B. K. BIRLA COLLEGE OF ARTS, SCIENCE & COMMERCE (AUTONOMOUS), KALYAN

DEPARTMENT OF INFORMATION TECHNOLOGY

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Subject:	BLOCKCHAIN TECHNOLOGY

B. K. BIRLA COLLEGE OF ARTS, SCIENCE COMMERCE (AUTONOMOUS), KALYAN

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DEPARTMENT OF INFORMATION TECHNOLOGY

CERTIFICATE

This is to certify that Mr/Ms Vivek Pandit bearing Seat. No: **(4839747)**, in class

Msc IT CC has successfully completed practical of the subject Blockchain Technology

Teacher's Signature: _____

Place:

Date: 06/07/2024

College Seal

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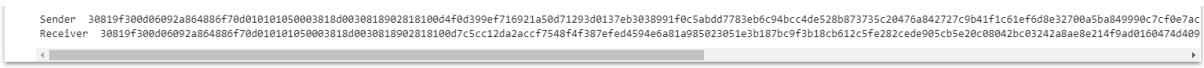
Practical No: 1

Aim: A simple client class that generates the private and public keys by using the built- in Python RSA algorithm and test it.

Program:

```
# following imports are required by PKI
!pip3 install pycryptodome
import hashlib
import random
import string
import binascii
import datetime
import collections
from Crypto.PublicKey import RSA
from Crypto import Random
from Crypto.Cipher import PKCS1_v1_5

class Client:
   def __init__(self):

      random = 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('asci
i')

Account_1 = Client()
Account_2 = Client()
print ("Sender ",Account_1.identity)
print ("Receiver ",Account_2.identity)
```

Output:



Practical No: 2

Aim: A transaction class to send and receive money and test it.

Program:

```
# following imports are required by PKI
!pip3 install pycryptodome
!pip3 install crypto

import hashlib
import random
import binascii
import datetime
import collections

from Crypto.PublicKey import RSA
from Crypto import Random
from Crypto.Cipher import PKCS1_v1_5
from collections import OrderedDict
import Crypto
import Crypto.Random
from Crypto.Hash import SHA
from Crypto.Signature import PKCS1_v1_5

class Client:
    def __init__(self):
      random = 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('asci
i')

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')

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 ('-----')



sa = Client()
rb = Client()

t1 = Transaction(
    sa,
    rb.identity,
    15.0
)
t1.sign_transaction()
display_transaction (t1)



sa2 = Client()
rb2 = Client()

t2 = Transaction(
    sa,
    rb.identity,
    15.0
)
```

```
t2.sign_transaction()
display_transaction (t2)
```

Output:

Practical No: 3

Aim: Create multiple transactions and display them.

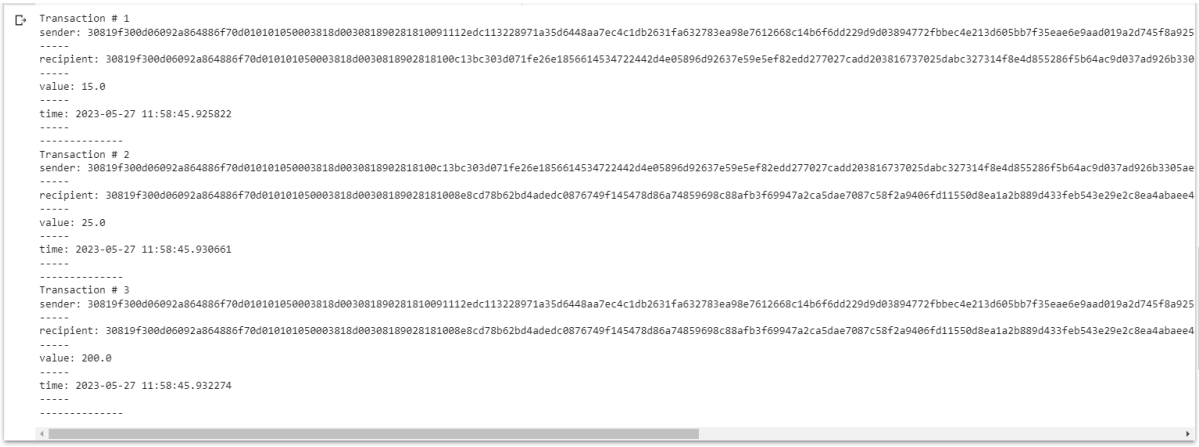
Program:

```
# following imports are required by PKI
!pip3 install pycryptodome

import hashlib
import random
import binascii
import datetime
import collections

from Crypto.PublicKey import RSA
from Crypto import Random
from Crypto.Cipher import PKCS1_v1_5
from collections import OrderedDict
import Crypto
import Crypto.Random
from Crypto.Hash import SHA
from Crypto.Signature import PKCS1_v1_5

class Client:
    def __init__(self):
      random = 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('asci
i')

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')

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 = []

a = Client()
b = Client()
c = Client()

t1 = Transaction(
    a,
    b.identity,
    15.0
)

t1.sign_transaction()
transactions.append(t1)

t2 = Transaction(
    b,
    c.identity,
    25.0
)
t2.sign_transaction()
transactions.append(t2)

t3 = Transaction(
```

```
    a,
    c.identity,
    200.0
)
t3.sign_transaction()
transactions.append(t3)

tn=1
for t in transactions:#t1 t2 t3
    print("Transaction #",tn)
    display_transaction (t)
    tn=tn+1
    print ('--------------')
```

