**Practical 1**

**Aim 1a: A simple client class that generates the private and public keys by using the built-in Python RSA algorithm and test it.**

**Code:**

!pip install pycryptodome

import Crypto

import binascii

from Crypto.PublicKey import RSA

from Crypto import Random

from Crypto.Hash import SHA

from Crypto.Signature import PKCS1\_v1\_5

class Client:

def \_\_init\_\_(self):

#Creating a random number for key

random = Crypto.Random.new().read

#Creating a new public key and private key

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')

Demo = Client()

print(Demo.identity)

**Output:**

**A close up of a text

Description automatically generated**

**Aim 1b: A transaction class to send and receive money and test it.**

**Code:**

!pip install pycryptodome

import collections

import datetime

import binascii

import Crypto

from Crypto.PublicKey import RSA

from Crypto import Random

from Crypto.Hash import SHA

from Crypto.Signature import PKCS1\_v1\_5

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')

def display\_transaction(transaction):

dict = transaction.to\_dict()

print ("Sender: \n" + dict['sender'])

print ('------------------------------------------------------------------')

print ("Recipient: \n" + dict['recipient'])

print ('------------------------------------------------------------------')

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

print ('------------------------------------------------------------------')

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

print ('------------------------------------------------------------------')

print ("Signature: \n" + signature)

print ('------------------------------------------------------------------')

Shlok = Client()

Jivesh = Client()

signature = Transaction(Shlok, Jivesh.identity, 5.0).sign\_transaction()

display\_transaction(Transaction(Shlok, Jivesh.identity, 5.0))

**Output:**

**A close-up of a text

Description automatically generated**

**Aim 1c: Create multiple transactions and display them.**

**Code:**

!pip install pycryptodome

import collections

import datetime

import binascii

import Crypto

import hashlib

from Crypto.PublicKey import RSA

from Crypto import Random

from Crypto.Hash import SHA

from Crypto.Signature import PKCS1\_v1\_5

class Client:

def \_\_init\_\_(self):

random = Crypto.Random.new().read

self.\_private\_key = RSA.generate(1024, random) #create private key

self.\_public\_key = self.\_private\_key.publickey() #create public key

self.\_signer = PKCS1\_v1\_5.new(self.\_private\_key) #create digital signature

@property

def identity(self):

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

class Transaction: #creating transaction

def \_\_init\_\_(self, sender, recipient, value): # in python client used to create constructor

self.sender = sender

self.recipient = recipient

self.value = value

self.time = datetime.datetime.now()

def to\_dict(self): #record identity

if self.sender == "Genesis": #base block in blockchain

identity = "Genesis"

else:

identity = self.sender.identity

return collections.OrderedDict({ # inserting in oredered manner \ storing | nothing but an ordered dictionary

'sender': identity,

'recipient': self.recipient,

'value': self.value,

'time' : self.time})

def sign\_transaction(self): # verify sender and converting into hash value

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):

dict = transaction.to\_dict()

print ("Sender: \n" + dict['sender'])

print ('------------------------------------------------------------------')

print ("Recipient: \n" + dict['recipient'])

print ('------------------------------------------------------------------')

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

print ('------------------------------------------------------------------')

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

print ('------------------------------------------------------------------')

transactions = []

Shlok = Client()

Jivesh = Client()

Shreyas = Client()

Himanshu = Client()

t1 = Transaction(Shlok, Jivesh.identity, 15.0)

t1.sign\_transaction()

transactions.append(t1)

t2 = Transaction(Shreyas, Himanshu.identity,6.0)

t2.sign\_transaction()

transactions.append(t2)

t3 = Transaction(Jivesh, Shlok.identity,2.0)

t3.sign\_transaction()

transactions.append(t3)

for txn in transactions:

display\_transaction (txn)

**Output:A screenshot of a computer

Description automatically generated**

**Aim 1d: Create a blockchain, a genesis block and execute it.**

**Code:**

!pip install pycryptodome

import collections

import datetime

import binascii

import Crypto

import hashlib

from Crypto.PublicKey import RSA

from Crypto import Random

from Crypto.Hash import SHA

from Crypto.Signature import PKCS1\_v1\_5

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')

class Block:

def \_\_init\_\_(self):

self.verified\_transactions = []

self.previous\_block\_hash = ""

#self.Nonce = ""

last\_block\_hash = ""

def blockchain (self):

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

for x in range (len(SampleCoins)):

block\_temp = SampleCoins[x]

print ("block # " + str(x))

for transaction in block\_temp.verified\_transactions:

display\_transaction (transaction)

def display\_transaction(transaction):

dict = transaction.to\_dict()

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

print ('------------------------------------------------------------------')

print ("Recipient: \n" + dict['recipient'])

print ('------------------------------------------------------------------')

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

print ('------------------------------------------------------------------')

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

print ('------------------------------------------------------------------')

SampleCoins = []

Shlok = Client()

Jivesh = Client()

txn0=Transaction("Genesis",Shlok.identity,10)

block0=Block()

block0.previous\_block\_hash = None

#Nonce = None

block0.verified\_transactions.append(txn0)

last\_block\_hash = hash(block0)

SampleCoins.append(block0)

blockchain(SampleCoins)

**Output:**

**A close-up of a computer screen

Description automatically generated**

**Aim 1e: Create a mining function and test it also add blocks to the miner and dump the blockchain.**

**Code:**

import collections

import datetime

import binascii

!pip install pycryptodome

import Crypto

from Crypto.PublicKey import RSA

from Crypto import Random

from Crypto.Hash import SHA

from Crypto.Signature import PKCS1\_v1\_5

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')

import hashlib

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)+"iterationsfoundnonce:"+digest)

return digest

class Block:

def \_\_init\_\_(self):

self.verified\_transactions=[]

self.previous\_block\_hash=""

self.Nonce=""

def display\_transaction(transaction):

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

last\_block\_hash=""

TPCoins=[]

last\_transaction\_index=0

transactions=[]

Raja=Client()

Rani=Client()

Seema=Client()

