010101050003818d0030818902818100b4bf0f68ec1170e4bdd44659c4dccae4057e6f3eb7740bd356122b447d23f87da0e6f6d3d9676ed216fac01062ab4b2b19f5aa594d1ed57e95c268f21ed412e96620fa4a98ee2b7601a3f5f172d72973fa54da3d9e101d7b0d090caaa1d6cd7e760c11f8995518940c7ebfef56ad704e03156d0e5b4add8ffdfbf26b80f1e5dd0203010001

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value: 5.0

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time: 2022-06-04 07:47:48.392725

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sender: 30819f300d06092a864886f70d010101050003818d003081890281810089daf44544ffeeab212814f023e3f4d3c1c9a2b090ca9a6457b677decec75ae95bb9d7e8c43869f2491b6f45af9f6acc11c345ad877c8d399cfd200c3941458a33ee03982a712e6f19b8aa6950dbffd591b60a4d18ac95c71179d96b85a24b77e4ed8e70582530f83d4366044ae692edd485da20344b169db3e281ba0be810690203010001

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recipient: 30819f300d06092a864886f70d010101050003818d0030818902818100ad78d8fdf3889e6768d1212d891392037521efaabf5e58886be8506d44dc26c36052e8c194cf4e42702d79c36b8414d68751834bf3c0a370f3f3f861bf0cc5f78fd4e5222f7d7b32932c4c81ba43d4161b04646283424683c18988f9fc9c2df1011444ab558003111659d32edeb7c8a110755fdef2ac5711695a562bddcf704b0203010001

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value: 3.0

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time: 2022-06-04 07:47:48.394620

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Number of blocks in the chain: 1

block # 0

sender: Genesis

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recipient: 30819f300d06092a864886f70d010101050003818d0030818902818100af575670e28b9b3a49cf71fc96c5d352d5d1109eac02a9fe6b0333319dc941b13be30d7c8e29b15e30b84724c1a6c0f3979325f0bb2cd02ccb6f5392ea9234330525b08d0f7576b2d01387f6ceae617148cec1fdd94ebbb75184404acb87244aeb53cf9c9a148178271cabdeecc9fea7bb724bc0581fd077954f02d1df4adc090203010001

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value: 500.0

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time: 2022-06-04 07:47:48.580360

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**Output Screenshot**

**A person standing in front of a white wall

Description automatically generated**

**A white rectangular object with a black border

Description automatically generated with medium confidence**

**A white rectangular object with a black border

Description automatically generated**

**A white background with black and white lines

Description automatically generated with medium confidence**

**A white background with blue text

Description automatically generated**

**A computer screen shot of a person

Description automatically generated**

**A screenshot of a computer

Description automatically generated**

**A white text with black lines

Description automatically generated with medium confidence**

**A white background with black lines

Description automatically generated**

**A white background with black lines

Description automatically generated**

**Practical 8 : Write the following programs for Blockchain in Python :**

1. Create a mining function and test it.
2. Add blocks to the miner and dump the blockchain.

**Code:-**

def sha256(message):

return hashlib.sha256(message.encode('ascii')).hexdigest()

def mine(message, difficulty=1):

assert difficulty >= 1

prefix = '1' \* difficulty

for i in range(1000):

digest = sha256(str(hash(message)) + str(i))

if digest.startswith(prefix):

print ("after " + str(i) + " iterations found nonce: "+ digest)

return digest

last\_transaction\_index = 0

block = Block()

for i in range(3):

temp\_transaction = transactions[last\_transaction\_index]

# validate transaction

# if valid

block.verified\_transactions.append (temp\_transaction)

last\_transaction\_index += 1 mine ("test message", 2)

block.previous\_block\_hash = last\_block\_hash

block.Nonce = mine (block, 2)

digest = hash (block)

TPCoins.append (block)

last\_block\_hash = digest

# Miner 2 adds a block

block = Block()

for i in range(3):

temp\_transaction = transactions[last\_transaction\_index]

# validate transaction

# if valid

block.verified\_transactions.append (temp\_transaction)

last\_transaction\_index += 1

block.previous\_block\_hash = last\_block\_hash

block.Nonce = mine(block, 2)

digest = hash (block)

TPCoins.append (block)

last\_block\_hash = digest

# Miner 3 adds a block

block = Block()

for i in range(3):

temp\_transaction = transactions[last\_transaction\_index]

#display\_transaction (temp\_transaction)

# validate transaction

# if valid

block.verified\_transactions.append (temp\_transaction)

last\_transaction\_index += 1

block.previous\_block\_hash = last\_block\_hash

block.Nonce = mine (block, 2)

digest = hash (block)

TPCoins.append (block)

last\_block\_hash = digest

dump\_blockchain(TPCoins)