Output:



Practical No: 4

Aim: Create a blockchain, a genesis block and execute it.

Program:

```
# following imports are required by PKI
!pip3 install pycryptodome

import hashlib
import random
import binascii
import numpy as np
import pandas as pd
import datetime
import collections

from Crypto.PublicKey import RSA
from Crypto import Random
from Crypto.Cipher import PKCS1_v1_5
from collections import OrderedDict
import Crypto
import Crypto.Random
from Crypto.Hash import SHA
from Crypto.Signature import PKCS1_v1_5

class Client:
    def __init__(self):
      random = 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('asci
i')

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')

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 ('-----')

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

class Block:
   def __init__(self):
      self.verified_transactions = []
      self.previous_block_hash = ""
      self.Nonce = ""

a = Client()

t0 = Transaction (
   "Genesis",
   a.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 = []   #coinbase
TPCoins.append (block0)

dump_blockchain(TPCoins)
```

Output:

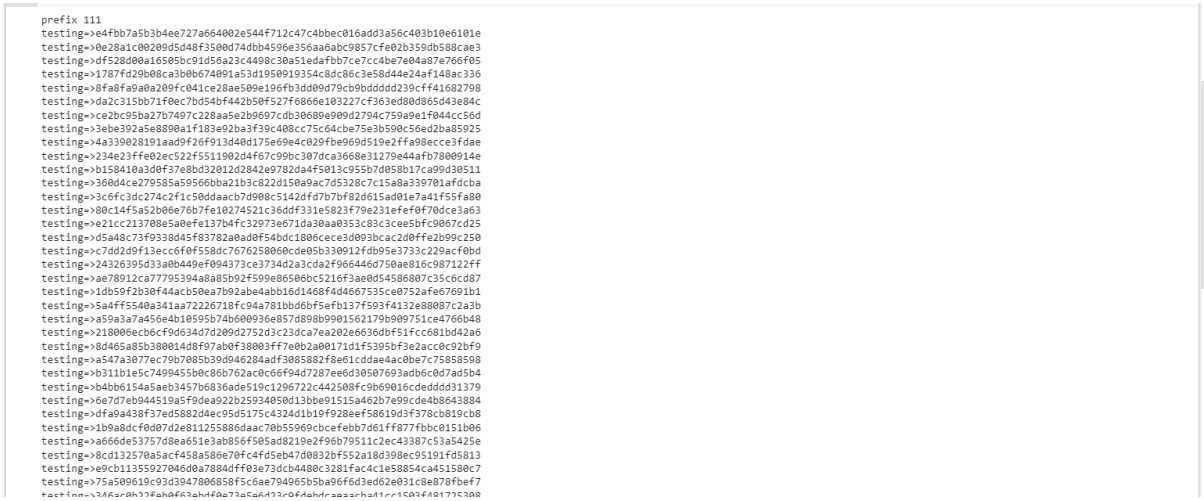
Practical No: 5

Aim: Create a mining function and test it.

Program:

```
import hashlib

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

def mine(message, difficulty=1):
   assert difficulty >= 1
   #if(difficulty <1):
   #        return
   #'1'*3=> '111'
   prefix = '1' * difficulty
   print("prefix",prefix)
   for i in range(1000):
      digest = sha256(str(hash(message)) + str(i))
      print("testing=>"+digest)
      if digest.startswith(prefix):
         print ("after " + str(i) + " iterations found nonce: "+
digest)
         return i #i= nonce value

n=mine ("test message",3)
print(n)
```

Output:



Practical No: 6

Aim: Add blocks to the miner and dump the blockchain.