Reema=Client()

t1=Transaction(Raja,Rani.identity,15.0)

t1.sign\_transaction()

transactions.append(t1)

t2=Transaction(Raja,Seema.identity,6.0)

t2.sign\_transaction()

transactions.append(t2)

t3=Transaction(Rani,Reema.identity,2.0)

t3.sign\_transaction()

transactions.append(t3)

t4=Transaction(Seema,Rani.identity,4.0)

t4.sign\_transaction()

transactions.append(t4)

t5=Transaction(Reema,Seema.identity,7.0)

t5.sign\_transaction()

transactions.append(t5)

t6=Transaction(Rani,Seema.identity,3.0)

t6.sign\_transaction()

transactions.append(t6)

t7=Transaction(Seema,Raja.identity,8.0)

t7.sign\_transaction()

transactions.append(t7)

t8=Transaction(Seema,Rani.identity,1.0)

t8.sign\_transaction()

transactions.append(t8)

t9=Transaction(Reema,Raja.identity,5.0)

t9.sign\_transaction()

transactions.append(t9)

t10=Transaction(Reema,Rani.identity,3.0)

t10.sign\_transaction()

transactions.append(t10)

#Miner1addsablock

block=Block()

for i in range(3):

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

#validatetransaction

#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

#Miner2 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

#Miner3 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

dump\_blockchain(TPCoins)

**Output:**

Number of blocks in the chain :3

Block # 0

sender : 30819f300d06092a864886f70d010101050003818d0030818902818100bb0d583a631d3afd2448d14dcc8b98e10420b08ce68e7b0e821cf6fb313b28fdf4f4e7b41875f1f54944330b4f623c72f4684683f3a35298ff380c7a8b1662c13f2e3acdfc58bfef36e0952656d994fe2eb65b53fa0805e06f9cc9e354a1b3e8308559065c93381771fd6c80655f1c6d1f91db07f48787d54ca85ea65b4da0910203010001

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recipient : 30819f300d06092a864886f70d010101050003818d0030818902818100b483c3a8caacd702be7df4f82b87aeae3cecccd9caef9a69270fc7386b0c194675d4c75582474bc006e1b73211434a3e3683a9f0d64da6f75c360b581af02bd2559c49715ffe87611e0a10f58d5c24f7ec6894eaccaac98a9d041a3f529585126a074eb39b0cf65d34317c4806d8708b9c604c029a2be7720d811ada8e2ef0270203010001

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value : 15.0

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time : 2024-07-26 18:39:29.864381

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sender : 30819f300d06092a864886f70d010101050003818d0030818902818100bb0d583a631d3afd2448d14dcc8b98e10420b08ce68e7b0e821cf6fb313b28fdf4f4e7b41875f1f54944330b4f623c72f4684683f3a35298ff380c7a8b1662c13f2e3acdfc58bfef36e0952656d994fe2eb65b53fa0805e06f9cc9e354a1b3e8308559065c93381771fd6c80655f1c6d1f91db07f48787d54ca85ea65b4da0910203010001

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recipient : 30819f300d06092a864886f70d010101050003818d0030818902818100e0d2cf8c997cff17fa7cf6cd5396d6457a2b8a1dbc5e29a7e190aa0d0812b8dcf1d50877871a8d3ef8a5740dd662decbfd64b7f90764e4b715eeb2cfe9a3a09f04ae0f80f91f7426db38083e4bef84698158a608762efd12d40ee61b53c8faaf9e042b67e719fc671a333e5eafd9afaad0ac1e2437beb6a28c203099dd197a570203010001

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value : 6.0

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time : 2024-07-26 18:39:29.867377

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sender : 30819f300d06092a864886f70d010101050003818d0030818902818100b483c3a8caacd702be7df4f82b87aeae3cecccd9caef9a69270fc7386b0c194675d4c75582474bc006e1b73211434a3e3683a9f0d64da6f75c360b581af02bd2559c49715ffe87611e0a10f58d5c24f7ec6894eaccaac98a9d041a3f529585126a074eb39b0cf65d34317c4806d8708b9c604c029a2be7720d811ada8e2ef0270203010001

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recipient : 30819f300d06092a864886f70d010101050003818d0030818902818100b1bcd63995fbcd7e1d0793dee29cfd92a5cff86a7a64f2c864e78b1853942ce47276d1ddcc23c3435c1f1043ddeda52388703706af4bb71d1a0a4f9f7041e029e408d6f04f960b915a1776588c4d814334e3cca82938b28e7f7784ce183d019438e9524e12447f26f2d3655b37772cb8c7d5e5a1eddf70bbb1ef6d766e4842bf0203010001

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value : 2.0

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time : 2024-07-26 18:39:29.867377

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Block # 1

sender : 30819f300d06092a864886f70d010101050003818d0030818902818100e0d2cf8c997cff17fa7cf6cd5396d6457a2b8a1dbc5e29a7e190aa0d0812b8dcf1d50877871a8d3ef8a5740dd662decbfd64b7f90764e4b715eeb2cfe9a3a09f04ae0f80f91f7426db38083e4bef84698158a608762efd12d40ee61b53c8faaf9e042b67e719fc671a333e5eafd9afaad0ac1e2437beb6a28c203099dd197a570203010001

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recipient : 30819f300d06092a864886f70d010101050003818d0030818902818100b483c3a8caacd702be7df4f82b87aeae3cecccd9caef9a69270fc7386b0c194675d4c75582474bc006e1b73211434a3e3683a9f0d64da6f75c360b581af02bd2559c49715ffe87611e0a10f58d5c24f7ec6894eaccaac98a9d041a3f529585126a074eb39b0cf65d34317c4806d8708b9c604c029a2be7720d811ada8e2ef0270203010001

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value : 4.0

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time : 2024-07-26 18:39:29.867377

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sender : 30819f300d06092a864886f70d010101050003818d0030818902818100b1bcd63995fbcd7e1d0793dee29cfd92a5cff86a7a64f2c864e78b1853942ce47276d1ddcc23c3435c1f1043ddeda52388703706af4bb71d1a0a4f9f7041e029e408d6f04f960b915a1776588c4d814334e3cca82938b28e7f7784ce183d019438e9524e12447f26f2d3655b37772cb8c7d5e5a1eddf70bbb1ef6d766e4842bf0203010001