**Output: -**

Number of blocks in the chain: 4

block # 0

sender: Genesis

-----

recipient:

30819f300d06092a864886f70d010101050003818d0030818902818100ed272b52ccb539e2cd779

c6cc10ed1dfadf5d97c6ab6de90ed0372b2655626fb79f62d0e01081c163b0864cc68d426bbe943

8e8566303bb77414d4bfcaa3468ab7febac099294de10273a816f7047d4087b4bafa11f141544d4

8e2f10b842cab91faf33153900c7bf6c08c9e47a7df8aa7e60dc9e0798fb2ba3484bbdad2e44302

03010001

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value: 500.0

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time: 2019-01-14 16:18:02.042739

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block # 1

sender:

30819f300d06092a864886f70d010101050003818d0030818902818100bb064c99c492144a9f463

480273aba93ac1db1f0da3cb9f3c1f9d058cf499fd8e54d244da0a8dd6ddd329ec86794b04d773e

b4841c9f935ea4d9ccc2821c7a1082d23b6c928d59863407f52fa05d8b47e5157f8fe56c2ce3279

c657f9c6a80500073b0be8093f748aef667c03e64f04f84d311c4d866c12d79d3fc3034563dfb02

03010001

-----

recipient:

30819f300d06092a864886f70d010101050003818d0030818902818100be93b516b28c6e674abe7

abdb11ce0fdf5bb728b75216b73f37a6432e4b402b3ad8139b8c0ba541a72c8add126b6e1a1308f

b98b727beb63c6060356bb177bb7d54b54dbe87aee7353d0a6baa9397704de625d1836d3f42c7ee

5683f6703259592cc24b09699376807f28fe0e00ff882974484d805f874260dfc2d1627473b9102

03010001

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value: 15.0

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time: 2019-01-14 16:18:01.859915

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sender:

30819f300d06092a864886f70d010101050003818d0030818902818100bb064c99c492144a9f463

480273aba93ac1db1f0da3cb9f3c1f9d058cf499fd8e54d244da0a8dd6ddd329ec86794b04d773e

b4841c9f935ea4d9ccc2821c7a1082d23b6c928d59863407f52fa05d8b47e5157f8fe56c2ce3279

c657f9c6a80500073b0be8093f748aef667c03e64f04f84d311c4d866c12d79d3fc3034563dfb02

03010001

-----

recipient:

30819f300d06092a864886f70d010101050003818d0030818902818100a070c82b34ae143cbe59b

3a2afde7186e9d5bc274955d8112d87a00256a35369acc4d0edfe65e8f9dc93fbd9ee74b9e7ea12

334da38c8c9900e6ced1c4ce93f86e06611e656521a1eab561892b7db0961b4f212d1fd5b5e49ae

09cf8c603a068f9b723aa8a651032ff6f24e5de00387e4d062375799742a359b8f22c5362e56502

03010001

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value: 6.0

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time: 2019-01-14 16:18:01.860966

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sender:

30819f300d06092a864886f70d010101050003818d0030818902818100be93b516b28c6e674abe7

abdb11ce0fdf5bb728b75216b73f37a6432e4b402b3ad8139b8c0ba541a72c8add126b6e1a1308f

b98b727beb63c6060356bb177bb7d54b54dbe87aee7353d0a6baa9397704de625d1836d3f42c7ee

5683f6703259592cc24b09699376807f28fe0e00ff882974484d805f874260dfc2d1627473b9102

03010001

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recipient:

30819f300d06092a864886f70d010101050003818d0030818902818100cba097c0854876f41338c

62598c658f545182cfa4acebce147aedf328181f9c4930f14498fd03c0af6b0cce25be99452a81d

f4fa30a53eddbb7bb7b203adf8764a0ccd9db6913a576d68d642d8fd47452590137869c25d9ff83

d68ebe6d616056a8425b85b52e69715b8b85ae807b84638d8f00e321b65e4c33acaf6469e18e302

03010001

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value: 2.0

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time: 2019-01-14 16:18:01.861958

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block # 2

sender:

30819f300d06092a864886f70d010101050003818d0030818902818100a070c82b34ae143cbe59b

3a2afde7186e9d5bc274955d8112d87a00256a35369acc4d0edfe65e8f9dc93fbd9ee74b9e7ea12

334da38c8c9900e6ced1c4ce93f86e06611e656521a1eab561892b7db0961b4f212d1fd5b5e49ae

09cf8c603a068f9b723aa8a651032ff6f24e5de00387e4d062375799742a359b8f22c5362e56502

03010001

-----

recipient:

30819f300d06092a864886f70d010101050003818d0030818902818100be93b516b28c6e674abe7

abdb11ce0fdf5bb728b75216b73f37a6432e4b402b3ad8139b8c0ba541a72c8add126b6e1a1308f

b98b727beb63c6060356bb177bb7d54b54dbe87aee7353d0a6baa9397704de625d1836d3f42c7ee

5683f6703259592cc24b09699376807f28fe0e00ff882974484d805f874260dfc2d1627473b9102

03010001

-----

value: 4.0

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time: 2019-01-14 16:18:01.862946

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sender:

30819f300d06092a864886f70d010101050003818d0030818902818100cba097c0854876f41338c

62598c658f545182cfa4acebce147aedf328181f9c4930f14498fd03c0af6b0cce25be99452a81d

f4fa30a53eddbb7bb7b203adf8764a0ccd9db6913a576d68d642d8fd47452590137869c25d9ff83

d68ebe6d616056a8425b85b52e69715b8b85ae807b84638d8f00e321b65e4c33acaf6469e18e302

03010001

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recipient:

30819f300d06092a864886f70d010101050003818d0030818902818100a070c82b34ae143cbe59b

3a2afde7186e9d5bc274955d8112d87a00256a35369acc4d0edfe65e8f9dc93fbd9ee74b9e7ea12

334da38c8c9900e6ced1c4ce93f86e06611e656521a1eab561892b7db0961b4f212d1fd5b5e49ae

09cf8c603a068f9b723aa8a651032ff6f24e5de00387e4d062375799742a359b8f22c5362e56502

03010001

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value: 7.0

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time: 2019-01-14 16:18:01.863932

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sender:

30819f300d06092a864886f70d010101050003818d0030818902818100be93b516b28c6e674abe7

abdb11ce0fdf5bb728b75216b73f37a6432e4b402b3ad8139b8c0ba541a72c8add126b6e1a1308f

b98b727beb63c6060356bb177bb7d54b54dbe87aee7353d0a6baa9397704de625d1836d3f42c7ee

5683f6703259592cc24b09699376807f28fe0e00ff882974484d805f874260dfc2d1627473b9102

03010001

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recipient:

30819f300d06092a864886f70d010101050003818d0030818902818100a070c82b34ae143cbe59b

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334da38c8c9900e6ced1c4ce93f86e06611e656521a1eab561892b7db0961b4f212d1fd5b5e49ae

09cf8c603a068f9b723aa8a651032ff6f24e5de00387e4d062375799742a359b8f22c5362e56502

03010001

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value: 3.0

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time: 2019-01-14 16:18:01.865099

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block # 3

sender:

30819f300d06092a864886f70d010101050003818d0030818902818100a070c82b34ae143cbe59b

3a2afde7186e9d5bc274955d8112d87a00256a35369acc4d0edfe65e8f9dc93fbd9ee74b9e7ea12

334da38c8c9900e6ced1c4ce93f86e06611e656521a1eab561892b7db0961b4f212d1fd5b5e49ae

09cf8c603a068f9b723aa8a651032ff6f24e5de00387e4d062375799742a359b8f22c5362e56502

03010001

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recipient:

30819f300d06092a864886f70d010101050003818d0030818902818100bb064c99c492144a9f463

480273aba93ac1db1f0da3cb9f3c1f9d058cf499fd8e54d244da0a8dd6ddd329ec86794b04d773e

b4841c9f935ea4d9ccc2821c7a1082d23b6c928d59863407f52fa05d8b47e5157f8fe56c2ce3279

c657f9c6a80500073b0be8093f748aef667c03e64f04f84d311c4d866c12d79d3fc3034563dfb02

03010001

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value: 8.0

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time: 2019-01-14 16:18:01.866219

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sender:

30819f300d06092a864886f70d010101050003818d0030818902818100a070c82b34ae143cbe59b

3a2afde7186e9d5bc274955d8112d87a00256a35369acc4d0edfe65e8f9dc93fbd9ee74b9e7ea12

334da38c8c9900e6ced1c4ce93f86e06611e656521a1eab561892b7db0961b4f212d1fd5b5e49ae

09cf8c603a068f9b723aa8a651032ff6f24e5de00387e4d062375799742a359b8f22c5362e56502

03010001

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recipient:

30819f300d06092a864886f70d010101050003818d0030818902818100be93b516b28c6e674abe7

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b98b727beb63c6060356bb177bb7d54b54dbe87aee7353d0a6baa9397704de625d1836d3f42c7ee

5683f6703259592cc24b09699376807f28fe0e00ff882974484d805f874260dfc2d1627473b9102

03010001

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value: 1.0

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time: 2019-01-14 16:18:01.867223

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sender:

30819f300d06092a864886f70d010101050003818d0030818902818100cba097c0854876f41338c

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03010001

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03010001

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value: 5.0

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time: 2019-01-14 16:18:01.868241

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