Program:

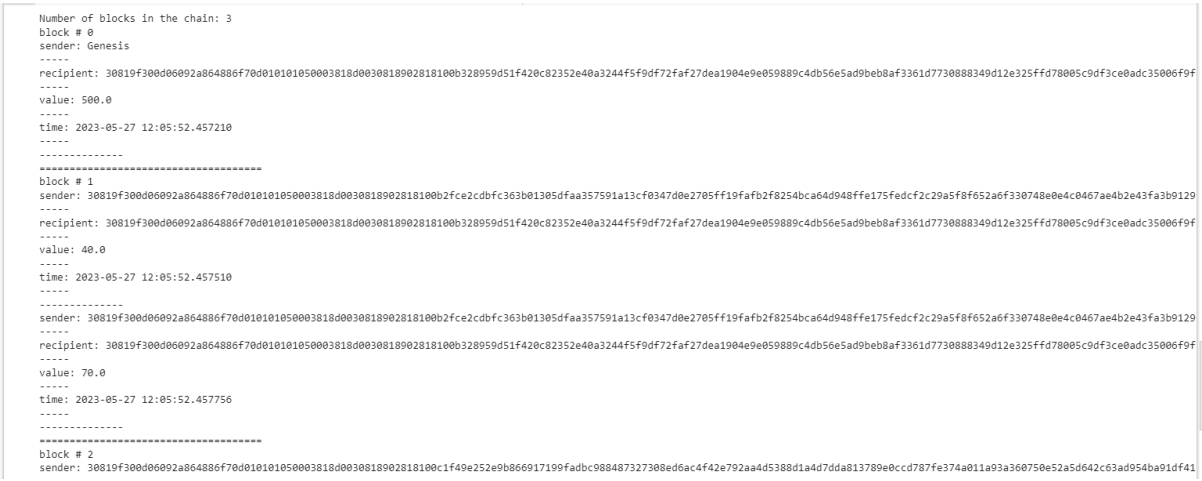
```
# following imports are required by PKI
!pip3 install pycryptodome

import hashlib
import random
import binascii
import datetime
import collections

from Crypto.PublicKey import RSA
from Crypto import Random
from Crypto.Cipher import PKCS1_v1_5
from collections import OrderedDict
import Crypto
import Crypto.Random
from Crypto.Hash import SHA
from Crypto.Signature import PKCS1_v1_5

class Client:
    def __init__(self):
      random = 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('asci
i')

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')

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 ('-----')

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

class Block:
    def __init__(self):
        self.verified_transactions = []
        self.previous_block_hash = ""
        self.Nonce = ""

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

def mine(message, difficulty=1):
    assert difficulty >= 1
    #if(difficulty <1):
    #        return
    #'1'*3=> '111'
```

```
   prefix = '1' * difficulty
   for i in range(1000):
      digest = sha256(str(hash(message)) + str(i))
      if digest.startswith(prefix):
         return i #i= nonce value


Dinesh = Client()
Ramesh =Client()
Vikas =Client()
t0 = Transaction (
   "Genesis",
   Dinesh.identity,
   500.0
)

t1 = Transaction (
   Ramesh,
   Dinesh.identity,
   40.0
)
t2 = Transaction (
   Ramesh,
   Dinesh.identity,
   70.0
)
t3 = Transaction (
   Vikas,
   Ramesh.identity,
   700.0
)
#blockchain
TPCoins = []

block0 = Block()
block0.previous_block_hash = None
Nonce = None
block0.verified_transactions.append (t0)
digest = hash (block0)
last_block_hash = digest #last_block_hash it is hash of block0
TPCoins.append (block0)

block1 = Block()
block1.previous_block_hash = last_block_hash
block1.verified_transactions.append (t1)
block1.verified_transactions.append (t2)
block1.Nonce=mine (block1, 2)
digest = hash (block1)
```

```
last_block_hash = digest
TPCoins.append (block1)


block2 = Block()
block2.previous_block_hash = last_block_hash
block2.verified_transactions.append (t3)
Nonce = mine (block2, 2)
block2.Nonce=mine (block2, 2)
digest = hash (block2)
last_block_hash = digest
TPCoins.append (block2)


dump_blockchain(TPCoins)
```

Output:



Practical No: 7

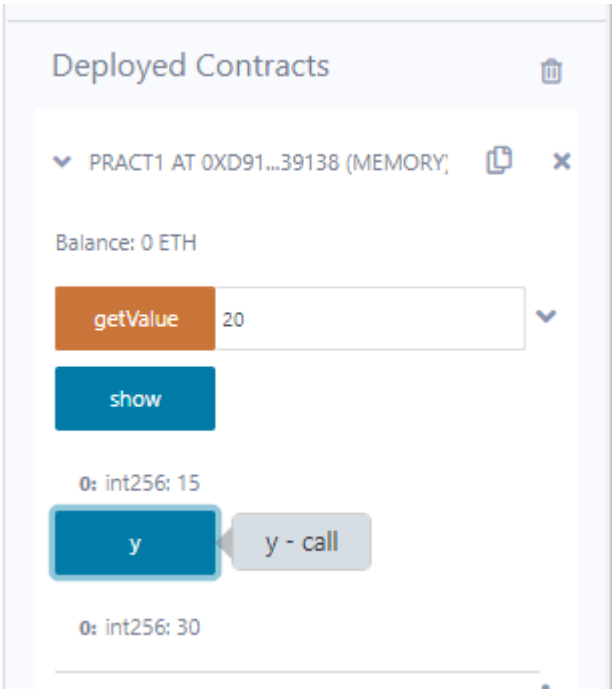
Aim: Implement and demonstrate the use of the following in Solidity: Variable, Operators, Loops, Decision Making, Strings, Arrays, Enums, Structs, Mappings, Conversions, Ether Units, Special Variables.