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recipient : 30819f300d06092a864886f70d010101050003818d0030818902818100e0d2cf8c997cff17fa7cf6cd5396d6457a2b8a1dbc5e29a7e190aa0d0812b8dcf1d50877871a8d3ef8a5740dd662decbfd64b7f90764e4b715eeb2cfe9a3a09f04ae0f80f91f7426db38083e4bef84698158a608762efd12d40ee61b53c8faaf9e042b67e719fc671a333e5eafd9afaad0ac1e2437beb6a28c203099dd197a570203010001

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value : 7.0

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time : 2024-07-26 18:39:29.870615

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sender : 30819f300d06092a864886f70d010101050003818d0030818902818100b483c3a8caacd702be7df4f82b87aeae3cecccd9caef9a69270fc7386b0c194675d4c75582474bc006e1b73211434a3e3683a9f0d64da6f75c360b581af02bd2559c49715ffe87611e0a10f58d5c24f7ec6894eaccaac98a9d041a3f529585126a074eb39b0cf65d34317c4806d8708b9c604c029a2be7720d811ada8e2ef0270203010001

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recipient : 30819f300d06092a864886f70d010101050003818d0030818902818100e0d2cf8c997cff17fa7cf6cd5396d6457a2b8a1dbc5e29a7e190aa0d0812b8dcf1d50877871a8d3ef8a5740dd662decbfd64b7f90764e4b715eeb2cfe9a3a09f04ae0f80f91f7426db38083e4bef84698158a608762efd12d40ee61b53c8faaf9e042b67e719fc671a333e5eafd9afaad0ac1e2437beb6a28c203099dd197a570203010001

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value : 3.0

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time : 2024-07-26 18:39:29.872114

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Block # 2

sender : 30819f300d06092a864886f70d010101050003818d0030818902818100e0d2cf8c997cff17fa7cf6cd5396d6457a2b8a1dbc5e29a7e190aa0d0812b8dcf1d50877871a8d3ef8a5740dd662decbfd64b7f90764e4b715eeb2cfe9a3a09f04ae0f80f91f7426db38083e4bef84698158a608762efd12d40ee61b53c8faaf9e042b67e719fc671a333e5eafd9afaad0ac1e2437beb6a28c203099dd197a570203010001

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recipient : 30819f300d06092a864886f70d010101050003818d0030818902818100bb0d583a631d3afd2448d14dcc8b98e10420b08ce68e7b0e821cf6fb313b28fdf4f4e7b41875f1f54944330b4f623c72f4684683f3a35298ff380c7a8b1662c13f2e3acdfc58bfef36e0952656d994fe2eb65b53fa0805e06f9cc9e354a1b3e8308559065c93381771fd6c80655f1c6d1f91db07f48787d54ca85ea65b4da0910203010001

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value : 8.0

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time : 2024-07-26 18:39:29.873138

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sender : 30819f300d06092a864886f70d010101050003818d0030818902818100e0d2cf8c997cff17fa7cf6cd5396d6457a2b8a1dbc5e29a7e190aa0d0812b8dcf1d50877871a8d3ef8a5740dd662decbfd64b7f90764e4b715eeb2cfe9a3a09f04ae0f80f91f7426db38083e4bef84698158a608762efd12d40ee61b53c8faaf9e042b67e719fc671a333e5eafd9afaad0ac1e2437beb6a28c203099dd197a570203010001

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recipient : 30819f300d06092a864886f70d010101050003818d0030818902818100b483c3a8caacd702be7df4f82b87aeae3cecccd9caef9a69270fc7386b0c194675d4c75582474bc006e1b73211434a3e3683a9f0d64da6f75c360b581af02bd2559c49715ffe87611e0a10f58d5c24f7ec6894eaccaac98a9d041a3f529585126a074eb39b0cf65d34317c4806d8708b9c604c029a2be7720d811ada8e2ef0270203010001

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value : 1.0

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time : 2024-07-26 18:39:29.873138

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sender : 30819f300d06092a864886f70d010101050003818d0030818902818100b1bcd63995fbcd7e1d0793dee29cfd92a5cff86a7a64f2c864e78b1853942ce47276d1ddcc23c3435c1f1043ddeda52388703706af4bb71d1a0a4f9f7041e029e408d6f04f960b915a1776588c4d814334e3cca82938b28e7f7784ce183d019438e9524e12447f26f2d3655b37772cb8c7d5e5a1eddf70bbb1ef6d766e4842bf0203010001

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recipient : 30819f300d06092a864886f70d010101050003818d0030818902818100bb0d583a631d3afd2448d14dcc8b98e10420b08ce68e7b0e821cf6fb313b28fdf4f4e7b41875f1f54944330b4f623c72f4684683f3a35298ff380c7a8b1662c13f2e3acdfc58bfef36e0952656d994fe2eb65b53fa0805e06f9cc9e354a1b3e8308559065c93381771fd6c80655f1c6d1f91db07f48787d54ca85ea65b4da0910203010001

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value : 5.0

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time : 2024-07-26 18:39:29.875404

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**Practical 2**

**Aim 2a: Implement and demonstrate the use of Variables and Operators in Solidity:**

**Code:**

// SPDX-License-Identifier: MIT

pragma solidity ^0.8.17;

contract PrimitiveDataTypes {

    //state variables (global variable)

    uint8   a = 20;

    uint256 b = 35;

    int     c = 10;

    int8    d = 3;

    bool    flag = true;

    address addr = 0xCA35b7d915458EF540aDe6068dFe2F44E8fa733c;

    // Operations in solidity

    uint public addition    = a + b;

    int  public subtraction = c - d;

    int  public multiply    = d \* c;

    int  public division    = c / d;

    int  public moduloDiv   = c % d;

    int  public increment   = ++c;

    int  public decrement   = --d;

}

**Output:**

**A screenshot of a computer

Description automatically generated**

**Aim 2b: Implement and demonstrate the use of Loops in Solidity:**

**Code**

// SPDX-License-Identifier: MIT

pragma solidity ^0.8.17;

contract Loop {

    function summation(uint n) public pure returns (uint) {

        uint sum = 0;

        for (uint i = 1; i <= n; i++) {

            sum += i;

        }

        return sum;

    }

    function sumWhile(uint n) public pure returns (uint) {

        uint sum = 0;

        uint i = 1;

        while (i <= n) {

            sum += i;

            i++;

        }

        return sum;

    }

    function sumDoWhile(uint n) public pure returns (uint) {

        uint sum = 0;

        uint i = 1;

        do {

            sum += i;

            i++;

        } while (i <= n);

        return sum;

    }

}

**Output:**

A screenshot of a computer

Description automatically generated

**Aim 2c: Implement and demonstrate the use of Decision Making in Solidity:**

**Code**

// SPDX-License-Identifier: MIT

pragma solidity ^0.8.17;

contract decision{

    function even(uint n) public pure returns(bool){

        if(n%2==0){

            return true;

        }

        else{

            return false;

        }

    }

}

**Output:**

**A screenshot of a computer

Description automatically generated**

**Aim 2d: Implement and demonstrate the use of Arrays in Solidity:**

**Code:**

// SPDX-License-Identifier: MIT

pragma solidity ^0.8.17;

contract Arrays {

    // Declaring an array

    uint[] public array1 = [1, 2, 3, 4];

    function fetch(uint index) public view returns (uint) {

        require(index < array1.length, "Index out of bounds");

        return array1[index];

    }

}

**Output:**

**A screenshot of a computer

Description automatically generated**

**Aim 2e: Implement and demonstrate the use of Enums in Solidity:**

**Code:**

// SPDX-License-Identifier: MIT

pragma solidity ^0.8.17;

contract Enums{

    //Define enum

    enum week\_days {Sunday,Monday,Tuesday,Wednesday,Thursday,Friday,Saturday}

    week\_days choice;

    function set\_value() public {

      choice = week\_days.Friday;

    }

    // Defining a function to

    // return value of choice

    function get\_choice(

    ) public view returns (week\_days) {

      return choice;

    }

}

**Output:**

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Description automatically generated**

**Aim 2f: Implement and demonstrate the use of Structs in Solidity:**

**Code:**

// SPDX-License-Identifier: MIT

pragma solidity ^0.8.17;

contract Structs{

    //declaring a struct

    struct Book {

        string name;

        string writer;

        uint price;

        bool available;

    }

    Book book1;

    //set book details like this

    Book book2 = Book ("Harry Potter","J.K.Rowling",300,true);

    //set book details like this

    function set\_book\_detail() public {

    book1 = Book("Introducing Ethereum and Solidity","Chris Dannen",250, true);

    }

    function book1\_info() public view returns (string memory, string memory, uint, bool) {

        return(book2.name, book2.writer,book2.price, book2.available);

    }

      function book2\_info() public view returns (string memory, string memory, uint, bool) {

      return (book1.name, book1.writer, book1.price, book1.available);

   }

}

**Output:**

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Description automatically generated**

**Aim 2g: Implement and demonstrate the use of Mappings in Solidity:**

**Code:**

// SPDX-License-Identifier: MIT

pragma solidity ^0.8.17;

contract maps{

    mapping (uint=>string) public roll\_no;

    function set(uint keys, string memory value) public {

        roll\_no[keys]=value;

    }

}

**Output:**

**A screenshot of a computer

Description automatically generated**

**Aim 2h: Implement and demonstrate the use of Conversions, Ether Units, Special Variables in Solidity:**

**Code:**

// SPDX-License-Identifier: MIT

pragma solidity ^0.8.17;

contract Conversion {

    uint   a = 5;

    uint8  b = 10;

    uint16 c = 15;

    function convert() public view returns (uint) {

        uint result = a + uint(b) + uint(c);

        return result;

    }

    // Demonstrating Ether Units

    function etherUnits() public pure returns (uint, uint, uint) {

        uint oneWei = 1 wei;

        uint oneEther = 1 ether;

        uint oneGwei = 1 gwei;

        return (oneWei, oneEther, oneGwei);

    }

    // Demonstrating Special Variables

    function specialVariables() public view returns (address, uint, uint) {

        address sender = msg.sender; // Sender of the message (current call)

        uint timestamp = block.timestamp; // Current block timestamp

        uint blockNumber = block.number; // Current block number

        return (sender, timestamp, blockNumber);

    }

}

**Output:**

**A screenshot of a computer

Description automatically generated**

**Aim 2i: Implement and demonstrate the use of Strings in Solidity:**

**Code:**

// SPDX-License-Identifier: MIT

pragma solidity ^0.8.17;

contract StringExample {

    // State variable to store a string

    string public greeting = "Hello, ";

    // Function to concatenate strings

    function concatenate(string memory \_name) public view returns (string memory) {

        return string(abi.encodePacked(greeting, \_name));

    }

    // Function to compare two strings

    function compareStrings(string memory \_a, string memory \_b) public pure returns (bool) {

        return keccak256(abi.encodePacked(\_a)) == keccak256(abi.encodePacked(\_b));

    }

    // Function to update the greeting

    function updateGreeting(string memory \_newGreeting) public {

        greeting = \_newGreeting;

    }

}

**Output:**

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**Practical 3**

**Aim 3a: Implement and demonstrate the use of Functions in Solidity:**

**Code:**

// SPDX-License-Identifier: MIT

pragma solidity ^0.8.17;

contract Addition {

    int public input1;

    int public input2;

    function setInputs(int \_input1, int \_input2) public {

        input1 = \_input1;

        input2 = \_input2;

    }

    function additions() public view returns(int) {

        return input1 + input2;

    }

    function subtract() public view returns(int) {

        return input1 - input2;

    }

}

**Output:**

A screenshot of a computer

Description automatically generated

**Aim 3b: Implement and demonstrate the use of Fallback Functions in Solidity:**

**Code:**

// SPDX-License-Identifier: MIT

pragma solidity ^0.8.17;

contract fallbackfn

{

    event Log(string func,address sender, uint value, bytes data);

    fallback() external payable{

        emit Log("fallback",msg.sender,msg.value,msg.data);

    }

    receive() external payable{

        emit Log("receive",msg.sender,msg.value,"");

        //msg.data is empty hence no need to specify it and mark it as empty string

    }

}

**Output:**

**A screenshot of a computer

Description automatically generated**

**Aim 3c: Implement and demonstrate the use of Mathematical functions in Solidity:**

**Code:**

// SPDX-License-Identifier: MIT

pragma solidity ^0.8.17;

contract MathOperations {

    // addMod computes (x + y) % k

    // mulMod computes (x \* y) % k

    function computeMod() public pure returns (uint addModResult, uint mulModResult) {

        uint x = 3;

        uint y = 2;

        uint k = 6;

        addModResult = addmod(x, y, k);

        mulModResult = mulmod(x, y, k);

    }

}

**Output:**

**A screenshot of a computer error

Description automatically generated**

**Aim 3d: Implement and demonstrate the use of Cryptographic functions in Solidity:**

**Code:**

// SPDX-License-Identifier: MIT

pragma solidity ^0.8.17;

contract Crypto {

    function hash(string memory \_text,uint \_num,address \_addr) public pure returns (bytes32) {

            return keccak256(abi.encodePacked(\_text, \_num, \_addr));

            }

    function collision(string memory \_text, string memory \_anotherText)public pure returns (bytes32){

                return keccak256(abi.encodePacked(\_text, \_anotherText));

            }

}

 //hash is same for collision

 //0x5f38993891425af42a69bd3cbabdc916f093d4f444455134d4371f4ddd17bd08 - shlok shivkar

 //0x5f38993891425af42a69bd3cbabdc916f093d4f444455134d4371f4ddd17bd08 - shl okshivkar

//abc, defgh

//0x48624fa43c68d5c552855a4e2919e74645f683f5384f72b5b051b71ea41d4f2d

//ab, cdefgh

//0x48624fa43c68d5c552855a4e2919e74645f683f5384f72b5b051b71ea41d4f2d

contract GuessTheWord {

    bytes32 public answer = 0x054d6026be33f8ebb0dbd5e7ee11b97bd98f59d6261e53559798f3f81e63dc30;

    function guess(string memory \_word) public view returns (bool) {

     return keccak256(abi.encodePacked(\_word)) == answer;

    }

}

**Output:**

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Description automatically generated**

**Aim 3e: Implement and demonstrate the use of Function Modifiers in Solidity:**

**Code:**

// SPDX-License-Identifier: MIT

pragma solidity ^0.8.13;

contract FunctionModifier{

    address public owner;

    uint public x = 100;

    bool public locked;

    constructor() {

        // Set the transaction sender as the owner of the contract.

        owner = msg.sender;

        }

        modifier onlyOwner() {

            require(msg.sender == owner, "Not owner");

            \_;

            }

        modifier validAddress(address \_addr) {

            require(\_addr != address(0), "Not valid address");

            \_;

            }

    function changeOwner(address \_newOwner) public onlyOwner validAddress(\_newOwner) {

        owner = \_newOwner;

        }

        modifier noReentrancy() {

            require(!locked, "No reentrancy");

            locked = true;

            \_;

            locked = false;

        }

    function decrement(uint i) public noReentrancy {

        x -= i;

        if (i > 1) {

            decrement(i - 1);

        }

    }

}

**Output:**

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Description automatically generated**

**A screenshot of a computer

Description automatically generated**

**Aim 3f: Implement and demonstrate the use of View and Pure Functions in Solidity:**

**Code:**

// SPDX-License-Identifier: MIT

pragma solidity ^0.8.3;

contract ViewAndPure {

    uint public x = 1;

    // Promise not to modify the state.

    function addToX(uint y) public view returns (uint) {

        return x + y;

    }

    // Promise not to modify or read from the state.

    function add(uint i, uint j) public pure returns (uint) {

        return i + j;

    }

}

**Output:**

**A screenshot of a computer

Description automatically generated**

**Aim 3g: Implement and demonstrate the use of** **Function Overloading in Solidity:**

**Code:**

// SPDX-License-Identifier: MIT

pragma solidity ^0.8.17;

contract FunctionOverloading {

    // Function with one parameter

    function sum(uint a) public pure returns (uint) { return a + 10; }

    // Overloaded function with two parameters

    function sum(uint a, uint b) public pure returns (uint) { return a + b; }

    // Overloaded function with three parameters

    function sum(uint a, uint b, uint c) public pure returns (uint) { return a + b + c; }

    // Examples of calling overloaded functions

    function exampleUsage() public pure returns (uint, uint, uint) {

        uint result1 = sum(5);            // Calls the first sum function

        uint result2 = sum(5, 10);        // Calls the second sum function

        uint result3 = sum(5, 10, 15);    // Calls the third sum function

        return (result1, result2, result3);

    }

}

**Output:**

**A screenshot of a computer

Description automatically generated**

**Practical 4**

**Aim 4a: Implement and demonstrate the use of Withdrawal Pattern in Solidity:**

**Code:**

// SPDX-License-Identifier: MIT

pragma solidity ^0.8.13;

contract withdrawalPattern{

    address public richest;

    uint public mostSent;

    mapping (address=>uint) pendingWithdrawals;

    error NotEnoughEther();

    constructor() payable{

        richest = msg.sender;

        mostSent = msg.value;

    }

    function becomeRichest() public payable{

        if (msg.value <= mostSent) revert NotEnoughEther();

        pendingWithdrawals[richest] += msg.value;

        richest = msg.sender;

        mostSent = msg.value;

    }

    function withdraw() public {

        uint amount = pendingWithdrawals[msg.sender];

        pendingWithdrawals[msg.sender] = 0;

        payable (msg.sender).transfer(amount);

    }

}

**Output:**

A screenshot of a computer

Description automatically generated **A screenshot of a computer

Description automatically generated**

**Aim 4b: Implement and demonstrate the use of Restricted Access in Solidity:**

**Code:**

// SPDX-License-Identifier: MIT

pragma solidity ^0.8.17;

contract AccessRestriction {

    address public owner = msg.sender;

    uint public creationTime = block.timestamp;

    error Unauthorized();

    error TooEarly();

    error NotEnoughEther();

    modifier onlyBy(address account){

        if (msg.sender != account)

        revert Unauthorized();

        \_;

    }

    modifier costs(uint amount) {

        if (msg.value < amount)

            revert NotEnoughEther();

            \_;

        if (msg.value > amount)

            payable(msg.sender).transfer(msg.value - amount);

    }

    modifier onlyAfter(uint time) {

        if (block.timestamp < time)

            revert TooEarly();

            \_;

    }

    function changeOwner(address newOwner)public onlyBy(owner){

        owner = newOwner;

    }

    function disown()public onlyBy(owner) onlyAfter(creationTime + 6 weeks){

        delete owner;

    }

    function forceOwnerChange(address newOwner)public payable costs(20 ether){

        owner = newOwner;

        // just some example condition

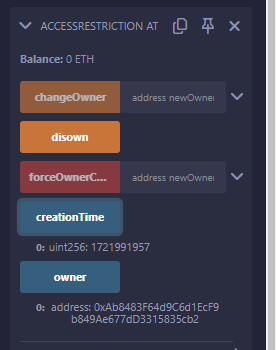
        if (uint160(owner) & 0 == 1)

            return;

    }

}

**Output:**

** A screenshot of a computer

Description automatically generated**

**Practical 5**

**Aim 5a:** **Implement and demonstrate the use of Contracts and Inheritance in Solidity:**

**Code:**

// SPDX-License-Identifier: MIT

pragma solidity ^0.8.17;

contract C{

    uint private data;

    uint public info;

    constructor()  {

        info = 10;

        }

        function increment(uint a) private pure returns(uint){

            return a + 1;

        }

        function updateData(uint a) public {

            data = a;

        }

        function getData() public view returns(uint) {

            return data;

        }

        function compute(uint a, uint b) internal pure returns (uint) {

            return a + b;

        }

}

contract D {

    function readData() public returns(uint) {

        C c = new C();

        c.updateData(7);

        return c.getData();

    }

}

contract E is C {

    uint private result;

    C private c;

    constructor()  {

        c = new C();

    }

    function getComputedResult() public {

        result = compute(3, 6);

    }

    function getResult() public view returns(uint) {

        return result;

    }

}

**Output:**

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Description automatically generated**

**Aim 5b: Implement and demonstrate the use of Constructors in Solidity:**

**Code:**

// SPDX-License-Identifier: MIT

pragma solidity ^0.8.17;

contract constructors{

    string str;

    uint amount;

    constructor(){

        str  = "Shlok is learning Solidity";

        amount = 10;

    }

    function const()public view returns(string memory,uint){

        return (str,amount);

    }

}

**Output:**

**A screenshot of a computer

Description automatically generated**

**Aim 5c: Implement and demonstrate the use of Abstract Contracts in Solidity:**

**Code:**

// SPDX-License-Identifier: MIT

pragma solidity ^0.8.17;

abstract contract Main {

    // Define an abstract function that can be overridden

    function add(uint a, uint b) public virtual pure returns (uint);

}

contract Adder is Main {

    // Override the add function from the Main contract

    function add(uint a, uint b) public override pure returns (uint) {

        return a + b;

    }

}

**Output:**

**A screenshot of a computer

Description automatically generated**

**Aim 5d: Implement and demonstrate the use of Abstract Contracts in Solidity:**

**Code:**

// SPDX-License-Identifier: MIT

pragma solidity ^0.8.17;

interface adder{

function add(uint a, uint b)external pure returns(uint);

}

contract adderContract is adder{

function add(uint a, uint b)external pure returns(uint){

return a+b;

}

}

**Output:**

**A screenshot of a phone

Description automatically generated**

**Practical 6**

**Aim 6a: Implement and demonstrate the use of Libraries in Solidity:**

**Code:**

// SPDX-License-Identifier: MIT

pragma solidity ^0.8.17;

library Search {

   function indexOf(uint[] storage self, uint value) internal view returns (uint) {

      for (uint i = 0; i < self.length; i++) {

         if (self[i] == value) {

            return i;

         }

      }

      return type(uint).max;

   }

}

contract Test {

   uint[] data;

   constructor() {

      data.push(1);

      data.push(2);

      data.push(3);

      data.push(4);

      data.push(5);

   }

   function isValuePresent() external view returns (uint) {

      uint value = 4;

      // Search if value is present in the array using Library function

      uint index = Search.indexOf(data, value);

      return index;

   }

}

library MathLibrary {

   function square(uint num) internal pure returns (uint) {

      return num \* num;

   }

}

contract SquareContract {

   using MathLibrary for uint;

   function calculateSquare(uint num) external pure returns (uint) {

      return num.square();

   }

}

**Output:**

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Description automatically generated

**Aim 6b: Implement and demonstrate the use of Assembly in Solidity:**

**Code:**

// SPDX-License-Identifier: MIT

pragma solidity ^0.8.17;

library Sum {

   function sumUsingInlineAssembly(uint[] memory \_data) public pure returns (uint sum) {

      for (uint i = 0; i < \_data.length; ++i) {

         assembly {

            // Load the value from memory at the current index

            let value := mload(add(add(\_data, 0x20), mul(i, 0x20)))

            // Add the value to the sum

            sum := add(sum, value)

         }

      }

      // Return the calculated sum

      return sum;

   }

}

contract Test {

   uint[] data;

   constructor() {

      data.push(1);

      data.push(2);

      data.push(3);

      data.push(4);

      data.push(5);

   }

   function sum() external view returns (uint) {

      return Sum.sumUsingInlineAssembly(data);

   }

}

**Output:**

**A screenshot of a computer

Description automatically generated**

**Aim 6c: Implement and demonstrate the use of Error handling in Solidity:**

**Code:**

pragma solidity ^0.8.17;

contract ErrorHandlingExample {

    constructor() payable {

        // Allow the contract to receive Ether during deployment

    }

    function divide(uint256 numerator, uint256 denominator) external pure returns (uint256) {

        require(denominator != 0, "Division by zero is not allowed");

        return numerator / denominator;

    }

    function withdraw(uint256 amount) external {

        require(amount <= address(this).balance, "Insufficient balance");

        payable(msg.sender).transfer(amount);

    }

    function assertExample() external pure {

        uint256 x = 5;

        uint256 y = 10;

        assert(x < y);

    }

    function tryCatchExample() external view returns (bool) {

        try this.divide(10, 5) returns (uint256 result) {

            // Handle successful division

            return true;

        } catch Error(string memory errorMessage) {

            // Handle division error

            return false;

        }

    }

}

**Output:**

A screenshot of a computer

Description automatically generated

**Aim 6d: Implement and demonstrate the use of Events in Solidity:**

**Code**

// SPDX-License-Identifier: MIT

pragma solidity ^0.8.17;

contract EventExample {

    // Define an event

    event Deposit(address indexed from, uint256 amount);

    event Withdraw(address indexed to, uint256 amount);

    // Mapping to keep track of user balances

    mapping(address => uint256) public balances;

    // Function to deposit ether into the contract

    function deposit() public payable {

        require(msg.value > 0, "Must deposit more than 0 ether");

        // Update the balance

        balances[msg.sender] += msg.value;

        // Emit the Deposit event

        emit Deposit(msg.sender, msg.value);

    }

    // Function to withdraw ether from the contract

    function withdraw(uint256 amount) public {

        require(balances[msg.sender] >= amount, "Insufficient balance");

        // Update the balance

        balances[msg.sender] -= amount;

        // Transfer the ether

        payable(msg.sender).transfer(amount);

        // Emit the Withdraw event

        emit Withdraw(msg.sender, amount);

    }

}

**Output:**

A screenshot of a computer

Description automatically generated

**Practical 7**

**Aim: Install hyperledger fabric**

**Commands and Output:**

A screenshot of a computer program

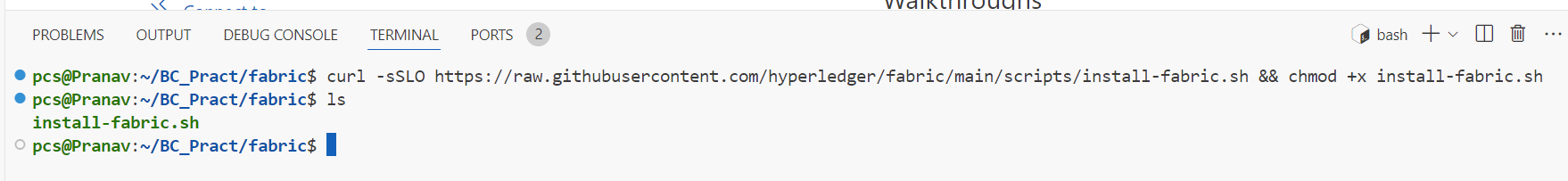
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A screen shot of a computer code

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**Download fabric samples**

curl -sSLO https://raw.githubusercontent.com/hyperledger/fabric/main/scripts/install-fabric.sh && chmod +x install-fabric.sh



**Pull the docker containers**

./install-fabric.sh

A screenshot of a computer

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**Navigate to test network directory**

ls

cd fabric-samples

ls

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cd test-network

ls

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**Remove any containers or artifacts**

./network.sh down

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**Up the network**

./network.sh up

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**Create a channel**

./network.sh createChannel

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**Deploy chaincode on peers and channel**

./network.sh deployCC -ccn basic -ccp ../asset-transfer-basic/chaincode-javascript -ccl javascript

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***Interacting with the network***

**Set the path for peer binary and config for core.yaml**

export PATH=${PWD}/../bin:$PATH

export FABRIC\_CFG\_PATH=$PWD/../config/

**Set the environment variables to operate Peer as Org1**

export CORE\_PEER\_TLS\_ENABLED=true

export CORE\_PEER\_LOCALMSPID="Org1MSP"

export CORE\_PEER\_TLS\_ROOTCERT\_FILE=${PWD}/organizations/peerOrganizations/org1.example.com/peers/peer0.org1.example.com/tls/ca.crt

export CORE\_PEER\_MSPCONFIGPATH=${PWD}/organizations/peerOrganizations/org1.example.com/users/Admin@org1.example.com/msp

export CORE\_PEER\_ADDRESS=localhost:7051

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**Command to initialize the ledger with assets**

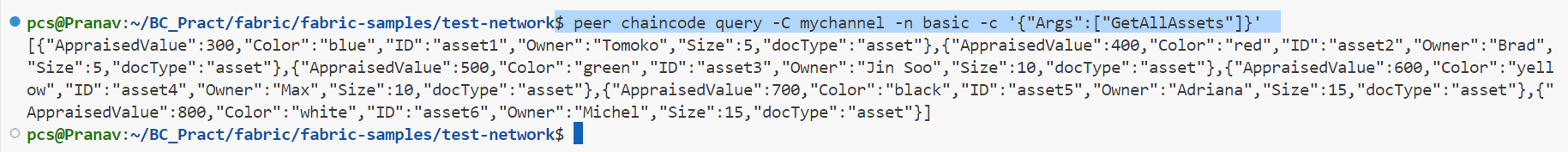
peer chaincode invoke -o localhost:7050 --ordererTLSHostnameOverride orderer.example.com --tls --cafile "${PWD}/organizations/ordererOrganizations/example.com/orderers/orderer.example.com/msp/tlscacerts/tlsca.example.com-cert.pem" -C mychannel -n basic --peerAddresses localhost:7051 --tlsRootCertFiles "${PWD}/organizations/peerOrganizations/org1.example.com/peers/peer0.org1.example.com/tls/ca.crt" --peerAddresses localhost:9051 --tlsRootCertFiles "${PWD}/organizations/peerOrganizations/org2.example.com/peers/peer0.org2.example.com/tls/ca.crt" -c '{"function":"InitLedger","Args":[]}'

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**Query the ledger**

peer chaincode query -C mychannel -n basic -c '{"Args":["GetAllAssets"]}'



**Transfer the asset**

peer chaincode invoke -o localhost:7050 --ordererTLSHostnameOverride orderer.example.com --tls --cafile "${PWD}/organizations/ordererOrganizations/example.com/orderers/orderer.example.com/msp/tlscacerts/tlsca.example.com-cert.pem" -C mychannel -n basic --peerAddresses localhost:7051 --tlsRootCertFiles "${PWD}/organizations/peerOrganizations/org1.example.com/peers/peer0.org1.example.com/tls/ca.crt" --peerAddresses localhost:9051 --tlsRootCertFiles "${PWD}/organizations/peerOrganizations/org2.example.com/peers/peer0.org2.example.com/tls/ca.crt" -c '{"function":"TransferAsset","Args":["asset6","Christopher"]}'

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**Lets query the ledger from Org2 peer**

**Set the environment variables to operate Peer as Org2**

export CORE\_PEER\_TLS\_ENABLED=true

export CORE\_PEER\_LOCALMSPID="Org2MSP"

export CORE\_PEER\_TLS\_ROOTCERT\_FILE=${PWD}/organizations/peerOrganizations/org2.example.com/peers/peer0.org2.example.com/tls/ca.crt

export CORE\_PEER\_MSPCONFIGPATH=${PWD}/organizations/peerOrganizations/org2.example.com/users/Admin@org2.example.com/msp

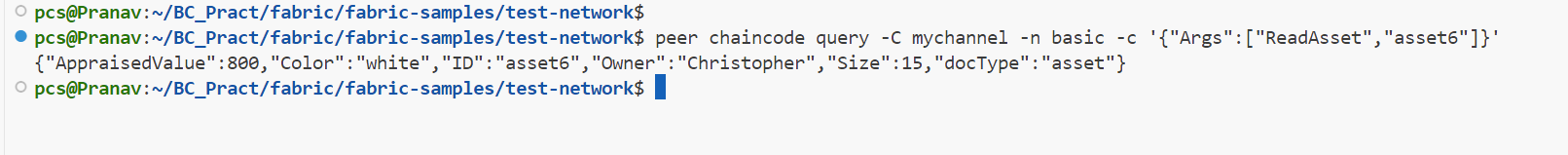
export CORE\_PEER\_ADDRESS=localhost:9051

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**Query the ledger**

peer chaincode query -C mychannel -n basic -c '{"Args":["ReadAsset","asset6"]}'



**Bring the network down**

./network.sh down

**Practical 8**

**Aim: Demonstrate the running of the blockchain node**

**Code and Output:**

**To check if the prerequisites (Node.js, npm, and Truffle) are installed, you can run the following commands:**

**Step 1: Prerequisites**

**Install Node.js**

<https://nodejs.org/en/download/prebuilt-installer>

**Execute the following Commands:**

npm install -g truffle

npm install -g ganache-cli

1. **Check Node.js and npm installation:**

node -v

npm -v

1. **Check Truffle installation:**

truffle version

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1. **Install Ganache**

<https://archive.trufflesuite.com/ganache/>

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1. **Create a new Workspace (BC\_Pract)**

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**Step 2: Initialize a Truffle Project**

1. **Create a new directory for your project:**

mkdir myProj

cd myProj

1. **Initialize the Truffle project:**

truffle init

**Step 3: Create a Solidity Smart Contract**

1. **Navigate to the Contracts directory(myProj/contracts):**

**SimpleStorage.sol**

// SPDX-License-Identifier: MIT

pragma solidity ^0.8.0;

contract SimpleStorage {

uint256 public storedData;

function set(uint256 x) public {

storedData = x;

}

function get() public view returns (uint256) {

return storedData;

}

}

1. **Compile the Smart Contract**

Command: truffle compile

**C:\Users\prana\Desktop\BC\_Pract\Pract\_8\myProj>truffle compile**

**Step 4: Configure Truffle to Use Ganache**

**Open the truffle-config.js file and configure the development network to use Ganache. Update the networks section:**

module.exports = {

networks: {

development: {

host: "127.0.0.1",

port: 7545, // Match the port Ganache is using

network\_id: "\*" // Match any network id

}

},

compilers: {

solc: {

version: "0.8.0" // Specify the Solidity compiler version

}

}

};

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**Step 5: Migrate the Smart Contract to Ganache**

1. **Start Ganache (open the Ganache application and start a new workspace(BC\_Pract)).**
2. **Create a migration script in the migrations directory   
   (e.g., deploy\_contracts.js):**

**Pract\_8\myProj\migrations\2\_deploy\_contracts.js**

const SimpleStorage = artifacts.require("SimpleStorage");

module.exports = function (deployer) {

deployer.deploy(SimpleStorage);

};

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1. **Run the migration:**

**Command: truffle migrate**

C:\Users\prana\Desktop\BC\_Pract\Pract\_8\myProj>truffle migrate

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**Step 6: Interact with the Deployed Contract**

1. **Open the new command prompt:**

**Command**: truffle console

C:\Users\prana\Desktop\BC\_Pract\Pract\_8\myProj>truffle console

1. **Interact with the deployed contract:**

Execute the following commands one-by-one

let instance = await SimpleStorage.deployed()

await instance.set(42)

let value = await instance.get()

value.toString() // Output should be '42'

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**Practical 9**

**Aim: Demonstrate the use of Bitcoin API.**

**Code:**

import requests

# Task 1: Get information regarding the current block

def get\_current\_block\_info():

    response = requests.get("https://blockchain.info/latestblock")

    block\_info = response.json()

    print("Current block information:")

    print("Block height:", block\_info['height'])

    print("Block hash:", block\_info['hash'])

    print("Block index:", block\_info['block\_index'])

    print("Timestamp:", block\_info['time'])

# Task 3: Get balance of an address

def get\_address\_balance(address):

    response = requests.get(f"https://blockchain.info/q/addressbalance/{address}")

    balance = float(response.text) / 10\*\*8

    print("Balance of address", address, ":", balance, "BTC")

# Example usage

if \_\_name\_\_ == "\_\_main\_\_":

    # Task 1: Get information regarding the current block

    get\_current\_block\_info()

    # Task 3: Get balance of an address

    address = "3Dh2ft6UsqjbTNzs5zrp7uK17Gqg1Pg5u5"

    get\_address\_balance(address)

**Output:**

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