Aim: Types of Variable

Program:

```
pragma solidity ^0.5.0;

contract Pract1 {

  // State variable
  int x = 15;

  // Global variable
  int public y = 10;

  // Function to get the value
  function getValue(int z) public {
    y = y + z;
  }

  // Function to show the value
  function show() public view returns (int) {
    return x;
  }
}
```

Output:

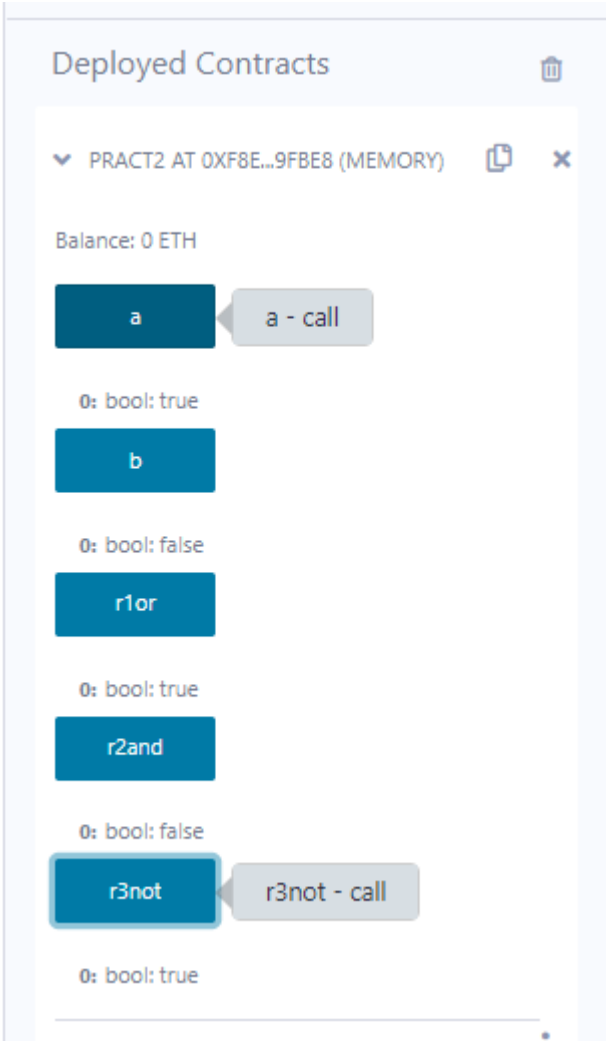


Aim: Relational Operators

Program:

```
pragma solidity ^0.5.0;

contract Pract2 {

  // State variables
  bool public a = true;
  bool public b = false;

  // Boolean operators
  bool public r1or = a || b;
  bool public r2and = a && b;
  bool public r3not = !b;
}
```

Output:



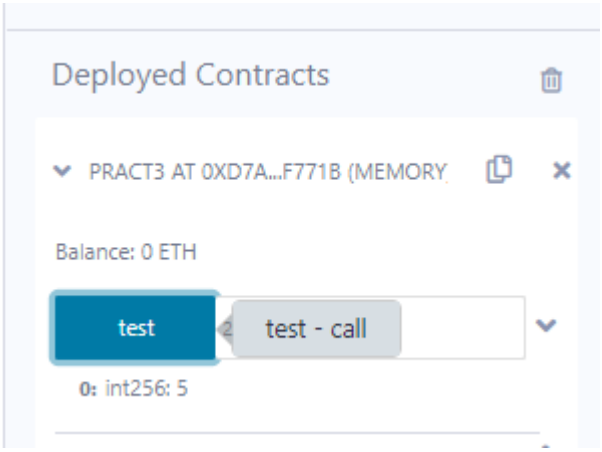
Aim: For Loop

Program:

```
pragma solidity ^0.5.0;

contract Pract3 {

  function test(int s, int e) public view returns(int) {

    int i;
    int sum = 0;

    // For loop
    for (i = s; i <= e; i++) {
      sum += i;
    }

    return sum;
```

```
  }
}
```

Output:

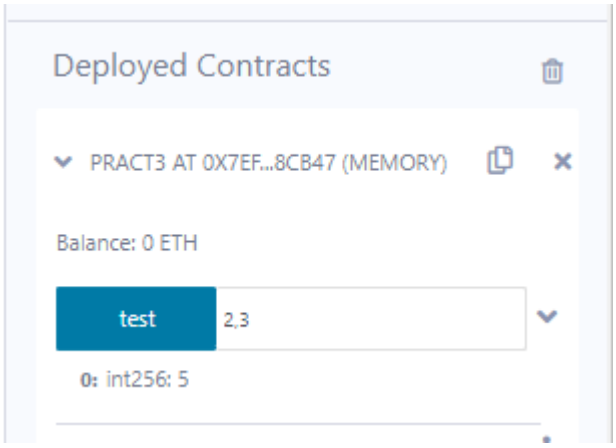


Aim: While Loop

Program:

```
pragma solidity ^0.5.0;

contract Pract3 {

  function test(int s, int e) public view returns(int) {

    int i;
    int sum = 0;

    // While loop
    i = s;
    while (i <= e) {
      sum += i;
      i++;
    }

    return sum;
  }
}
```

Output:

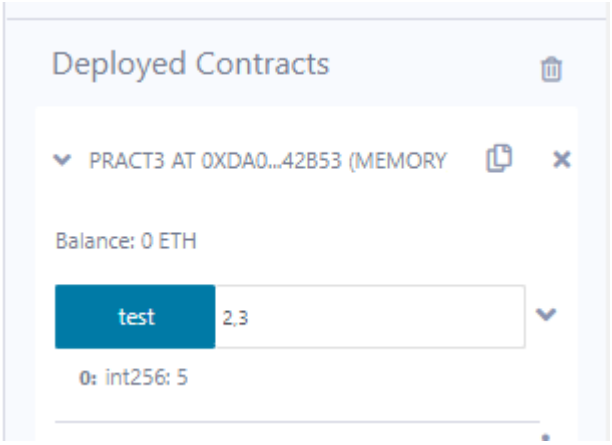


Aim: Do-While Loop

Program:

```
pragma solidity ^0.5.0;

contract Pract3 {

  function test(int s, int e) public view returns(int) {

    int i;
    int sum = 0;

    // Do-while loop
    i = s;
    do {
      sum += i;
      i++;
    } while (i <= e);

    return sum;
  }
}
```

Output:

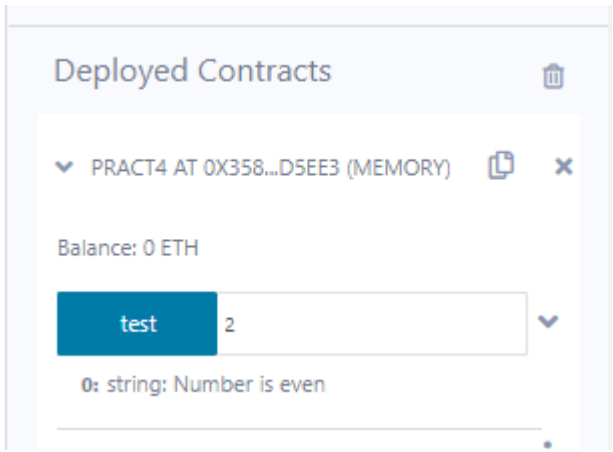


Aim: If Else

Program:

```
pragma solidity ^0.5.0;

contract Pract4 {

  function test(int x) public view returns(string memory) {

    // Check if the number is even
    if (x % 2 == 0) {
      return "Number is even";
    } else {
      return "Number is odd";
    }
  }
}
```

Output:

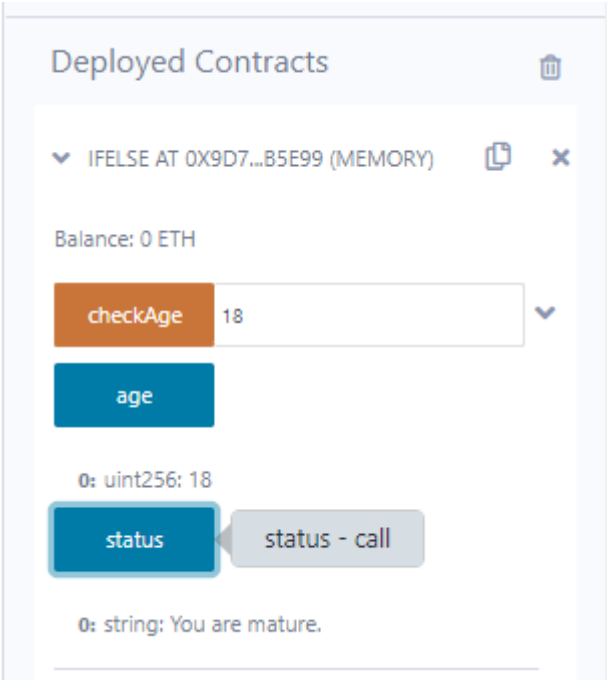


Aim: string

Program:

```
pragma solidity ^0.5.0;

contract IfElse {
    uint public age;
    string public status;

    function checkAge(uint _age) public returns (string memory) {
        age = _age;

        if (age >= 18) {
            status = "You are mature.";
        } else {
            status = "You are a minor.";
        }
    }
}
```

Output:



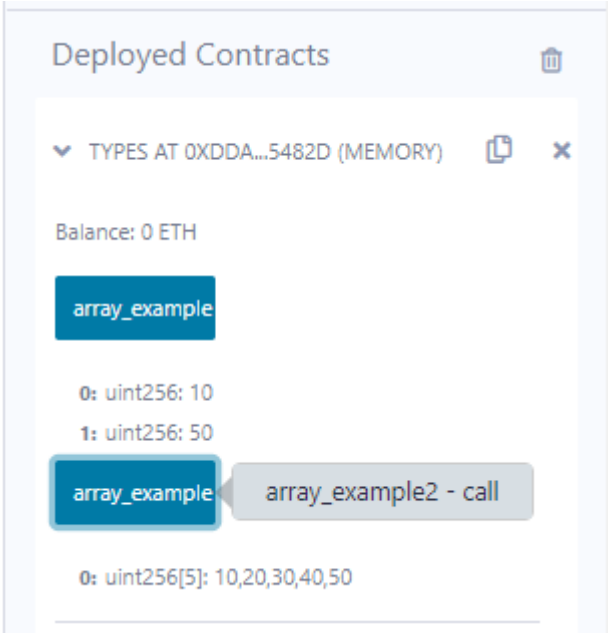
Aim: Array

Program:

```
pragma solidity ^0.5.0;
```

```
contract Types {

  uint[5] data;

  constructor() public {

    data = [uint(10), 20, 30, 40, 50];
  }

  function array_example() public view returns (uint, uint) {

    // Return the element at index 0 of the `data` array and the element at
index 4.
    return (data[0], data[4]);
  }

  function array_example2() public view returns (uint[5] memory) {

    return data;
  }
}
```

Output:

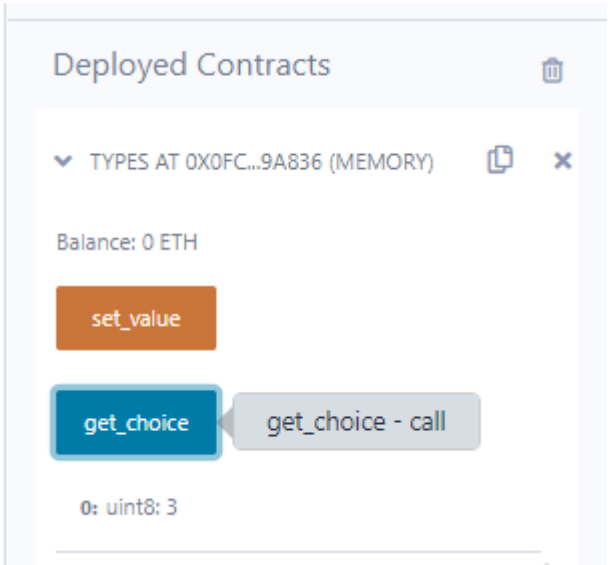


Aim: Enum

Program:

```
pragma solidity ^0.5.0;

contract Types {

  // Declare an enum called `week_days` with 7 values.
  enum week_days {
    Monday,
    Tuesday,
    Wednesday,
    Thursday,
    Friday,
    Saturday,
    Sunday
  }

  // Declare a variable called `choice` of type `week_days`.
  week_days choice;

  function set_value() public {

    // Set the value of the `choice` variable to `week_days.Thursday`.
    choice = week_days.Thursday;
  }

  function get_choice() public view returns (week_days) {
    return choice;
  }
}
```

Output:



Aim: Arithmetic Operations

Program:

```
pragma solidity ^0.5.0;

contract SolidityTest {

  uint16 public a = 20;
  uint16 public b = 10;

  // sum of `a` and `b`.
  uint public sum = a + b;

  // difference of `a` and `b`.
  uint public diff = a - b;

  // product of `a` and `b`.
  uint public mul = a * b;

  // quotient of `a` and `b`.
  uint public div = a / b;

  // modulus of `a` and `b`.
  uint public mod = a % b;

  // decrement value of `b`.
  uint public dec = --b;

  // increment value of `a`.
  uint public inc = ++a;
}
```

Output:

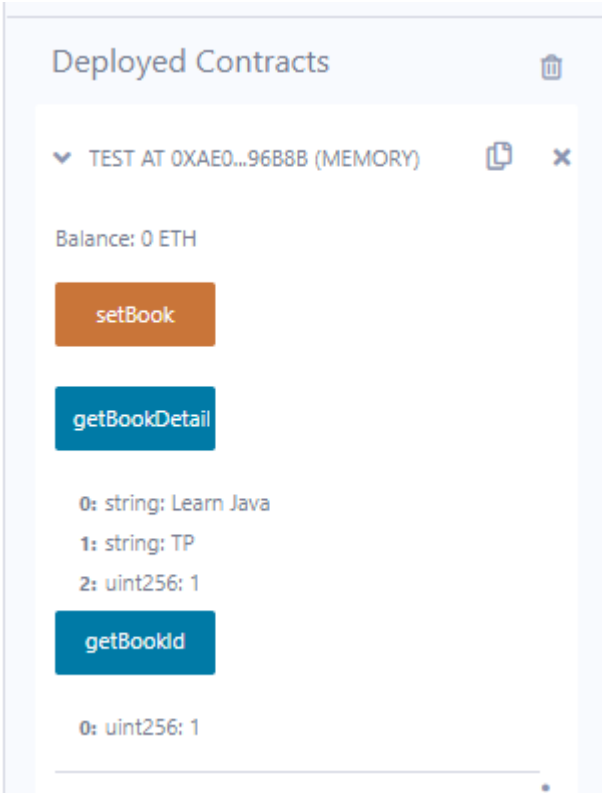
Aim: Structure

Program:

```
pragma solidity ^0.5.0;
```

```
contract test {

  // This struct defines a book.
  struct Book {
    string title;
    string author;
    uint book_id;
  }

  // This variable stores a book.
  Book book;

  // This function sets the values of the book's members.
  function setBook() public {
    book.title = "Learn Java";
    book.author = "TP";
    book.book_id = 1;
  }

  // This function returns the ID of the book.
  function getBookId() public view returns (uint) {
    return book.book_id;
  }

  // This function returns the title, author, and ID of the book.
  function getBookDetail() public view returns (string memory, string memory,
uint) {
    return (book.title, book.author, book.book_id);
  }

}
```

Output:



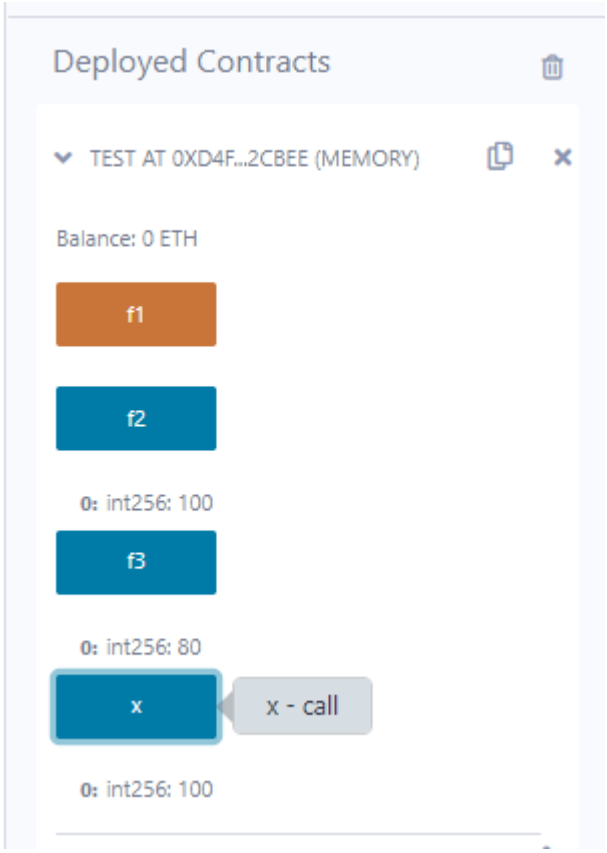
Aim: Type of Function (View, Pure)

Program:

```
pragma solidity ^0.5.0;

contract Test {

  // global integer.
  int public x = 10;

  // state integer.
  int y = 90;

  function f1() public returns (int) {
    // We can read and update the global integer.
    x = 100;
    return x;
  }

  function f2() public view returns (int) {
    // We can only read the global integer.
    return x;
  }

  function f3() public pure returns (int) {
```

```
    // We cannot access or update the global integer in a pure function.
    int z = 80;
    return z;
  }

}
```

Output:



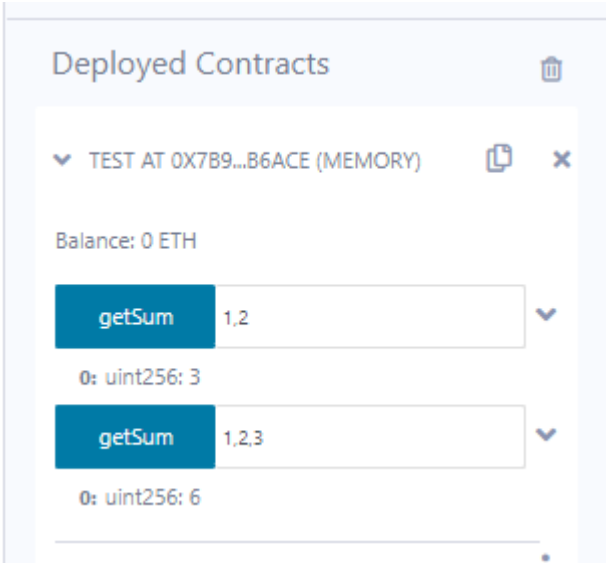
Aim: Function Overloading

Program:

```
pragma solidity ^0.5.0;

contract Test {

  function getSum(uint a, uint b) public pure returns (uint) {
    // sum of `a` and `b`.
    return a + b;
  }

  function getSum(uint a, uint b, uint c) public pure returns (uint) {
```

```
    // sum of `a`, `b`, and `c`.
    return a + b + c;
  }

}
```

Output:

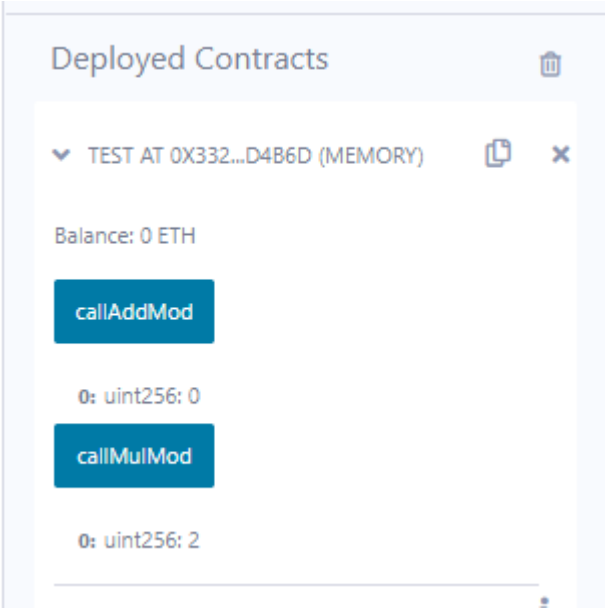


Aim: Mathematical Function

Program:

```
pragma solidity ^0.5.0;

contract Test {

  function callAddMod() public pure returns (uint) {
    // Return the result of the `addmod` operation.
    return addmod(4, 5, 3);
  }

  function callMulMod() public pure returns (uint) {
    // Return the result of the `mulmod` operation.
    return mulmod(4, 5, 3);
  }

}
```

Output:

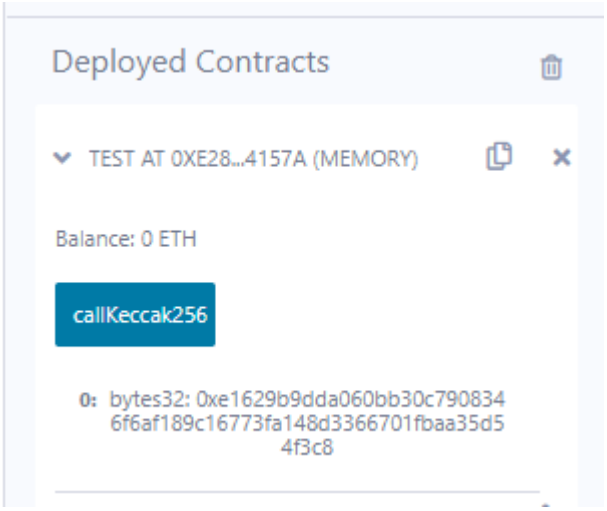


Aim: Cryptographic Function

Program:

```
pragma solidity ^0.5.0;

contract Test {

  function callKeccak256() public pure returns (bytes32) {
    // Return the result of the `keccak256` operation.
    return keccak256("ABC");
  }

}
```

Output:


Deployed Contracts
TEST AT 0XE28...4157A (MEMORY)
Balance: 0 ETH
callKeccak256
0: bytes32: 0xe1629b9dda060bb30c790834
6f6af189c16773fa148d3366701fbaa35d5
4f3c8

Practical No: 8

Aim: Demonstrate the use of Bitcoin Core API.

Program:

```
from bitcoinlib.wallets import Wallet
w = Wallet.create('Wallet8')
key1 = w.get_key()
print(key1.address)
w.scan()
print(w.info())
```

Output: