UNIVERSITY OF MUMBAI

PRACTICAL REPORT
M.Sc. I.T (PART 2) 2024-2025

PAPER 1: BLOCKCHAIN

PAPER 2: DEEP LEARNING

PAPER 3: ROBOTIC PROCESS AUTOMATION

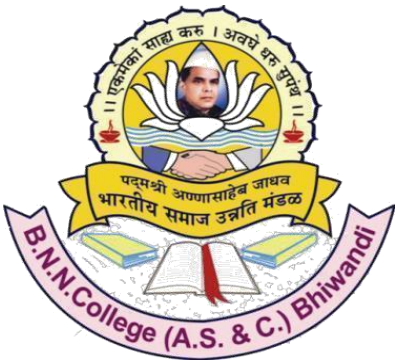
SUBMITTED BY:
(VENKATESH SRINIVAS KATKAM)

(PROF. SIMRAN A. SHAIKH)
{TEACHER INCHARGE}

(PROF. SAFA MOMIN)
{TEACHER INCHARGE}

(PROF. PRAGATI MHATRE)
{TEACHER INCHARGE}

Padmashri Annasaheb Jadhav Bhartiya Samaj Unnati Mandal's
B.N.N COLLEGE
(Arts, Science, Commerce & Self-Funded Course)
(Affiliated to University of Mumbai)
DEPARTMENT OF INFORMATION TECHNOLOGY BHIWANDI,
MAHARASHTRA-421302



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B.N.N College of Arts, Science and Commerce Bhiwandi

(Self-Funded Course)

(Department of Information Technology)

CERTIFICATE

This is to certify that Mr./Miss._____

Class: **MSc-IT** Exam Seat No._____ has satisfactorily completed practical in. **BLOCKCHAIN**. As laid down in the regulation of University of Mumbai for the purpose of **Semester- IV Practical** Examination 2024-2025.

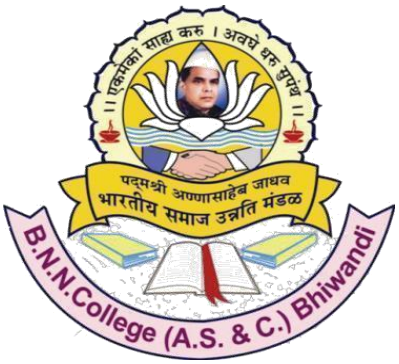
Date: Place: Bhiwandi

_____ _____

In-Charge Professor **Signature of External Examiner**

_____ _____

Signature of HOD **Signature of Principal**



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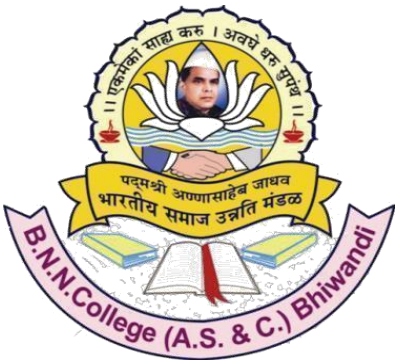

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BLOCKCHAIN

INDEX

Sr. No		Practical	Signature
1	A	Develop a secure messaging application where users can exchange messages securely using RSA encryption. Implement a mechanism for generating RSA key pairs and encrypting/decrypting messages.	
	B	Allow users to create multiple transactions and display them in an organised format.	
	C	Create a Python class named Transaction with attributes for sender, receiver, and amount. Implement a method within the class to transfer money from the sender's account to the receiver's account..	
	D	Implement a function to add new blocks to the miner and dump the blockchain.	
2	A	Write a python program to demonstrate mining.	
	B	Demonstrate the use of the Bitcoin Core API to interact with a Bitcoin Core node.	
	C	Demonstrating the process of running a blockchain node on your local machine.	
3	A	Write a Solidity program that demonstrates various types of functions including regular functions, view functions, pure functions, and the fallback function.	
	B	Write a Solidity program that demonstrates function overloading, mathematical functions, and cryptographic functions.	
	C	Write a Solidity program that demonstrates various features including contracts, inheritance, constructors, abstract contracts, interfaces.	
	D	Write a Solidity program that demonstrates use of libraries, assembly, events, and error handling	
4	A	Install and demonstrate use of hyperledger-Irhoa.	

DEEP LEARNING

INDEX

SR No.	Practical List	Sign
1	**Introduction to TensorFlow**	
a.	• Create tensors with different shapes and data types. • Perform basic operations like addition, subtraction, multiplication, and division on tensors. • Reshape, slice, and index tensors to extract specific elements or sections • Performing matrix multiplication and finding eigenvectors and eigenvalues using TensorFlow	
b.	Program to solve the XOR problem	
2	**Linear Regression**	
a.	• Implement a simple linear regression model using TensorFlow's lowlevel API (or tf. keras). • Train the model on a toy dataset (e.g., housing prices vs. square footage) • Visualize the loss function and the learned linear relationship.	
b.	Make predictions on new data points	
3	**Convolutional Neural Networks (Classification)**	
a.	Implementing deep neural network for performing binary classification task	
b.	Using a deep feed-forward network with two hidden layers for performing multiclass classification and predicting the class.	
4	Write a program to implement deep learning Techniques for image segmentation. O	
5	Write a program to predict a caption for a sample image using LSTM	
6	Applying the Autoencoder algorithms for encoding real-world data	
7	Write a program for character recognition using RNN and compare it with CNN.	
8	Write a program to develop Autoencoders using MNIST Handwritten Digits	
9	Demonstrate recurrent neural network that learns to perform sequence analysis for stock price.(google stock price)	
10	Applying Generative Adversarial Networks for image generation and unsupervised tasks.	

Robotic Process Automation

INDEX

Pract No.	Practical Description	Sign
1	**RPA Basics : Sequences and Flowcharts:**	
	a. Create a simple sequence-based project.	
	b. Create a flowchart-based project.	
	c. Automate UiPath Number Calculation (Subtraction, Multiplication, Division of numbers).	
	d. Create an automation UiPath project using different types of variables (number, datetime, Boolean, generic, array, data table)	
2	**Decision making and looping:**	
	a. Consider an array of names. We have to find out how many of them start with the letter "a". Create an automation where the number of names starting with "a" is counted and the result is displayed.	
	b. Demonstrate switch statement with an example	
	c. Create an automation To Print numbers from 1 to 10 with break after the writeline activity inside for each activity	
	d. Create an automation using Do..While Activity to print numbers from 5 to 1	
	e. Create an automation using Delay Activity between two writeline activities to separate their execution by 5 seconds	
	f. Create an automation to demonstrate use of decision statements (if)	
3	**Types of Recording:**	
	a. Basic Recording using Toolbar	
	b. Basic Recording using Notepad	
	c. Desktop Recording using Tool bar	
	d. Desktop Recording by creating a workflow	
	e. Web Recording e.g. Find the rating of the movie from imdb web site	
	f. Web Recording manually	
4	**Excel Automation:**	
	a. Automate the process to extract data from an excel file into a data table and vice versa.	
	b. Create an automation to Write data to specific cell of an excel sheet.	
	c. Create an automation to Read data to specific cell of an excel sheet.	
	d. Create an automation to append data to specific cell of an excel sheet.	
	e. Create an automation to sort a table of an excel sheet.	
	f. Create an automation to filter a table of an excel sheet.	
	g. Choose a repetitive manual task from your workplace or daily life. Design and implement an RPA bot to automate this task using your preferred RPA tool	
5	**Different controls in UiPath:**	
	a. Implement the attach window activity	
	b. Automate using Anchor Base	
	c. Automate using Element Exists.	
	d. Automate using Find Children control.	
	e. Use Get Ancestor control	
	f. Use Find Relative control	

6	**Keyboard and Mouse Events:**	
	a. Demonstrate the following activities in UiPath:	
	i. Mouse (click, double click and hover)	
	ii. Type into	
	iii. Type Secure text	
	b. Demonstrate the following events in UiPath:	
	i. Element triggering event	
	ii. Image triggering event	
	iii. System Triggering Event	
	c. Automate the process of launching an assistant bot on a keyboard event.	
7	**Screen Scraping and Web Scraping methods:**	
	a. Automate the following screen scraping methods using UiPath:	
	a. Full Text	
	b. Native	
	c. OCR	
	b. Demonstrate Data Scraping and display values in Message box.	
	c. Demonstrate Screen Scraping for a pdf, web page and image file.	
8	**PDF Automation and Exception Handling:**	
	a. Read PDF With OCR	
	b. Merge PDF's into one	
	c. Get PDF Total Page count Using Regex	
	d. Extract data from a PDF or Excel file and populate it into a database or spreadsheet.	
	e. Extract data from a PDF or Excel file and populate it into a database or spreadsheet. Implement data manipulation techniques like filtering, sorting, or data validation.	
	f. Demonstrate Exception Handling using UiPath	
9	**Email Automation:**	
	a. Configure Email using UiPath	
	b. Read Emails	
	c. Send Email with Attachment	
	d. Save Email Attachments	
	e. Reply to Email	
10	**Orchestrator management and mini project:**	
	a. Deploy bots to Orchestrator	
	b. Run jobs from Orchestrator	
	c. Queue Introduction:	
	i. Add items to Queue	
	ii. Get Queue item from Orchestrator	
	d. Build UiPath Chatbot using Google dialogflow	
11	**RPA Applications:**	
	a. Automate the extraction of data from invoices, validate information, and update accounting systems.	
	b. Automate data entry tasks from various sources such as emails, forms, or documents, and validate data against predefined rules.	

	c. Automate the process of expense reporting by extracting data from receipts, categorizing expenses, and generating reports.	
	d. Automate inventory tracking and management processes, including stock updates, reordering, and inventory audits.	
	e. Automate sales order processing tasks such as order entry, validation, and fulfilment.	
12	**Prepare the Robotics process automation project on any one of the following domains:**	
	RPA in Logistics, Intelligent Process Automation, IT Process Automation Explained, RPA in Banking, RPA in Education, RPA in Telecommunications, RPA in Healthcare, RPA in Insurance, RPA in Accounting, RPA Challenges, RPA in Real Estate, RPA in BPO, RPA Security	

BLOCKCHAIN

Practical 1

A. Develop a secure messaging application where users can exchange messages securely using RSA encryption. Implement a mechanism for generating RSA key pairs and encrypting/decrypting messages.

```
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
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)

self.identity=binascii.hexlify(self._public_key.exportKey(format='DER')).decode('asc
ii')

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')

client1 = Client()
client2 = Client()

print (client1.identity)
print("*******")
print (client2.identity)
```

B. Allow users to create multiple transactions and display them in an organised format.

C. Create a Python class named Transaction with attributes for sender, receiver, and amount. Implement a method within the class to transfer money from the sender's account to the receiver's account..

```
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
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)

self.identity=binascii.hexlify(self._public_key.exportKey(format='DER')).decode('asc
ii')

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 == "LDS":
            identity = "LDS"
        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')

Manisha = Client()
Karan = Client()
t = Transaction (sender=Manisha,recipient=Karan.identity,value=5.0)
signature = t.sign_transaction()
print (signature)

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 = []
Manisha = Client()
Karan = Client()
Seema = Client()
Priti = Client()
t1 = Transaction( Manisha, Karan.identity, 15.0 )
t1.sign_transaction()
transactions.append(t1)
t2 = Transaction( Manisha, Seema.identity, 6.0 )
t2.sign_transaction()
transactions.append(t2)
t3 = Transaction( Karan, Priti.identity, 2.0)
t3.sign_transaction()
transactions.append(t3)
t4 = Transaction( Seema, Karan.identity, 4.0 )
t4.sign_transaction()
transactions.append(t4)
t5 = Transaction( Priti, Seema.identity, 7.0 )
t5.sign_transaction()
transactions.append(t5)
t6 = Transaction( Karan, Seema.identity, 3.0 )
t6.sign_transaction()
transactions.append(t6)
t7 = Transaction( Seema, Manisha.identity, 8.0 )
```

```
t7.sign_transaction()
transactions.append(t7)
t8 = Transaction( Seema, Karan.identity, 1.0 )
t8.sign_transaction()
transactions.append(t8)
t9 = Transaction( Priti, Manisha.identity, 5.0 )
t9.sign_transaction()
transactions.append(t9)
t10 = Transaction( Priti, Karan.identity, 3.0 )
t10.sign_transaction()
transactions.append(t10)

for transaction in transactions:
    display_transaction (transaction)
print ('==================================')
```

D. Implement a function to add new blocks to the miner and dump the blockchain.

```
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
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)

self.identity=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 == "LDS":
            identity = "LDS"
        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')

Manisha = Client()
Karan = Client()
t = Transaction (sender=Manisha,recipient=Karan.identity,value=5.0)
signature = t.sign_transaction()
print (signature)
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 = []
Manisha = Client()
Karan = Client()
Seema = Client()
Priti = Client()
t1 = Transaction( Manisha, Karan.identity, 15.0 )
t1.sign_transaction()
transactions.append(t1)
t2 = Transaction( Manisha, Seema.identity, 6.0 )
t2.sign_transaction()
transactions.append(t2)
t3 = Transaction( Karan, Priti.identity, 2.0)
t3.sign_transaction()
transactions.append(t3)
t4 = Transaction( Seema, Karan.identity, 4.0 )
t4.sign_transaction()
transactions.append(t4)
t5 = Transaction( Priti, Seema.identity, 7.0 )
t5.sign_transaction()
transactions.append(t5)
t6 = Transaction( Karan, Seema.identity, 3.0 )
t6.sign_transaction()
transactions.append(t6)
t7 = Transaction( Seema, Manisha.identity, 8.0 )
t7.sign_transaction()
transactions.append(t7)
t8 = Transaction( Seema, Karan.identity, 1.0 )
t8.sign_transaction()
transactions.append(t8)
t9 = Transaction( Priti, Manisha.identity, 5.0 )
```

```
t9.sign_transaction()
transactions.append(t9)
t10 = Transaction( Priti, Karan.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 = ""
Manisha = Client()
t0 = Transaction ( "LDS", Karan.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)
```

```
time:2025-06-06 10:36:39.923717
==========
sender:30819f300d06092a864886f70d0101010500038180003081890281810100e68bf736d3664542d08f40ca4ebcaa8aa5fb411d0a62f03f7c32a29d262b028f86fd136125be2ba35c32f14a78d7088eb96c473de93620f4670336cec7b
b42b2fbf497f118faedc5ccf170eb4124e054858ff8b9b7d59775a0fe24cece4dcc89baa290dd2144b083c917611c3178245ede709f48f8ab967b2da7f0b2d35b74ab0203010001
==========
recipient:30819f300d06092a864886f70d0101010500038180003081890281810100f3f58e3950bf07934149de06e06490907876fd21c9fb8228ffe5f6b5742d969b4ab38dc9b5c93bf576092a42e7cdab9a8fe99888f000626a6a6bef49
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==========
value:1.0
==========
time:2025-06-06 10:36:39.923717
==========
sender:30819f300d06092a864886f70d0101010500038180003081890281810100a93af40de2b8575c033293092ba151924538790d60fc83eb45724fff93a4bd766da27b8b17d25678ba94a2b9a057ee487a870fa0eb74f3b082038978b4
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==========
recipient:30819f300d06092a864886f70d0101010500038180003081890281810100967827c49db72935ad24527d9fe2106d1005abc8961c36cca053027cff759b495a2290fc349af5e2a54e40b3e11ab2088fa3c53881b70851b1e4a85
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==========
value:5.0
==========
time:2025-06-06 10:36:39.923717
==========
sender:30819f300d06092a864886f70d0101010500038180003081890281810100a93af40de2b8575c033293092ba151924538790d60fc83eb45724fff93a4bd766da27b8b17d25678ba94a2b9a057ee487a870fa0eb74f3b082038978b4
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==========
recipient:30819f300d06092a864886f70d0101010500038180003081890281810100f3f58e3950bf07934149de06e06490907876fd21c9fb8228ffe5f6b5742d969b4ab38dc9b5c93bf576092a42e7cdab9a8fe99888f000626a6a6bef49
79b2b90751541cd1999c195131bb161a05093fc81a7330697d1ff576c8b8e80ffb559ba8484fc81e428d667f923a7b7a30fb5b2556074316d35cc69bf3100044af5365fb0203010001
==========
value:3.0
==========
time:2025-06-06 10:36:39.923717
==========
==========
Number of blocks in the chain:1
block #0
sender:LDS
==========
recipient:30819f300d06092a864886f70d0101010500038180003081890281810100f3f58e3950bf07934149de06e06490907876fd21c9fb8228ffe5f6b5742d969b4ab38dc9b5c93bf576092a42e7cdab9a8fe99888f000626a6a6bef49
79b2b90751541cd1999c195131bb161a05093fc81a7330697d1ff576c8b8e80ffb559ba8484fc81e428d667f923a7b7a30fb5b2556074316d35cc69bf3100044af5365fb0203010001
==========
value:500.0
==========
time:2025-06-06 10:36:40.788674
==========
```

Practical 2

A. Write a python program to demonstrate mining.

```
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) + " iterations found nonce: "+ digest)
      return digest
mine ("welcome", 2)
```

```
>>>
========== RESTART: C:/WORK/MSC IT/blockchain/new2a.py ==========
after 258 iterations found nonce: 11ad95a2996e2c26c523bc7b298dd0de8ee83513b167943e5d07bce55e0767f9
```

B. Demonstrate the use of the Bitcoin Core API to interact with a Bitcoin Core node.

C. Demonstrating the process of running a blockchain node on your local machine.

What Is A Full Node?

A full node is a program that fully validates transactions and blocks. Almost all full nodes also help the network by accepting transactions and blocks from other full nodes, validating those transactions and blocks, and then relaying them to further full nodes. Most full nodes also serve lightweight clients by allowing them to transmit their transactions to the network and by notifying them when a transaction affects their wallet. If not enough nodes perform this function, clients won't be able to connect through the peer-to-peer network—they'll have to use centralized services instead.

Many people and organizations volunteer to run full nodes using spare computing and bandwidth resources—but more volunteers are needed to allow Bitcoin to continue to grow. This document describes how you can help and what helping will cost you.

Costs And Warnings

Running a Bitcoin full node comes with certain costs and can expose you to certain risks. This section will explain those costs and risks so you can decide whether you're able to help the network.

Special Cases

Miners, businesses, and privacy-conscious users rely on particular behavior from the full nodes they use, so they will often run their own full nodes and take special safety precautions. This document does not cover those precautions—it only describes running a full node to help support the Bitcoin network in general.

Please seek out assistance in the community if you need help setting up your full node correctly to handle high-value and privacy-sensitive tasks. Do your own diligence to ensure who you get help from is ethical, reputable and qualified to assist you.

Secure Your Wallet

It's possible and safe to run a full node to support the network and use its wallet to store your bitcoins, but you must take the same precautions you would when using any Bitcoin wallet. Please see the securing your wallet page for more information.

Minimum Requirements

Bitcoin Core full nodes have certain requirements. If you try running a node on weak hardware, it may work—but you'll likely spend more time dealing with issues. If you can meet the following requirements, you'll have an easy-to-use node.

- Desktop or laptop hardware running recent versions of Windows, Mac OS X, or Linux.
- 7 gigabytes of free disk space, accessible at a minimum read/write speed of 100 MB/s.
- 2 gigabytes of memory (RAM)
- A broadband Internet connection with upload speeds of at least 400 kilobits (50 kilobytes) per second
- An unmetered connection, a connection with high upload limits, or a connection you regularly monitor to ensure it doesn't exceed its upload limits. It's common for full nodes on high-speed connections to use 200 gigabytes upload or more a month. Download usage is around 20 gigabytes a month, plus around an additional 340 gigabytes the first time you start your node.
- 6 hours a day that your full node can be left running. (You can do other things with your computer while running a full node.) More hours would be better, and best of all would be if you can run your node continuously.

Possible Problems

- **Legal:** Bitcoin use is prohibited or restricted in some areas.
- **Bandwidth limits**: Some Internet plans will charge an additional amount for any excess upload bandwidth used that isn't included in the plan. Worse, some providers may terminate your connection without warning because of overuse. We advise that you check whether your Internet connection is subjected to such limitations and monitor your bandwidth use so that you can stop Bitcoin Core before you reach your upload limit.
- **Anti-virus:** Several people have placed parts of known computer viruses in the Bitcoin block chain. This block chain data can't infect your computer, but some anti-virus programs quarantine the data anyway, making it more difficult to run Bitcoin Core. This problem mostly affects computers running Windows.
- **Attack target:** Bitcoin Core powers the Bitcoin peer-to-peer network, so people who want to disrupt the network may attack Bitcoin Core users in ways that will affect other things you do with your computer, such as an attack that limits your available download bandwidth.

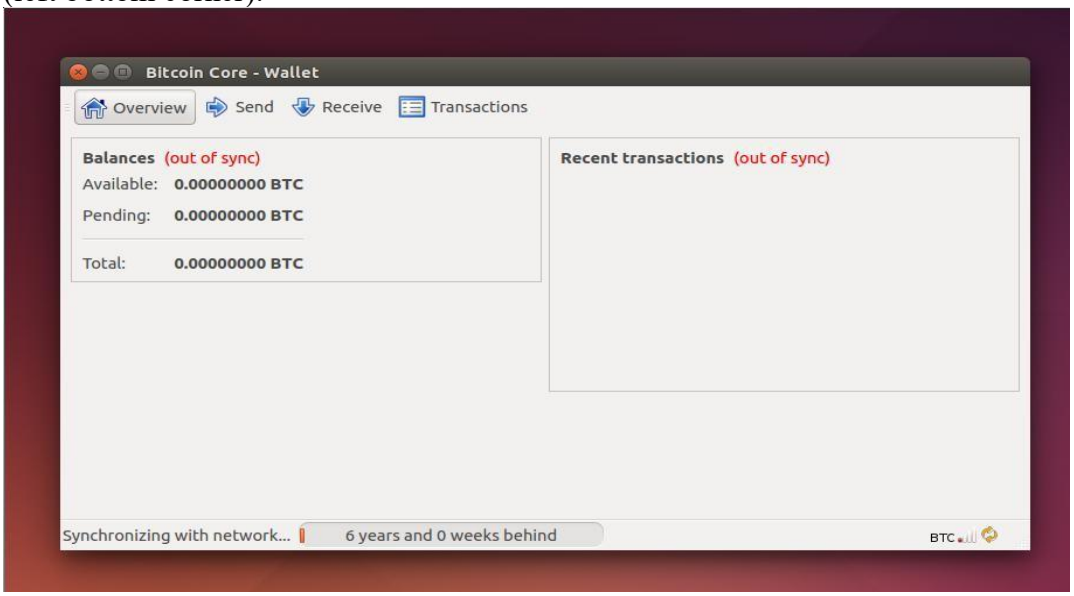
Initial Block Download(IBD)

Initial block download refers to the process where nodes synchronize themselves to the network by downloading blocks that are new to them. This will happen when a node is far behind the tip of the best block chain. In the process of IBD, a node does not accept incoming transactions nor request mempool transactions.

If you are trying to set up a new node following the instructions below, you will go through the IBD process at the first run, and it may take a considerable amount of time since a new node has to download the entire block chain (which is roughly 340 gigabytes now). During the download, there could be a high usage for the network and CPU (since the node has to verify the blocks downloaded), and the client will take up an increasing amount of storage space (reduce storage provides more details on reducing storage).

Before the node finishes IBD, you will not be able to see a new transaction related to your account until the client has caught up to the block containing that transaction. So your wallet may not count new payments/spendings into the balance.

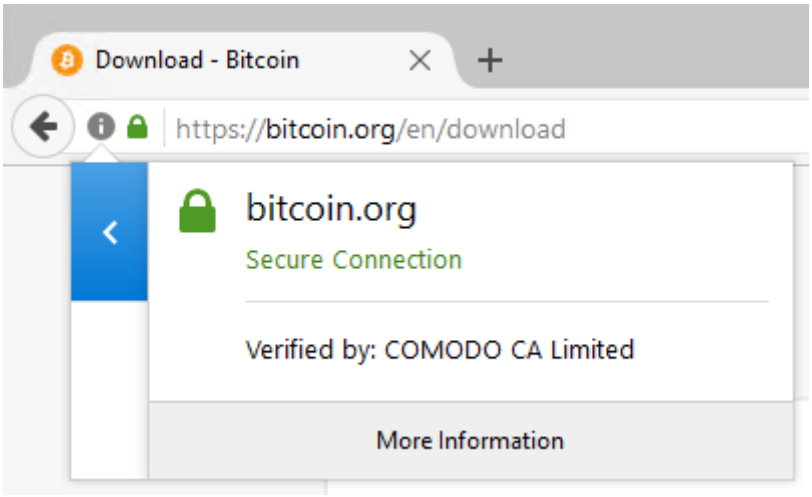
If you are using Bitcoin Core GUI, you can monitor the progress of IBD in the status bar (left bottom corner).



Windows Instructions

Windows 10

Go to the Bitcoin Core download page and verify you have made a secure connection to the server.



Click the large blue *Download Bitcoin Core* button to download the Bitcoin Core installer to your desktop.

If you know how to use PGP, you should also click the *Verify Release Signatures* link on the download page to download a signed list of SHA256 file hashes. The 0.11 and later releases are signed by Wladimir J. van der Laan's releases key with the fingerprint:

01EA 5486 DE18 A882 D4C2 6845 90C8 019E 36C2 E964

Earlier releases were signed by Wladimir J. van der Laan's regular key. That key's fingerprint is:

71A3 B167 3540 5025 D447 E8F2 7481 0B01 2346 C9A6

Even earlier releases were signed by Gavin Andresen's key. His primary key's fingerprint is:

2664 6D99 CBAE C9B8 1982 EF60 29D9 EE6B 1FC7 30C1

You should verify these keys belong to their owners using the web of trust or other trustworthy means. Then use PGP to verify the signature on the release signatures file. Finally, use PGP or another utility to compute the SHA256 hash of the archive you downloaded, and ensure the computed hash matches the hash listed in the verified release signatures file.

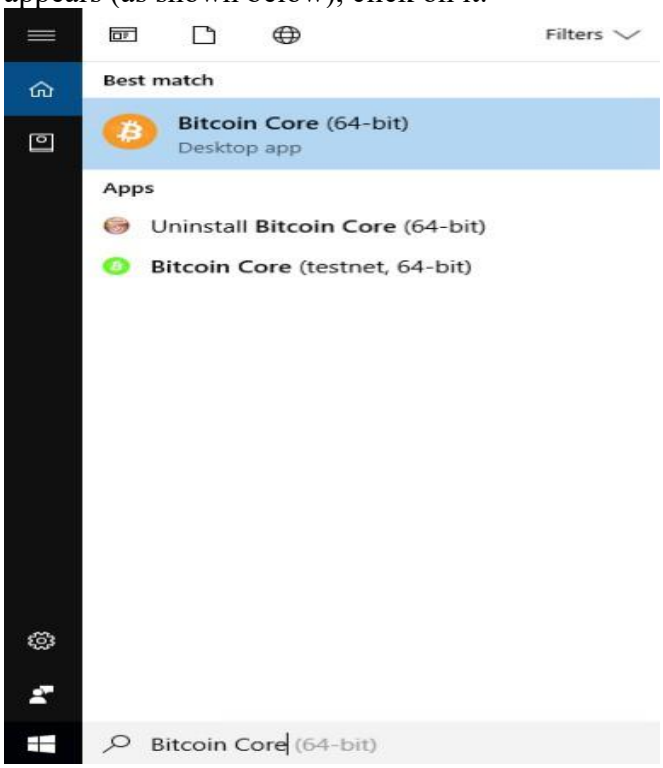
After downloading the file to your desktop or your Downloads folder (C:\Users\<YOUR USER NAME>\Downloads), run it by double-clicking its icon. Windows will ask you to confirm that you want to run it. Click Yes and the Bitcoin installer will start. It's a typical Windows installer, and it will guide you through the decisions you need to make about where to install Bitcoin Core.

To continue, choose one of the following options

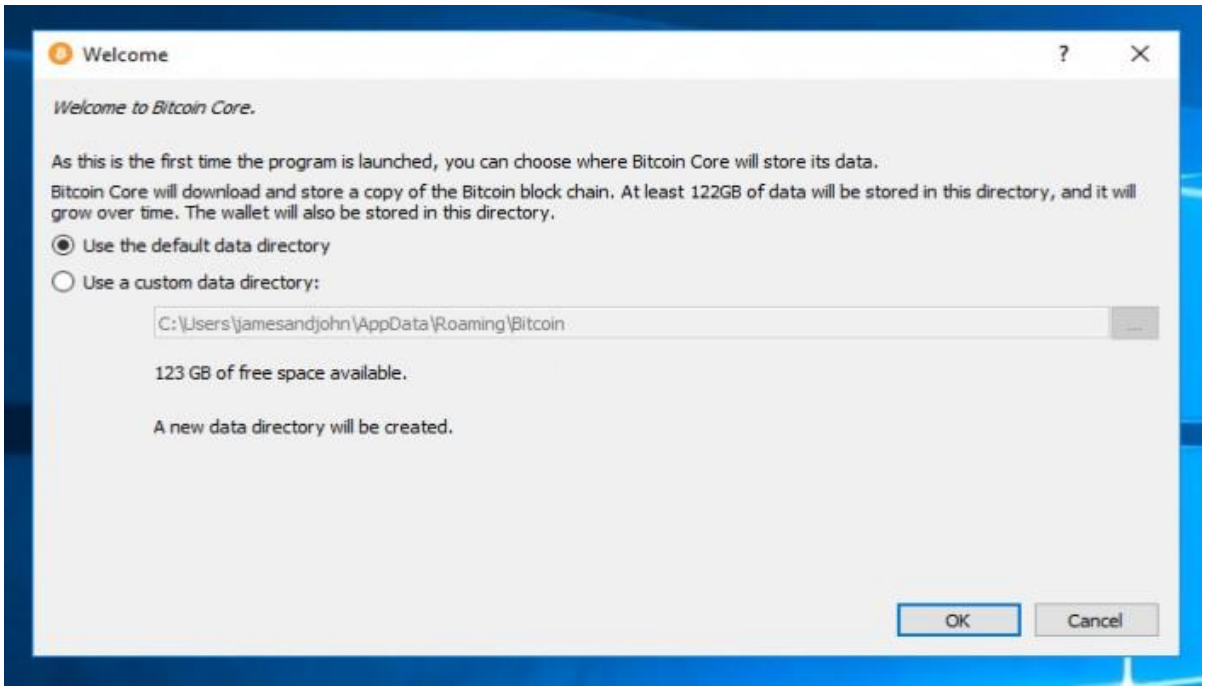
1. If you want to use the Bitcoin Core Graphical User Interface (GUI), proceed to the Bitcoin Core GUI section below.
2. If you want to use the Bitcoin Core daemon (bitcoind), which is useful for programmers and advanced users, proceed to the Bitcoin Core Daemon section below.
3. If you want to use both the GUI and the daemon, read both the GUI instructions and the daemon instructions. Note that you can't run both the GUI and the daemon at the same time using the same configuration directory.

Bitcoin Core GUI

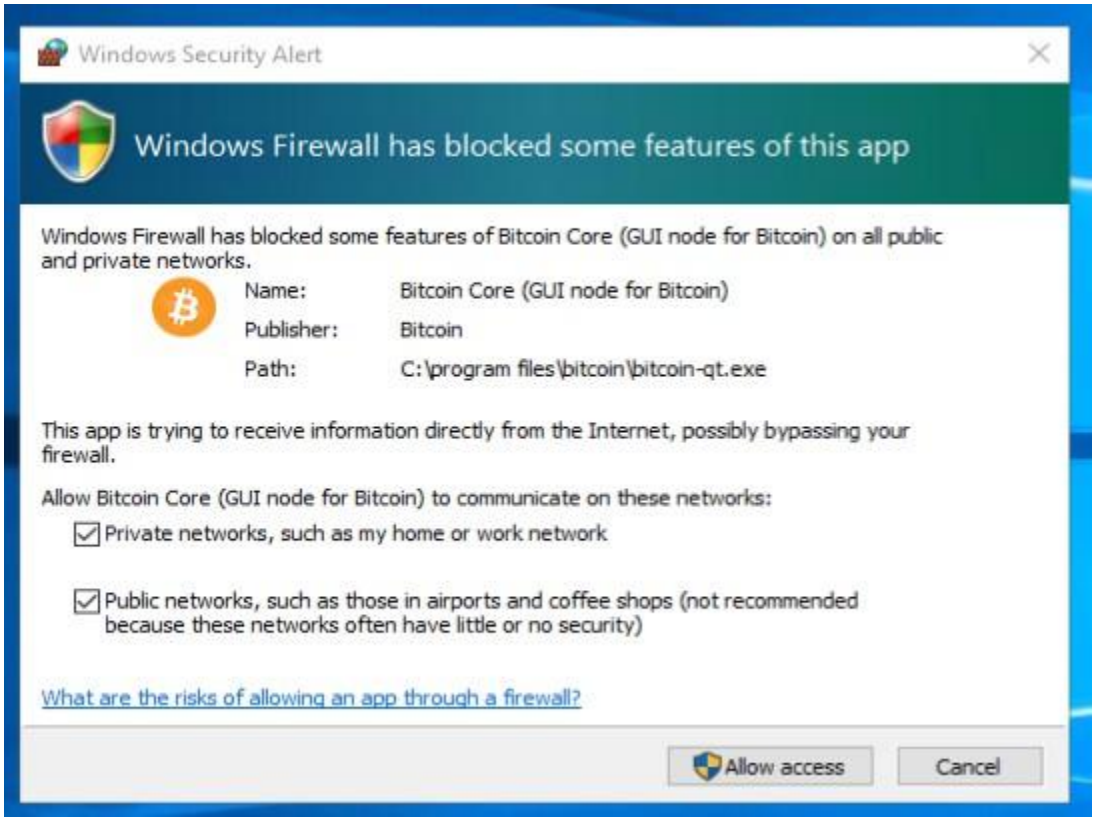
Press the Windows key (⊞ Win) and start typing "bitcoin". When the Bitcoin Core icon appears (as shown below), click on it.



You will be prompted to choose a directory to store the Bitcoin block chain and your wallet. Unless you have a separate partition or drive you want to use, click Ok to use the default.

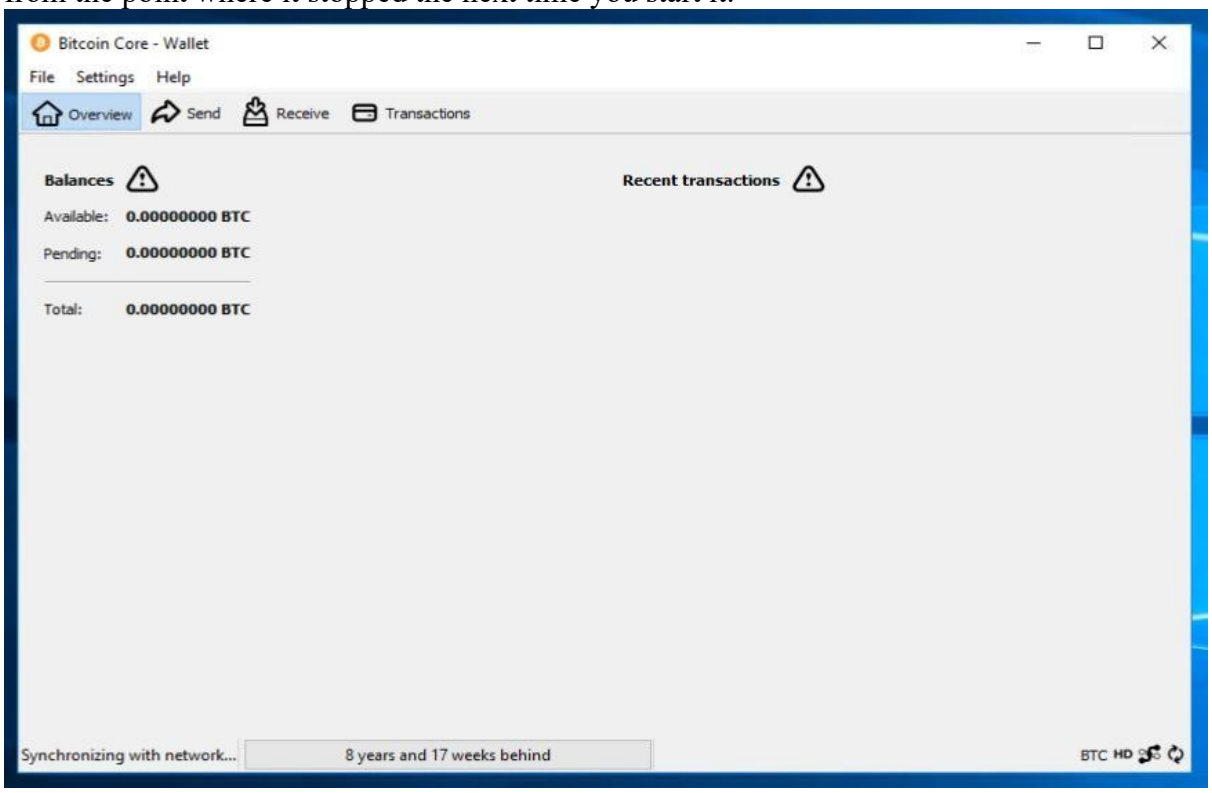


Your firewall may block Bitcoin Core from making outbound connections. It's safe to allow Bitcoin Core to use all networks.



Bitcoin Core GUI will begin to download the block chain. This step will take at least several days, and it may take much more time on a slow Internet connection or with a slow computer. During the download, Bitcoin Core will use a significant part of your

connection bandwidth. You can stop Bitcoin Core at any time by closing it; it will resume from the point where it stopped the next time you start it.

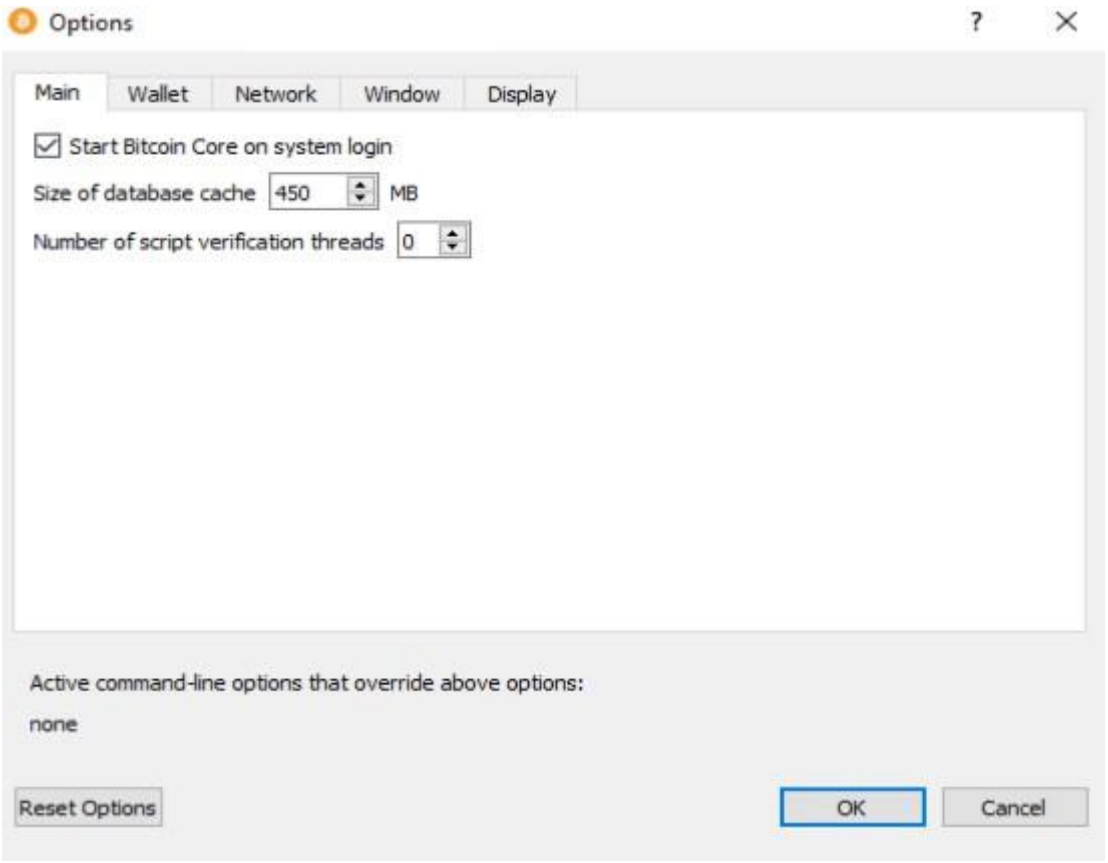


After download is complete, you may use Bitcoin Core as your wallet or you can just let it run to help support the Bitcoin network.

Optional: Start Your Node At Login

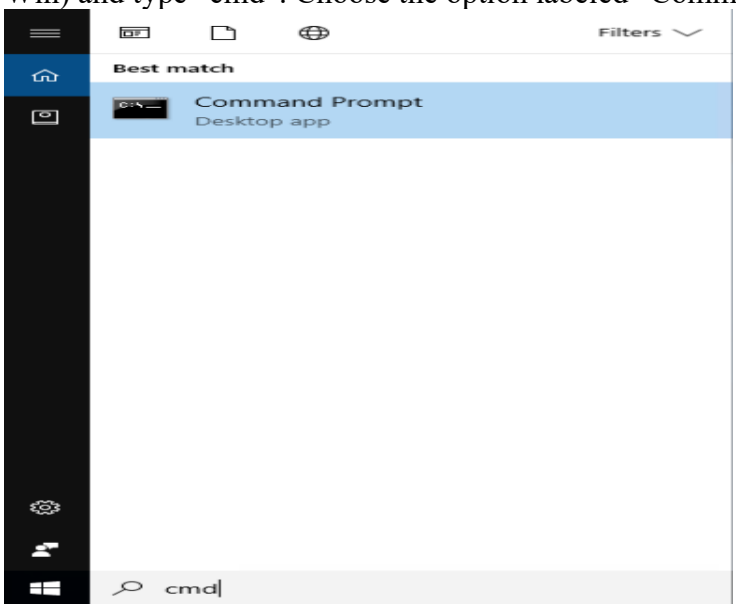
Starting your node automatically each time you login to your computer makes it easy for you to contribute to the network. The easiest way to do this is to tell Bitcoin Core GUI to start at login.

While running Bitcoin Core GUI, open the Settings menu and choose Options. On the Main tab, click *Start Bitcoin on system login*. Click the Ok button to save the new settings.



The next time you login to your desktop, Bitcoin Core GUI will be automatically started minimized in the task bar.

To start Bitcoin Core daemon, first open a command window: press the Windows key (⊞ Win) and type “cmd”. Choose the option labeled “Command Prompt”.



If you installed Bitcoin Core into the default directory, type the following at the command prompt:

C:\Program Files\Bitcoin\daemon\bitcoind

Bitcoin Core daemon should start. To interact with Bitcoin Core daemon, you will use the command bitcoin-cli (Bitcoin command line interface). If you installed Bitcoin Core into the default location, type the following at the command prompt to see whether it works:

C:\Program Files\Bitcoin\daemon\bitcoin-cli getblockchaininfo
Note: it may take up to several minutes for Bitcoin Core to start, during which it will display the following message whenever you use bitcoin-cli:
error: {"code":-28,"message":"Verifying blocks..."}
After it starts, you may find the following commands useful for basic interaction with your node: getblockchaininfo, getnetworkinfo, getnettotals, getwalletinfo, stop, and help. For example, to safely stop your node, run the following command:
C:\Program Files\Bitcoin\daemon\bitcoin-cli stop
A complete list of commands is available in the Bitcoin.org developer reference.
When Bitcoin Core daemon first starts, it will begin to download the block chain. This step will take at least several days, and it may take much more time on a slow Internet connection or with a slow computer. During the download, Bitcoin Core will use a significant part of your connection bandwidth. You can stop Bitcoin Core at any time using the stop command; it will resume from the point where it stopped the next time you start it.
Optional: Start Your Node At Boot
Starting your node automatically each time your computer boots makes it easy for you to contribute to the network. The easiest way to do this is to start Bitcoin Core daemon when you login to your computer.
Start File Explorer and go to:
C:\ProgramData\Microsoft\Windows\Start Menu\Programs\StartUp
Right-click on the File Explorer window and choose New → Text file. Name the file start_bitcoind.bat. Then right-click on it and choose Open in Notepad (or whatever editor you prefer). Copy and paste the following line into the file.
C:\Program Files\Bitcoin\daemon\bitcoind
(If you installed Bitcoin Core in a non-default directory, use that directory path instead.)
Save the file. The next time you login to your computer, Bitcoin Core daemon will be automatically started.

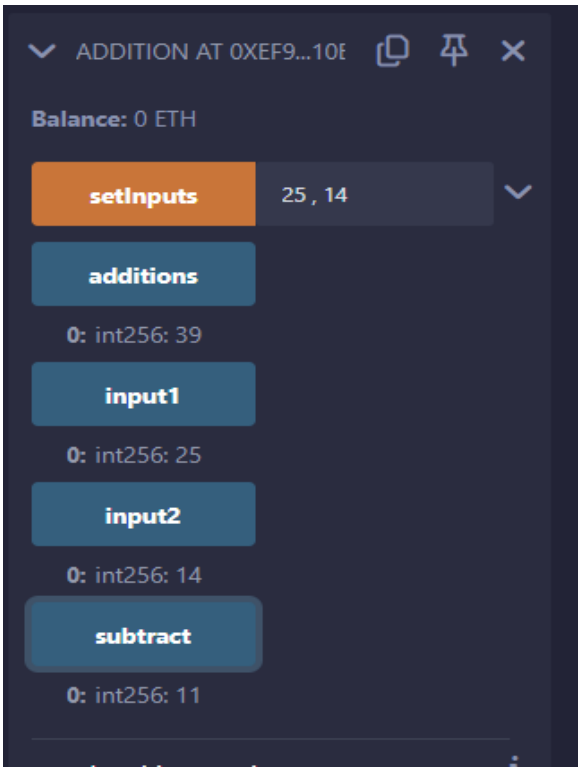
Practical 3

A. Write a Solidity program that demonstrates various types of functions including regular functions, view functions, pure functions, and the fallback function.

- **regular functions**

Code:

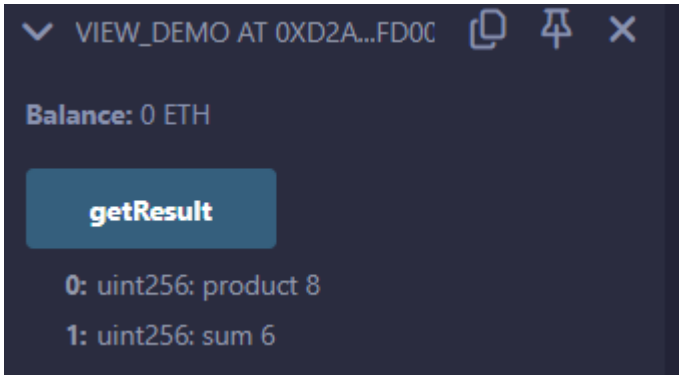
```
pragma solidity ^0.8.17;

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;
   }
}
```



- **view functions**

Code:

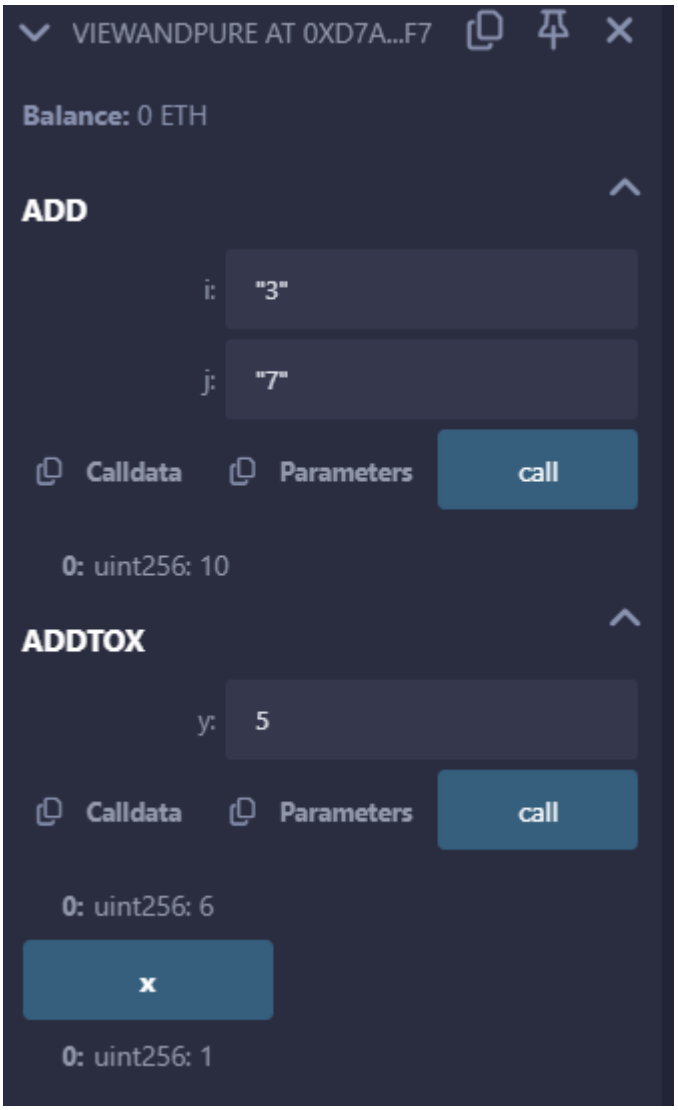
```
pragma solidity ^0.8.0;

contract view_demo
{
   uint256 num1 = 2;
   uint256 num2 = 4;

   function getResult() public view returns (uint256 product, uint256 sum) {
      product = num1 * num2;
      sum = num1 + num2;
   }
}
```



- **view and pure functions**

  Code:

```
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;
   }
}
```



- fallback function
  Code:

```
pragma solidity ^0.8.17;

contract fallbackfn {

    // Event to log details when fallback or receive function is called
    event Log(string func, address sender, uint value, bytes data);

    // Fallback function to handle calls to the contract with data or no matching function
    fallback() external payable {
        emit Log("fallback", msg.sender, msg.value, msg.data); // Emit log with details
    }

    // Receive function to handle plain ether transfers
    receive() external payable {
        emit Log("receive", msg.sender, msg.value, ""); // Emit log with details (msg.data is
empty)
```

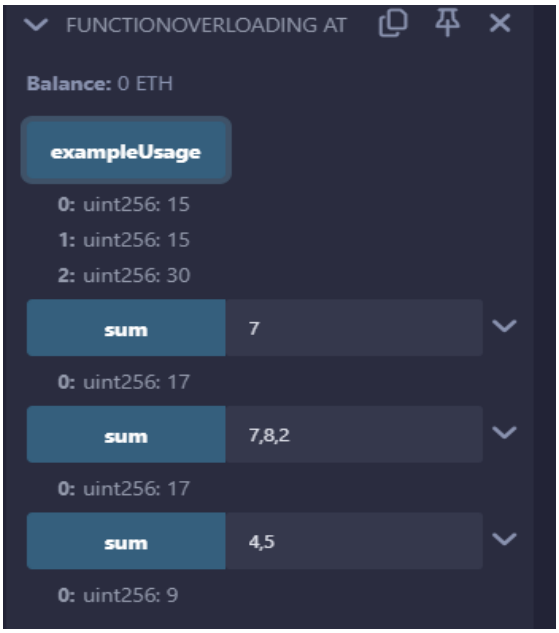
```
        //msg.data is empty hence no need to specify it and mark it as empty string

    }
}
```

B. Write a Solidity program that demonstrates function overloading, mathematical functions, and cryptographic functions.

- function overloading

Code:

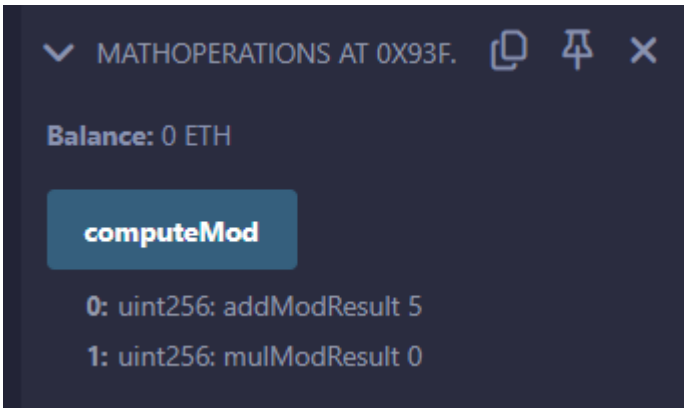
```
pragma solidity ^0.8.17;

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);
    }
}
```



- **mathematical functions**

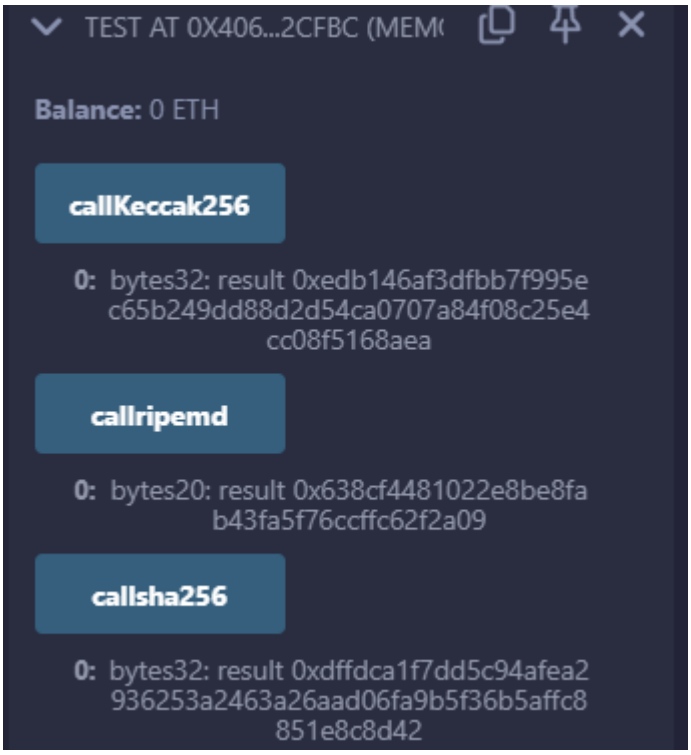
Code:

```
pragma solidity ^0.8.17;

contract MathOperations {
    // addMod computes (x + y) % k
    // mulMod computes (x * y) % k

    // Function to compute modular addition and multiplication
    // @return addModResult: Result of (x + y) % k
    // @return mulModResult: Result of (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); // Compute (x + y) % k
        mulModResult = mulmod(x, y, k); // Compute (x * y) % k
    }
}
```



- **cryptographic functions**
  Code:

```
pragma solidity ^0.8.17;
contract Test{
    function callKeccak256() public pure returns(bytes32 result){
        return keccak256("BLOCKCHAIN");
    }
    function callsha256() public pure returns(bytes32 result){
        return sha256("BLOCKCHAIN");
    }
    function callripemd() public pure returns (bytes20 result){
        return ripemd160("BLOCKCHAIN");
    }
}
```


TEST AT 0X406...2CFBC (MEM
Balance: 0 ETH
callKeccak256
0: bytes32: result 0xedb146af3dfbb7f995ec65b249dd88d2d54ca0707a84f08c25e4cc08f5168aea
callripemd
0: bytes20: result 0x638cf4481022e8be8fab43fa5f76ccffc62f2a09
callsha256
0: bytes32: result 0xdffdca1f7dd5c94afea2936253a2463a26aad06fa9b5f36b5affc8851e8c8d42

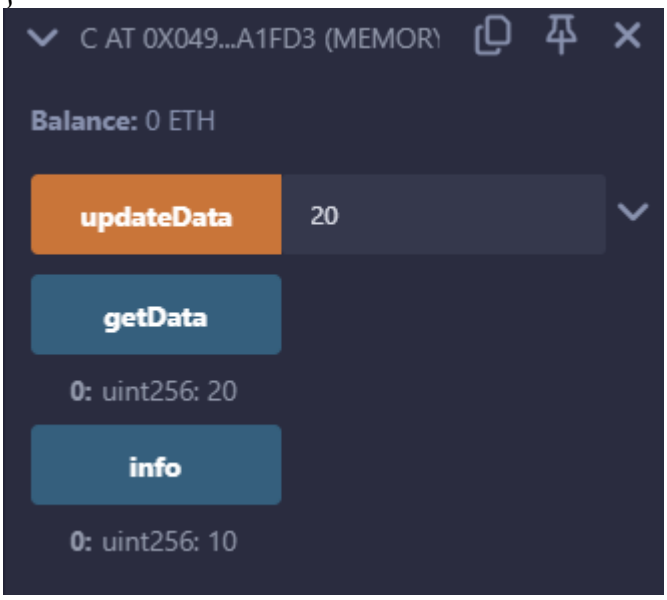
C. Write a Solidity program that demonstrates various features including contracts, inheritance, constructors, abstract contracts, interfaces.

- **Contracts, inheritance**

Code:

```
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()  {
```

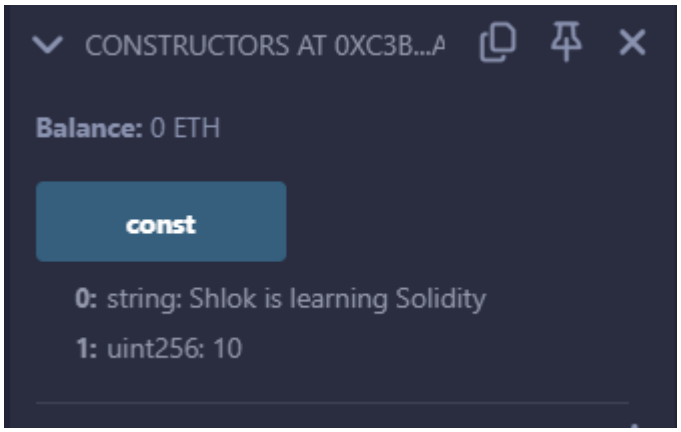
```
        c = new C();
    }

    function getComputedResult() public {
        result = compute(3, 6);
    }

    function getResult() public view returns(uint) {
        return result;
    }
}
```



- **Constructors**

Code:

```
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);

    }

}
```



- **abstract contracts**

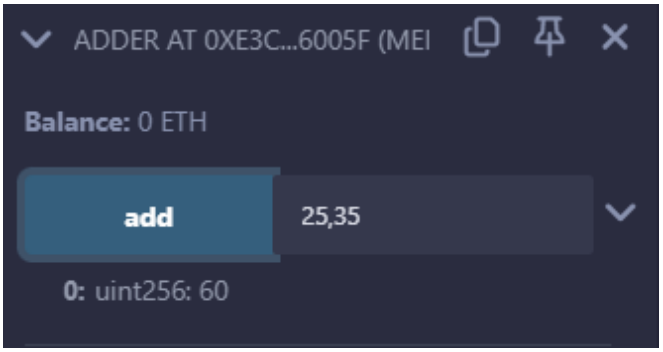
Code:

```
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;
    }
}
```

- **interfaces**

Code:

```
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;
   }
}
```



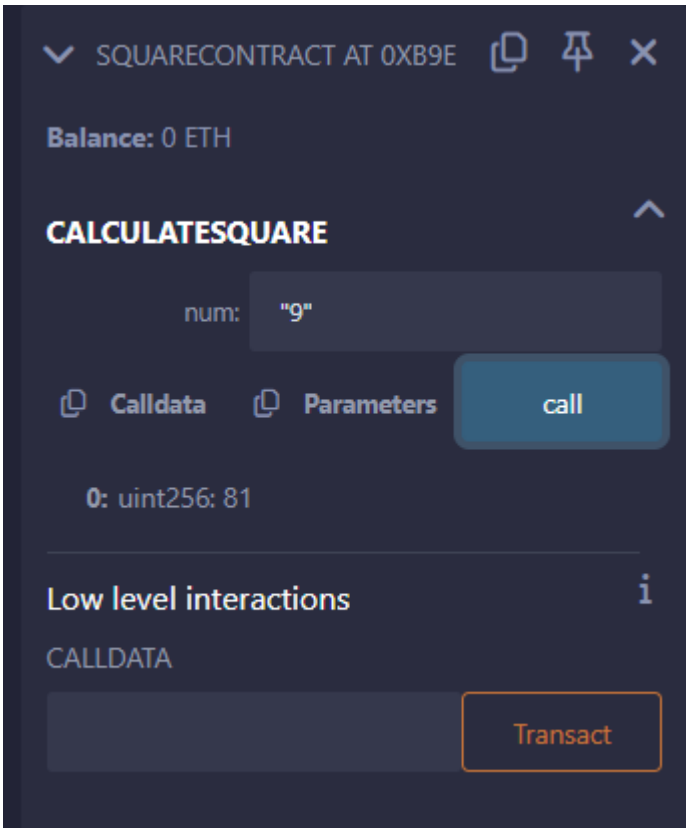
D. Write a Solidity program that demonstrates use of libraries, assembly, events, and error handling.

a. Libraries.

Code:

```
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:

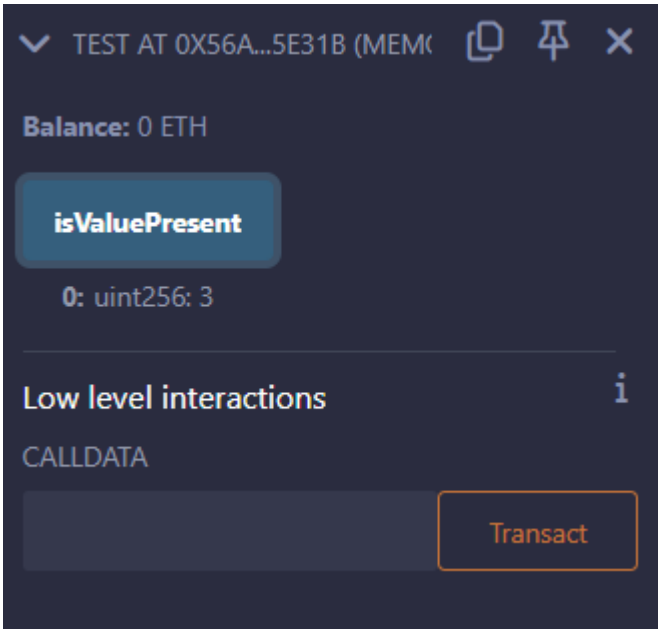


b. Assembly
Code:

```
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:

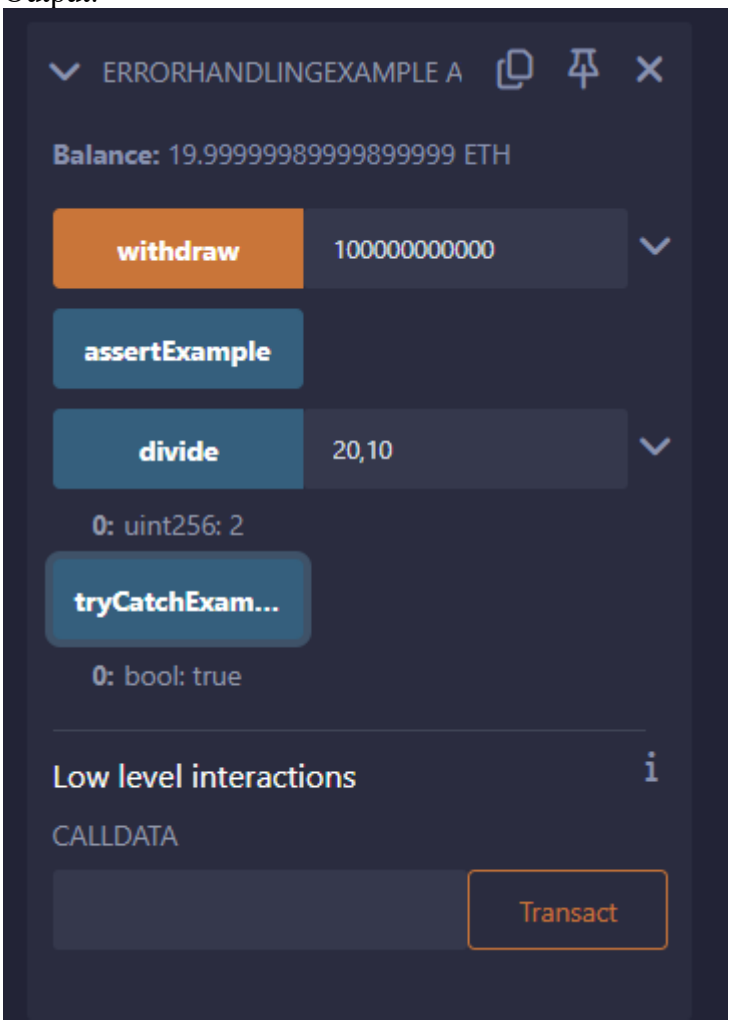


c. Error handling.
Code:

```
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:



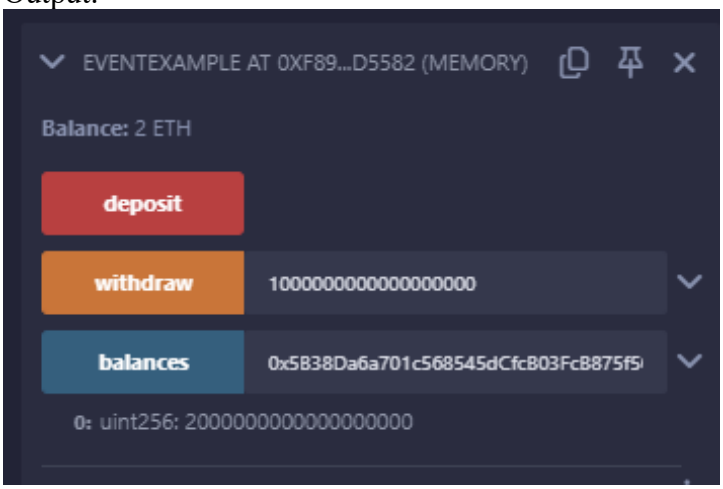
d. Events.

Code:

```
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:



Practical 4

Aim: Install and demonstrate use of hyperledger-Irhoa.

Hyperledger is an open source collaborative effort created to advance blockchain technologies. The Hyperledger organization has a number of projects (10 right now) for various blockchain solutions, such as smart contract engines, permissioned networks, querying for information inside a ledger, etc.

Iroha is a blockchain platform implementation meant for the simple modeling of financial transactions. So basically, if you have some asset with a quantity (maybe 100 forks and 200 spoons), you can easily model that on the blockchain, transfer those assets, see how many of those assets a certain person has, etc. Of course, this can be easily extended for various assets and quantities.

Iroha Terminology and Concepts

There are a few terms we need to know to get a good grasp on Iroha.
To begin learning the terms and concepts, we'll setup an example scenario, which we're going to model on the blockchain.
We own a farm, named "srcmakeFarm". We have some sheep, corn, a barn, and some other farm stuff on our land. We also have a few workers on our farm.
With that in mind, let's see the Iroha terminology that we need to model our farm.

1. **Asset** - Any countable commodity or value. It could be currency, like $US dollars$, Euros, bitcoins. It could be sheep, corn, windows. It can be anything that can be counted. We could have an asset named "sheep" on our blockchain.
2. **Account** - An entity that's able to perform a specified set of actions. For example, maybe one of our farmboys who feed the sheep has an account on our blockchain.
3. **Domain** - Assets and accounts are labeled by a domain, which is just a way of grouping them. For example, we could have a domain named "srcmakeFarm" that our "sheep" assets and "farmboy" account belong too.
4. **Permission** - Does an account have the privilege do perform a certain command? For example, to transfer sheeps from "srcmakeFarm" to another might require the "can_transfer" permission.
5. **Role** - A group of permissions. Perhaps we want the farmboy to be able to view how many sheep we have, but not be able to transfer the sheep to anyone else. In that case, we'd create a role for the farmboy with to view our asset count, but not to transfer them.
6. **Transaction** - A set of commands that are applied to the ledger. For example: 1) Add 20 "sheep" assets and 2) Remove 40 "sheep food" assets, could be some commands that form a transaction.
7. **Query** - Checking the state of data in the system. For example, a query to check how much sheep food "srcmakeFarm" currently has is valid.

Creating An Iroha Network

We're going to create a basic Iroha network.
Any Unix style terminal will work, but I've personally used Linux (Ubuntu 16.04).
The commands to install Docker on Ubuntu from the terminal are:

```
sudo apt-get install curl
curl -fsSL https://download.docker.com/linux/ubuntu/gpg | sudo apt-key add -
sudo add-apt-repository "deb [arch=amd64] https://download.docker.com/linux/ubuntu $(lsb_relea
sudo apt-get update
apt-cache policy docker-ce
sudo apt-get install -y docker-ce
```

Next, we need to create a docker network. We'll name it "srcmake-iroha-network".

```
sudo docker network create srcmake-iroha-network
```

Next, we're going to add PostgreSQL to our network.

```
sudo docker run --name some-postgres \
-e POSTGRES_USER=postgres \
-e POSTGRES_PASSWORD=mysecretpassword \
-p 5432:5432 \
--network=srcmake-iroha-network \
-d postgres:9.5
```

Next, we'll create a volume of persistant storage named "blockstore" to store the blocks for our blockchain.

```
sudo docker volume create blockstore
```

Now, we need to configure Iroha on the network. Download the Iroha code from github. (And install git if you don't already have it.)

```
sudo apt-get install git
git clone -b develop https://github.com/hyperledger/iroh
```

We're going to use the Iroha configuration that's been prepared as an example to run the Iroha docker container.

```
sudo docker run -it --name iroha \
-p 50051:50051 \
-v $(pwd)/iroha/example:/opt/iroha_data \
-v blockstore:/tmp/block_store \
--network=srcmake-iroha-network \
--entrypoint=/bin/bash \
hyperledger/iroha:x86_64-develop-latest
```

Now we're going to actually run Iroha.

```
irohad --config config.docker --genesis_block genesis.bl
```

And now our Iroha blockchain is running in our terminal, so don't close it!

Interacting with our Iroha Network

So we have our Iroha network running, so let's make some transactions. If you look at the code for our genesis block, you can see that some commands were invoked to help get us started, so we're going to use those.

To interact with Iroha, we're going to use the command line tool.

```
sudo apt-get install curl
curl -fsSL https://download.docker.com/linux/ubuntu/gpg | sudo apt-key add -
sudo add-apt-repository "deb [arch=amd64] https://download.docker.com/linux/ubuntu $(lsb_relea
sudo apt-get update
apt-cache policy docker-ce
sudo apt-get install -y docker-ce
```

Next, we need to create a docker network. We'll name it "srcmake-iroha-network".

```
sudo docker network create srcmake-iroha-network
```

Next, we're going to add PostgreSQL to our network.

```
sudo docker run --name some-postgres \
-e POSTGRES_USER=postgres \
-e POSTGRES_PASSWORD=mysecretpassword \
-p 5432:5432 \
--network=srcmake-iroha-network \
-d postgres:9.5
```

Next, we'll create a volume of persistant storage named "blockstore" to store the blocks for our blockchain.

```
sudo docker volume create blockstore
```

Now, we need to configure Iroha on the network. Download the Iroha code from github. (And install git if you don't already have it.)

```
sudo apt-get install git
git clone -b develop https://github.com/hyperledger/iroh
```

We're going to use the Iroha configuration that's been prepared as an example to run the Iroha docker container.

```
sudo docker run -it --name iroha \
-p 50051:50051 \
-v $(pwd)/iroha/example:/opt/iroha_data \
-v blockstore:/tmp/block_store \
--network=srcmake-iroha-network \
--entrypoint=/bin/bash \
hyperledger/iroha:x86_64-develop-latest
```

Now we're going to actually run Iroha.

```
irohad --config config.docker --genesis_block genesis.bl
```

And now our Iroha blockchain is running in our terminal, so don't close it!

Interacting with our Iroha Network

So we have our Iroha network running, so let's make some transactions. If you look at the code for our genesis block, you can see that some commands were invoked to help get us started, so we're going to use those.

To interact with Iroha, we're going to use the command line tool.

Open a new terminal (don't close the one with our Iroha network!) and attach the docker container to our terminal.

```
sudo docker exec -it iroha /bin/bash
```

We should be inside the docker container's shell. Launch the iroha-cli tool and login as admin@test.

```
iroha-cli -account_name admin@test
```

```
root@f33e705c9721:/opt/iroha_data# iroha-cli -account_name admin@test
Welcome to Iroha-Cli.
Choose what to do:
1. New transaction (tx)
2. New query (qry)
3. New transaction status request (st)
> :
```

Type 1 and press enter to start a new transaction.

```
1
```

```
> : 1
Forming a new transactions, choose command to add:
1. Detach role from account (detach)
2. Add new role to account (apnd_role)
3. Create new role (crt_role)
4. Set account key/value detail (set_acc_kv)
5. Transfer Assets (tran_ast)
6. Grant permission over your account (grant_perm)
7. Subtract Assets Quantity from Account (sub_ast_qty)
8. Set Account Quorum (set_qrm)
9. Remove Signatory (rem_sign)
10. Create Domain (crt_dmn)
11. Revoke permission from account (revoke_perm)
12. Create Account (crt_acc)
13. Add Signatory to Account (add_sign)
14. Create Asset (crt_ast)
15. Add Peer to Iroha Network (add_peer)
16. Add Asset Quantity (add_ast_qty)
0. Back (b)
> :
```

There are a lot of commands that we can do. Let's try to model our farm a bit. Let's first create the domain.
Type 10 and create an domain with the id "srcmakeFarm". The default role name is role (list of permissions) the domain has, and we'll give it a "user" role that was created for us as part of this example.

```
10
srcmakeFarm
user
```

```
> : 10
Domain Id: srcmakeFarm
Default Role name: user
Command is formed. Choose what to do:
1. Add one more command to the transaction (add)
2. Send to Iroha peer (send)
3. Go back and start a new transaction (b)
4. Save as json file (save)
> : 1
```

Next, let's add some sheep to our farm. Type 1 to add one more command to the transaction. Then type 14 to create the sheep asset. It belongs to the domain srcmakeFarm, and the precision is 0 (meaning we don't allow decimals. Sheeps only come in whole numbers.)

```
1
14
sheep
srcmakeFarm
0
2
```

```
> : 14
Asset name: sheep
Domain Id: srcmakeFarm
Asset precision: 0
Command is formed. Choose what to do:
1. Add one more command to the transaction (add)
2. Send to Iroha peer (send)
3. Go back and start a new transaction (b)
4. Save as json file (save)
> : 2
```

Our farm looks pretty good, so let's send this to Iroha peer (the network) by typing 2. The peer address is "localhost" and it's on port "50051".

```
localhost
50051
```

```
> : 2
Peer address (0.0.0.0): localhost
Peer port (50051): 50051
[2018-04-25 03:53:24.674649529][th:41][info] TransactionResponseHandler Transact
ion successfully sent
Congratulation, your transaction was accepted for processing.
Its hash is 0fc3abceb23dce55f6756ccea788f81b47d0b96d7abb7a81984ae9f1c9154b33
--------------------
Choose what to do:
1. New transaction (tx)
2. New query (qry)
3. New transaction status request (st)
> :
```

```
root@a645aef9ea62: /opt/iroha_data
[2018-04-25 03:53:24.666927875][th:57][info] TxProcessor handle transaction
[2018-04-25 03:53:24.666985842][th:57][info] PCS propagate tx
[2018-04-25 03:53:24.667006281][th:57][info] OrderingGate propagate tx, account_
id:  account_id: admin@test
[2018-04-25 03:53:24.667025256][th:57][info] OrderingGate Propagate tx (on trans
port)
[2018-04-25 03:53:24.673036508][th:20][info] OrderingServiceTransportGrpc Orderi
ngServiceTransportGrpc::onTransaction
[2018-04-25 03:53:24.673704479][th:20][info] OrderingServiceImpl Queue size is 1
[2018-04-25 03:53:28.465926418][th:191][info] OrderingServiceImpl Start proposal
```

You can see we get a hash for the transaction, and back in our Iroha network terminal, stuff happens (because we pushed a transaction onto the blockchain). so we have our srcmakeFarm and created an asset named sheep. Let's add 50 sheep (and give it to admin@test since we haven't made our own account).

Type 1 to make another transaction. Type 16 to add some quantity to an asset. The account is "admin@test", the asset is "sheep#srcmakeFarm" (notice the #domain), there are 50 sheep, and the precision is 0. Type 2 and send it to the localhost at 50051.

```
1
16
admin@test
sheep#srcmakeFarm
50
0
2
localhost
50051
```

```
> : 16
Account Id: admin@test
Asset Id: sheep#srcmakeFarm
Amount to add (integer part): 50
Amount to add (precision): 0
50 0
Command is formed. Choose what to do:
1. Add one more command to the transaction (add)
2. Send to Iroha peer (send)
3. Go back and start a new transaction (b)
4. Save as json file (save)
> : 2
Peer address (0.0.0.0): localhost
Peer port (50051): 50051
[2018-04-25 04:03:08.653226959][th:41][info] TransactionResponseHandler Transact
ion successfully sent
Congratulation, your transaction was accepted for processing.
Its hash is 2ddd8a4fd0af0507572a2b3fb8b0682ce5f01f775cfbf70c69d6cf101437be0b
--------------------
Choose what to do:
1. New transaction (tx)
2. New query (qry)
3. New transaction status request (st)
> :
```

Making A Query
Let's check how many sheep we have. Type 2 to make a new query this time.

```
2
```

```
Choose what to do:
1. New transaction (tx)
2. New query (qry)
3. New transaction status request (st)
> : 2
Choose query:
1. Get all permissions related to role (get_role_perm)
2. Get Transactions by transactions' hashes (get_tx)
3. Get information about asset (get_ast_info)
4. Get Account's Transactions (get_acc_tx)
5. Get all current roles in the system (get_roles)
6. Get Account's Signatories (get_acc_sign)
7. Get Account's Assets (get_acc_ast)
8. Get Account Information (get_acc)
0. Back (b)
> :
```

There are lots of query types. We're going to query a particular account's assets, so type 7.

The account that owns the sheep is "admin@test", the asset we need is "sheep#srcmakeFarm". Send the query request to "localhost" at port "50051".

```
7
admin@test
sheep#srcmakeFarm
1
localhost
50051
```

```
> : 7
Requested account Id: admin@test
Requested asset Id: sheep#srcmakeFarm
Query is formed. Choose what to do:
1. Send to Iroha peer (send)
2. Save as json file (save)
0. Back (b)
> : 1
Peer address (0.0.0.0): localhost
Peer port (50051): 50051
[2018-04-25 04:16:12.946124963][th:41][info] QueryResponseHandler [Account Assets]
[2018-04-25 04:16:12.946210132][th:41][info] QueryResponseHandler -Account Id:- admin@test
[2018-04-25 04:16:12.946229238][th:41][info] QueryResponseHandler -Asset Id- sheep#srcmakeFarm
[2018-04-25 04:16:12.946251209][th:41][info] QueryResponseHandler -Balance- 50
--------------------
```

DEEP LEARNING

Practical 1 : Introduction to TensorFlow

1-a1. Create tensors with different shapes and data types

Code :

```
import tensorflow as tf

# Create a scalar (0-D tensor)
scalar = tf.constant(42)
print("Scalar (0-D Tensor):", scalar)

# Create a vector (1-D tensor)
vector = tf.constant([1.5, 2.5, 3.5], dtype=tf.float32)
print("Vector (1-D Tensor):", vector)

# Create a matrix (2-D tensor)
matrix = tf.constant([[1, 2], [3, 4], [5, 6]], dtype=tf.int32)
print("Matrix (2-D Tensor):", matrix)

# Create a 3-D tensor
tensor_3d = tf.constant([[[1, 2], [3, 4]], [[5, 6], [7, 8]]])
print("3-D Tensor:", tensor_3d)

# Create a tensor of all zeros
zeros_tensor = tf.zeros([2, 3])
print("Zeros Tensor:", zeros_tensor)

# Create a tensor of all ones
ones_tensor = tf.ones([3, 2, 2])
print("Ones Tensor:", ones_tensor)
```

 # Create a tensor with random values

random_tensor = tf.random.normal([2, 2], mean=0, stddev=1)

print("Random Tensor:", random_tensor)

 # Get the shape and data type of a tensor

print("Shape of matrix:", matrix.shape)

print("Data type of vector:", vector.dtype)

Output :

```
Scalar (0-D Tensor): tf.Tensor(42, shape=(), dtype=int32)
Vector (1-D Tensor): tf.Tensor([1.5 2.5 3.5], shape=(3,), dtype=float32)
Matrix (2-D Tensor): tf.Tensor(
[[1 2]
 [3 4]
 [5 6]], shape=(3, 2), dtype=int32)
3-D Tensor: tf.Tensor(
[[[1 2]
  [3 4]]

 [[5 6]
  [7 8]]], shape=(2, 2, 2), dtype=int32)
Zeros Tensor: tf.Tensor(
[[0. 0. 0.]
 [0. 0. 0.]], shape=(2, 3), dtype=float32)
Ones Tensor: tf.Tensor(
[[[1. 1.]
  [1. 1.]]

 [[1. 1.]
  [1. 1.]]

 [[1. 1.]
  [1. 1.]]], shape=(3, 2, 2), dtype=float32)
Random Tensor: tf.Tensor(
[[-1.2160594  0.9616411]
 [-1.099461   0.8020662]], shape=(2, 2), dtype=float32)
Shape of matrix: (3, 2)
Data type of vector: <dtype: 'float32'>
```

1-a2. Perform basic operations like addition, subtraction, multiplication, and division on tensors.

Code :

```
import tensorflow as tf

# Define two tensors
a = tf.constant([3, 6, 9], dtype=tf.int32)
b = tf.constant([2, 4, 6], dtype=tf.int32)

# Perform basic arithmetic operations
addition = tf.add(a, b)
subtraction = tf.subtract(a, b)
multiplication = tf.multiply(a, b)
division = tf.divide(a, b)

# Display the results
print("Tensor A:", a.numpy())
print("Tensor B:", b.numpy())
print("Addition:", addition.numpy())
print("Subtraction:", subtraction.numpy())
print("Multiplication:", multiplication.numpy())
print("Division:", division.numpy())

# More tensor operations
squared = tf.square(a)
sqrt_b = tf.sqrt(tf.cast(b, tf.float32))
dot_product = tf.tensordot(a, b, axes=1)
```

```
print("Squared A:", squared.numpy())
print("Square root of B:", sqrt_b.numpy())
print("Dot product of A and B:", dot_product.numpy())
```

Output :

```
Tensor A: [3 6 9]
Tensor B: [2 4 6]
Addition: [ 5 10 15]
Subtraction: [1 2 3]
Multiplication: [ 6 24 54]
Division: [1.5 1.5 1.5]
Squared A: [ 9 36 81]
Square root of B: [1.4142135 2.        2.4494898]
Dot product of A and B: 84
```

1-a3. Reshape, slice, and index tensors to extract specific elements or sections

Code :

```
import tensorflow as tf

# Create a sample tensor
original_tensor = tf.constant([[1, 2, 3], [4, 5, 6], [7, 8, 9]])
print("Original Tensor:\n", original_tensor.numpy())

# Reshape the tensor
reshaped_tensor = tf.reshape(original_tensor, (1, 9))
print("\nReshaped Tensor (1x9):\n", reshaped_tensor.numpy())

# Slice the tensor (Extract rows 1 and 2, columns 1 and 2)
sliced_tensor = original_tensor[1:3, 1:3]
print("\nSliced Tensor (Rows 1-2, Columns 1-2):\n", sliced_tensor.numpy())

# Indexing (Extract specific elements)
first_element = original_tensor[0, 0]
last_row = original_tensor[-1]
print("\nFirst Element (0,0):", first_element.numpy())
print("Last Row:", last_row.numpy())

# Use tf.gather to extract specific indices
gathered_elements = tf.gather(original_tensor, [0, 2], axis=0)
print("\nGathered Rows 0 and 2:\n", gathered_elements.numpy())

# Use tf.boolean_mask to extract elements with a condition
```

```
masked_elements = tf.boolean_mask(original_tensor, original_tensor > 4)
print("\nElements Greater than 4:\n", masked_elements.numpy())
```

Output :

```
Original Tensor:
 [[1 2 3]
 [4 5 6]
 [7 8 9]]

Reshaped Tensor (1x9):
 [[1 2 3 4 5 6 7 8 9]]

Sliced Tensor (Rows 1-2, Columns 1-2):
 [[5 6]
 [8 9]]

First Element (0,0): 1
Last Row: [7 8 9]

Gathered Rows 0 and 2:
 [[1 2 3]
 [7 8 9]]

Elements Greater than 4:
 [5 6 7 8 9]
```

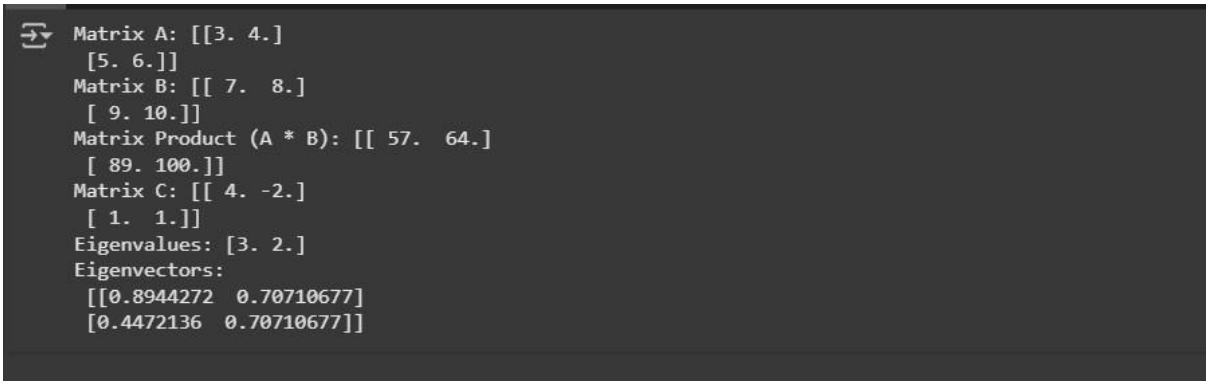
1-a4. Performing matrix multiplication and finding eigenvectors and eigenvalues using TensorFlow

Code :

```
import tensorflow as tf
import numpy as np

# Define two matrices
matrix_a = tf.constant([[3, 4], [5, 6]], dtype=tf.float32)
matrix_b = tf.constant([[7, 8], [9, 10]], dtype=tf.float32)

# Perform matrix multiplication
matrix_product = tf.matmul(matrix_a, matrix_b)

# Display the result of matrix multiplication
print("Matrix A:", matrix_a.numpy())
print("Matrix B:", matrix_b.numpy())
print("Matrix Product (A * B):", matrix_product.numpy())

# Finding eigenvalues and eigenvectors
matrix_c = tf.constant([[4, -2], [1, 1]], dtype=tf.float32)

# Convert TensorFlow tensor to NumPy array for eigenvalue computation
matrix_c_np = matrix_c.numpy()
eigenvalues, eigenvectors = np.linalg.eig(matrix_c_np)

# Display eigenvalues and eigenvectors
print("Matrix C:", matrix_c_np)
print("Eigenvalues:", eigenvalues)
```

print("Eigenvectors:\n", eigenvectors)

Output :



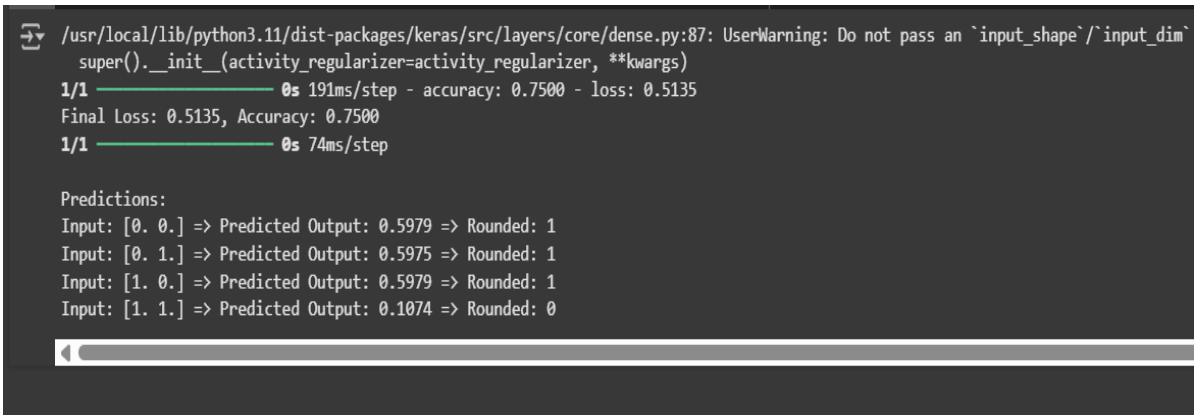
1b. Program to solve the XOR problem

Code :

```
import tensorflow as tf
from tensorflow import keras
from tensorflow.keras import layers
import numpy as np

# Define XOR inputs and outputs
X = np.array([[0, 0], [0, 1], [1, 0], [1, 1]], dtype=np.float32)
y = np.array([[0], [1], [1], [0]], dtype=np.float32)

# Define a simple neural network model
model = keras.Sequential([
    layers.Dense(4, activation='relu', input_shape=(2,)),
    layers.Dense(4, activation='relu'),
    layers.Dense(1, activation='sigmoid')])

# Compile the model
model.compile(optimizer='adam', loss='binary_crossentropy', metrics=['accuracy'])

# Train the model
history = model.fit(X, y, epochs=1000, verbose=0)

# Evaluate the model
loss, accuracy = model.evaluate(X, y)
print(f"Final Loss: {loss:.4f}, Accuracy: {accuracy:.4f}")

# Make predictions
predictions = model.predict(X)
```

```
print("\nPredictions:")
for i, p in enumerate(predictions):
    print(f"Input: {X[i]} => Predicted Output: {p[0]:.4f} => Rounded: {int(np.round(p[0]))}")
```

Output :



Practical 2 : Linear Regression

2-a1. Implement a simple linear regression model using TensorFlow's lowlevel API (or tf. keras).

Code :

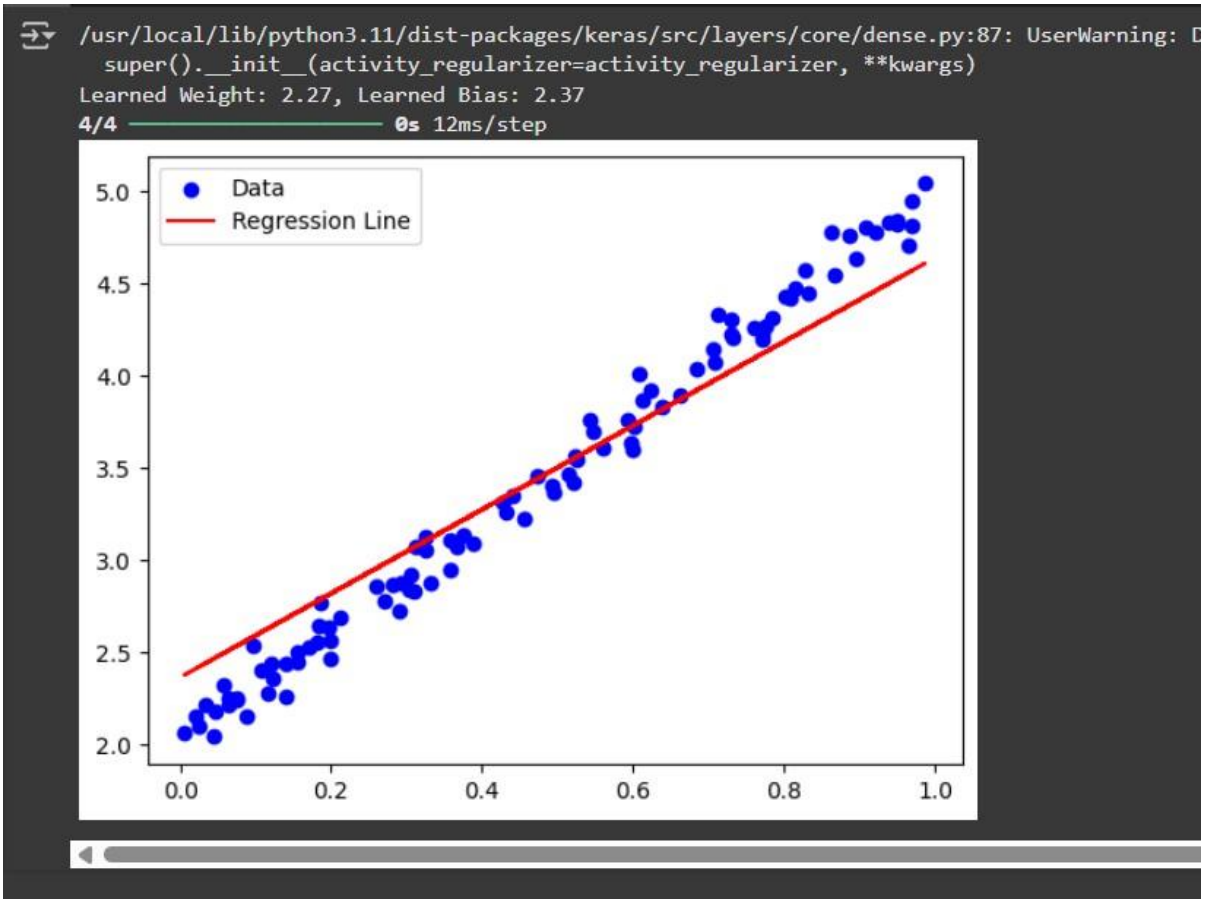
```
import tensorflow as tf
import numpy as np
import matplotlib.pyplot as plt

# Generate synthetic data
np.random.seed(42)
X = np.random.rand(100, 1).astype(np.float32)
y = 3 * X + 2 + np.random.normal(0, 0.1, (100, 1)).astype(np.float32)

# Define a simple linear regression model
model = tf.keras.Sequential([
    tf.keras.layers.Dense(1, input_shape=(1,))])

# Compile the model
model.compile(optimizer='sgd', loss='mse')

# Train the model
history = model.fit(X, y, epochs=200, verbose=0)

# Get the model's weights
W, b = model.layers[0].get_weights()
print(f"Learned Weight: {W[0][0]:.2f}, Learned Bias: {b[0]:.2f}")

# Make predictions
```

```
y_pred = model.predict(X)
```

 # Plot the results

```
plt.scatter(X, y, color='blue', label='Data')
plt.plot(X, y_pred, color='red', label='Regression Line')
plt.legend()
plt.show()
```

Output :



2-a2 Train the model on a toy dataset (e.g., housing prices vs. square footage).

Code :

```
import tensorflow as tf

import numpy as np

import matplotlib.pyplot as plt


# Toy dataset: square footage vs. housing prices

square_feet = np.array([600, 800, 1000, 1200, 1500, 1800, 2000, 2200, 2500],
dtype=np.float32)

prices = np.array([150000, 200000, 250000, 300000, 350000, 400000, 450000, 475000,
500000], dtype=np.float32)


# Reshape data

X = square_feet.reshape(-1, 1)

y = prices.reshape(-1, 1)


# Define a simple linear regression model

model = tf.keras.Sequential([

    tf.keras.layers.Dense(1, input_shape=(1,))])


# Compile the model

model.compile(optimizer='adam', loss='mse')


# Train the model

history = model.fit(X, y, epochs=500, verbose=0)


# Get the model's weights

W, b = model.layers[0].get_weights()
```

```
print(f"Learned Weight: {W[0][0]:.2f}, Learned Bias: {b[0]:.2f}")
```

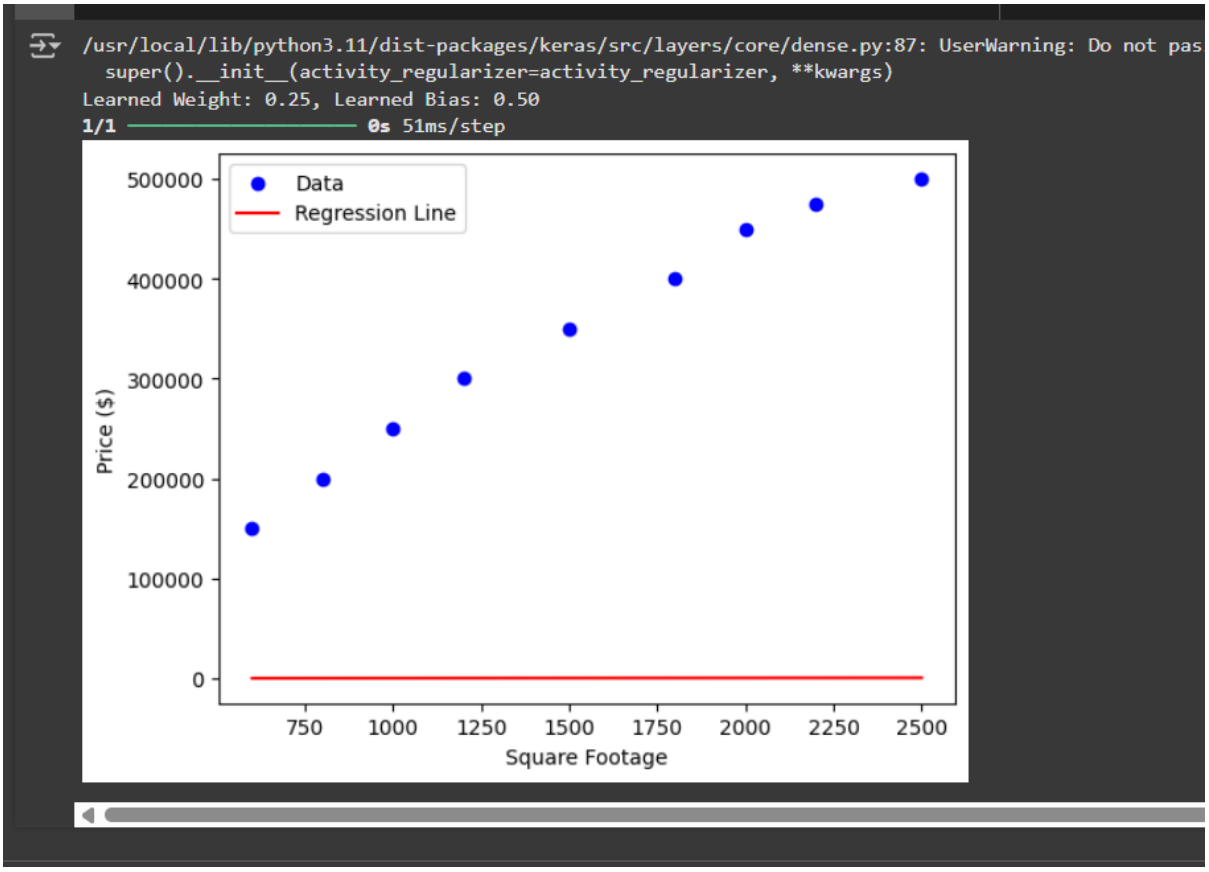
 # Make predictions

```
y_pred = model.predict(X)
```

 # Plot the results

```
plt.scatter(X, y, color='blue', label='Data')
plt.plot(X, y_pred, color='red', label='Regression Line')
plt.xlabel('Square Footage')
plt.ylabel('Price ($)')
plt.legend()
plt.show()
```

Output :



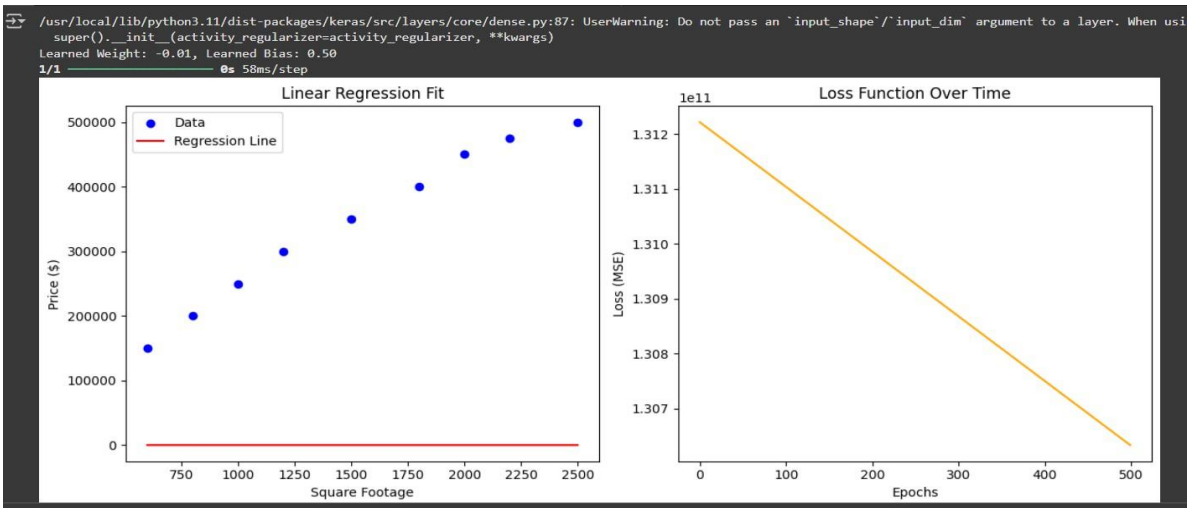
2-a3. Visualize the loss function and the learned linear relationship.

Code :

```
import tensorflow as tf
import numpy as np
import matplotlib.pyplot as plt

# Toy dataset: square footage vs. housing prices
square_feet = np.array([600, 800, 1000, 1200, 1500, 1800, 2000, 2200, 2500], dtype=np.float32)
prices = np.array([150000, 200000, 250000, 300000, 350000, 400000, 450000, 475000, 500000], dtype=np.float32)

# Reshape data
X = square_feet.reshape(-1, 1)
y = prices.reshape(-1, 1)

# Define a simple linear regression model
model = tf.keras.Sequential([
    tf.keras.layers.Dense(1, input_shape=(1,))])

# Compile the model
model.compile(optimizer='adam', loss='mse')
# Train the model
history = model.fit(X, y, epochs=500, verbose=0)

# Get the model's weights
W, b = model.layers[0].get_weights()
print(f"Learned Weight: {W[0][0]:.2f}, Learned Bias: {b[0]:.2f}")

# Make predictions
```

```
y_pred = model.predict(X)
# Plot the results
plt.figure(figsize=(12, 5))

# Plot the data and regression line
plt.subplot(1, 2, 1)
plt.scatter(X, y, color='blue', label='Data')
plt.plot(X, y_pred, color='red', label='Regression Line')
plt.xlabel('Square Footage')
plt.ylabel('Price ($)')
plt.legend()
plt.title('Linear Regression Fit')
# Plot the loss function
plt.subplot(1, 2, 2)
plt.plot(history.history['loss'], color='orange')
plt.xlabel('Epochs')
plt.ylabel('Loss (MSE)')
plt.title('Loss Function Over Time')
plt.tight_layout()
plt.show()
```

Output :



2-a4. Make predictions on new data points

Code :

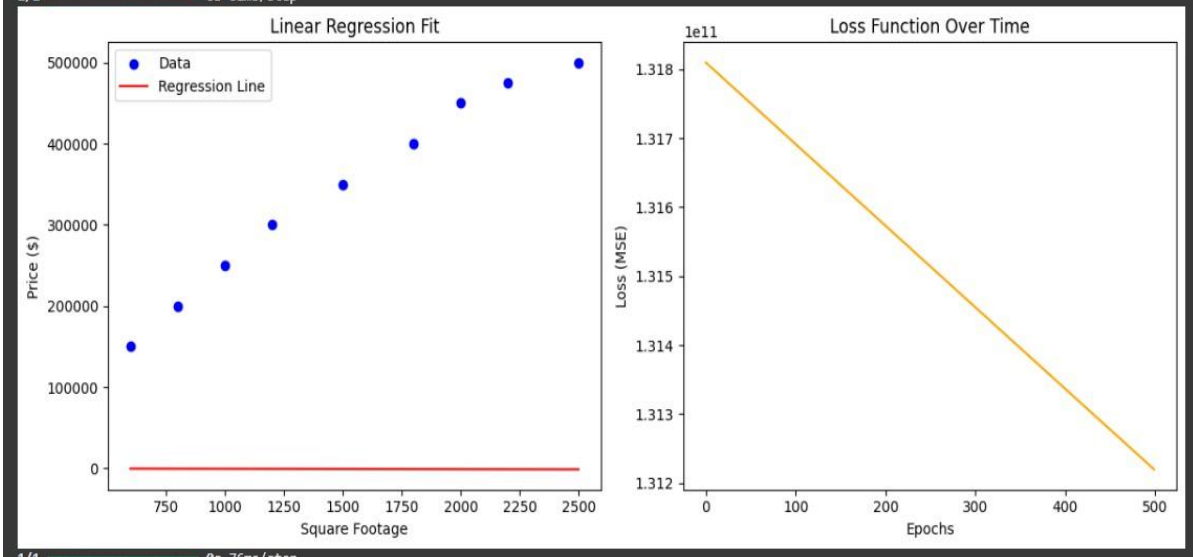
```
import tensorflow as tf

import numpy as np

import matplotlib.pyplot as plt


# Toy dataset: square footage vs. housing prices

square_feet = np.array([600, 800, 1000, 1200, 1500, 1800, 2000, 2200, 2500],
dtype=np.float32)

prices = np.array([150000, 200000, 250000, 300000, 350000, 400000, 450000, 475000,
500000], dtype=np.float32)


# Reshape data

X = square_feet.reshape(-1, 1)

y = prices.reshape(-1, 1)


# Define a simple linear regression model

model = tf.keras.Sequential([

    tf.keras.layers.Dense(1, input_shape=(1,))])


# Compile the model

model.compile(optimizer='adam', loss='mse')


# Train the model

history = model.fit(X, y, epochs=500, verbose=0)


# Get the model's weights

W, b = model.layers[0].get_weights()

print(f"Learned Weight: {W[0][0]:.2f}, Learned Bias: {b[0]:.2f}")
```

```
# Make predictions
y_pred = model.predict(X)

# Visualize the results
plt.figure(figsize=(12, 5))

# Plot the data and regression line
plt.subplot(1, 2, 1)
plt.scatter(X, y, color='blue', label='Data')
plt.plot(X, y_pred, color='red', label='Regression Line')
plt.xlabel('Square Footage')
plt.ylabel('Price ($)')
plt.legend()
plt.title('Linear Regression Fit')

# Plot the loss function
plt.subplot(1, 2, 2)
plt.plot(history.history['loss'], color='orange')
plt.xlabel('Epochs')
plt.ylabel('Loss (MSE)')
plt.title('Loss Function Over Time')
plt.tight_layout()
plt.show()

# Make predictions on new data points
new_data = np.array([[1600], [2100], [3000]], dtype=np.float32)
new_predictions = model.predict(new_data)

print("\nPredictions on New Data:")
for sqft, price in zip(new_data.flatten(), new_predictions.flatten()):
```

```
print(f"Square Footage: {sqft}, Predicted Price: ${price:.2f}")
```

Output :

```
/usr/local/lib/python3.11/dist-packages/keras/src/layers/core/dense.py:87: UserWarning: Do not pass an `input_shape`/`input_dim` argument to a layer. When using Sequ
  super().__init__(activity_regularizer=activity_regularizer, **kwargs)
Learned Weight: -0.50, Learned Bias: 0.50
1/1 ━━━━━━━━━━━━━━━━━━━━ 0s 82ms/step
```




```
1/1 ━━━━━━━━━━━━━━━━━━━━ 0s 76ms/step
```

```
Predictions on New Data:
Square Footage: 1600.0, Predicted Price: $-805.47
Square Footage: 2100.0, Predicted Price: $-1057.33
Square Footage: 3000.0, Predicted Price: $-1510.69
```

Practical 3 : Convolutional Neural Networks (Classification)

3a. Implementing deep neural network for performing binary classification task

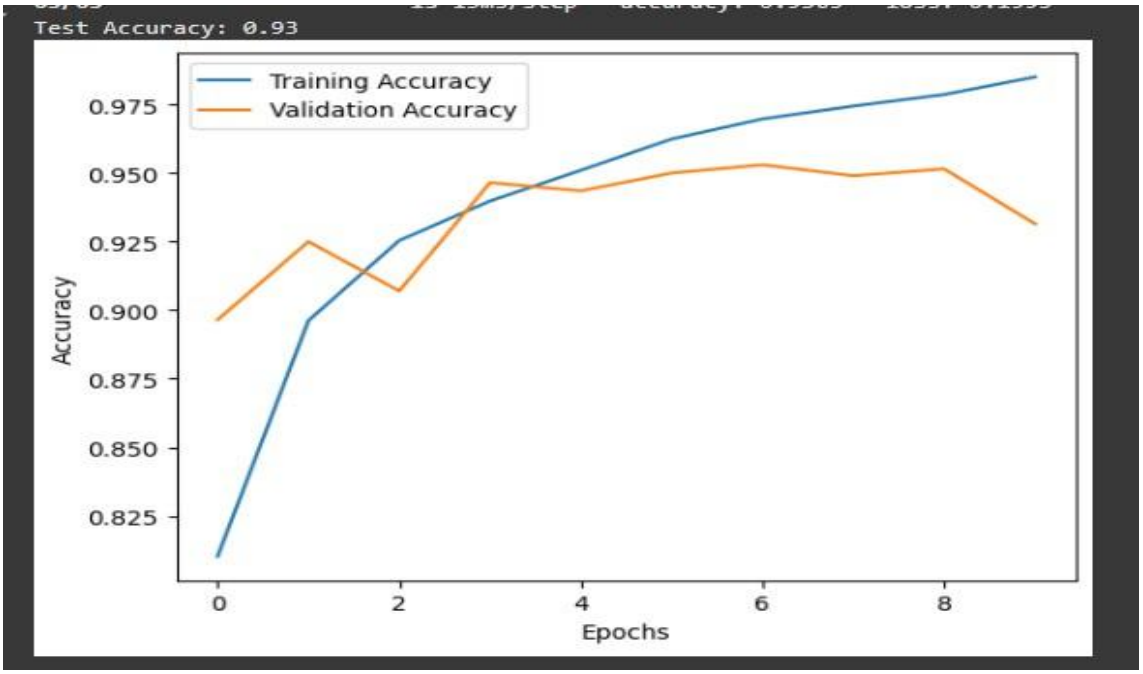
Code :

```
import tensorflow as tf
from tensorflow.keras import layers, models
from tensorflow.keras.datasets import cifar10
import matplotlib.pyplot as plt

# Load and preprocess data
(X_train, y_train), (X_test, y_test) = cifar10.load_data()

# For binary classification, let's classify 'airplane' (class 0) vs 'automobile' (class 1)
# Reshape y_trrain & y_test to 1D arrays
y_train = y_train.reshape(-1)
y_test = y_test.reshape(-1)

X_train = X_train[(y_train == 0) | (y_train == 1)].astype('float32') / 255.0
X_test = X_test[(y_test == 0) | (y_test == 1)].astype('float32') / 255.0

y_train = y_train[(y_train == 0) | (y_train == 1)]
y_test = y_test[(y_test == 0) | (y_test == 1)]

# Build CNN model
model = models.Sequential([
    layers.Conv2D(32, (3, 3), activation='relu', input_shape=(32, 32, 3)),
    layers.MaxPooling2D((2, 2)),
    layers.Conv2D(64, (3, 3), activation='relu'),
```

```
    layers.MaxPooling2D((2, 2)),
    layers.Conv2D(64, (3, 3), activation='relu'),
    layers.Flatten(),
    layers.Dense(64, activation='relu'),
    layers.Dense(1, activation='sigmoid')])

# Compile the model
model.compile(optimizer='adam', loss='binary_crossentropy', metrics=['accuracy'])

# Train the model
history = model.fit(X_train, y_train, epochs=10, batch_size=32, validation_data=(X_test,
y_test), verbose=2)

# Evaluate the model
loss, accuracy = model.evaluate(X_test, y_test)
print(f"Test Accuracy: {accuracy:.2f}")

# Plot training history
plt.plot(history.history['accuracy'], label='Training Accuracy')
plt.plot(history.history['val_accuracy'], label='Validation Accuracy')
plt.xlabel('Epochs')
plt.ylabel('Accuracy')
plt.legend()
plt.show()
```

Output :

```
/usr/local/lib/python3.11/dist-packages/keras/src/layers/convolutional/base_conv.py:107: UserWarning: Do not pass an
  super().__init__(activity_regularizer=activity_regularizer, **kwargs)
Epoch 1/10
313/313 - 16s - 52ms/step - accuracy: 0.8103 - loss: 0.4080 - val_accuracy: 0.8965 - val_loss: 0.2718
Epoch 2/10
313/313 - 20s - 63ms/step - accuracy: 0.8962 - loss: 0.2507 - val_accuracy: 0.9250 - val_loss: 0.1876
Epoch 3/10
313/313 - 14s - 44ms/step - accuracy: 0.9254 - loss: 0.1894 - val_accuracy: 0.9070 - val_loss: 0.2266
Epoch 4/10
313/313 - 21s - 66ms/step - accuracy: 0.9398 - loss: 0.1529 - val_accuracy: 0.9465 - val_loss: 0.1405
Epoch 5/10
313/313 - 21s - 66ms/step - accuracy: 0.9510 - loss: 0.1233 - val_accuracy: 0.9435 - val_loss: 0.1526
Epoch 6/10
313/313 - 20s - 64ms/step - accuracy: 0.9624 - loss: 0.0994 - val_accuracy: 0.9500 - val_loss: 0.1584
Epoch 7/10
313/313 - 21s - 66ms/step - accuracy: 0.9697 - loss: 0.0846 - val_accuracy: 0.9530 - val_loss: 0.1345
Epoch 8/10
313/313 - 21s - 66ms/step - accuracy: 0.9744 - loss: 0.0689 - val_accuracy: 0.9490 - val_loss: 0.1546
Epoch 9/10
313/313 - 21s - 68ms/step - accuracy: 0.9786 - loss: 0.0595 - val_accuracy: 0.9515 - val_loss: 0.1363
Epoch 10/10
313/313 - 20s - 63ms/step - accuracy: 0.9850 - loss: 0.0421 - val_accuracy: 0.9315 - val_loss: 0.2261
63/63 ━━━━━━━━━━━━━━━━━━━━ 1s 13ms/step - accuracy: 0.9363 - loss: 0.1993
Test Accuracy: 0.93
```



3b. Using a deep feed-forward network with two hidden layers for performing multiclass classification and predicting the class.

Code :

```
import tensorflow as tf
from tensorflow.keras import layers, models
from tensorflow.keras.datasets import mnist
import matplotlib.pyplot as plt

# Load and preprocess data
(X_train, y_train), (X_test, y_test) = mnist.load_data()

# Normalize the data
X_train = X_train.reshape(-1, 28 * 28).astype('float32') / 255.0
X_test = X_test.reshape(-1, 28 * 28).astype('float32') / 255.0

# Define a deep feed-forward network model
model = models.Sequential([
    layers.Dense(128, activation='relu', input_shape=(28 * 28,)),
    layers.Dense(64, activation='relu'),
    layers.Dense(10, activation='softmax')])
# Compile the model
model.compile(optimizer='adam', loss='sparse_categorical_crossentropy',
metrics=['accuracy'])
# Train the model
history = model.fit(X_train, y_train, epochs=10, batch_size=32, validation_data=(X_test,
y_test), verbose=2)

# Evaluate the model
loss, accuracy = model.evaluate(X_test, y_test)
print(f"Test Accuracy: {accuracy:.2f}")
```

 # Make predictions on new data

predictions = model.predict(X_test[:5])

print("Predicted classes:", [tf.argmax(p).numpy() for p in predictions])

 # Plot training history

plt.plot(history.history['accuracy'], label='Training Accuracy')

plt.plot(history.history['val_accuracy'], label='Validation Accuracy')

plt.xlabel('Epochs')

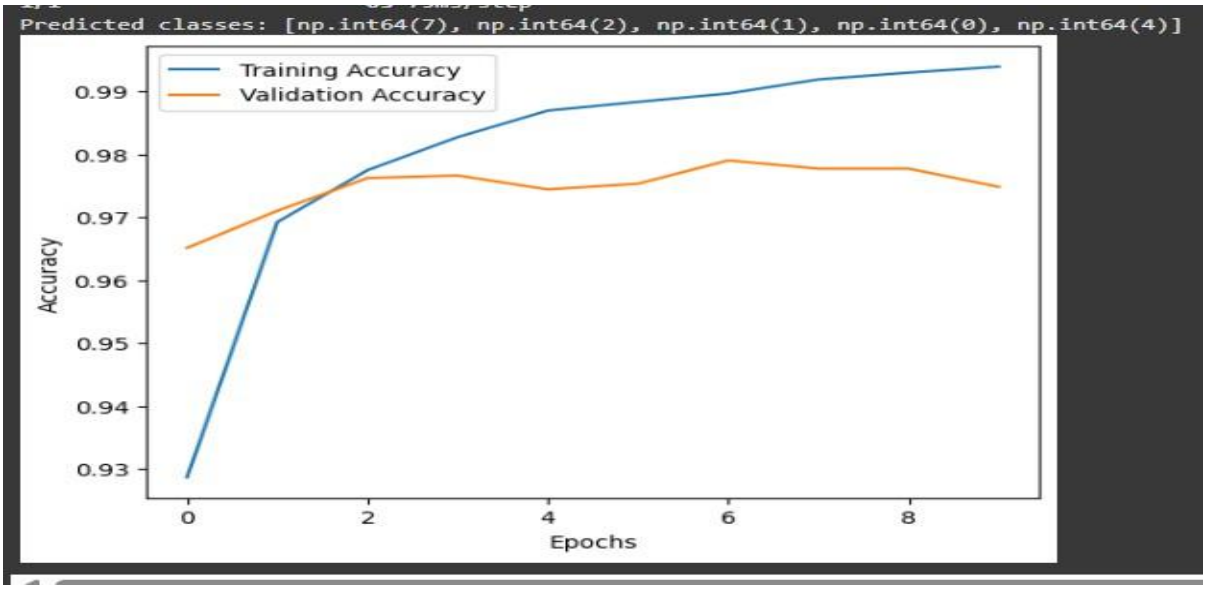
plt.ylabel('Accuracy')

plt.legend()

plt.show()

Output :

```
Downloading data from https://storage.googleapis.com/tensorflow/tf-keras-datasets/mnist.npz
11490434/11490434 ━━━━━━━━━━━━━━━━━━━━ 0s 0us/step
/usr/local/lib/python3.11/dist-packages/keras/src/layers/core/dense.py:87: UserWarning: Do not pass an `input_shape`/`inpu
  super().__init__(activity_regularizer=activity_regularizer, **kwargs)
Epoch 1/10
1875/1875 - 16s - 8ms/step - accuracy: 0.9287 - loss: 0.2419 - val_accuracy: 0.9651 - val_loss: 0.1213
Epoch 2/10
1875/1875 - 9s - 5ms/step - accuracy: 0.9692 - loss: 0.1025 - val_accuracy: 0.9710 - val_loss: 0.0920
Epoch 3/10
1875/1875 - 8s - 4ms/step - accuracy: 0.9775 - loss: 0.0726 - val_accuracy: 0.9762 - val_loss: 0.0791
Epoch 4/10
1875/1875 - 8s - 4ms/step - accuracy: 0.9827 - loss: 0.0544 - val_accuracy: 0.9766 - val_loss: 0.0746
Epoch 5/10
1875/1875 - 8s - 4ms/step - accuracy: 0.9869 - loss: 0.0419 - val_accuracy: 0.9744 - val_loss: 0.0809
Epoch 6/10
1875/1875 - 7s - 4ms/step - accuracy: 0.9883 - loss: 0.0348 - val_accuracy: 0.9753 - val_loss: 0.0840
Epoch 7/10
1875/1875 - 9s - 5ms/step - accuracy: 0.9896 - loss: 0.0303 - val_accuracy: 0.9790 - val_loss: 0.0755
Epoch 8/10
1875/1875 - 10s - 5ms/step - accuracy: 0.9919 - loss: 0.0247 - val_accuracy: 0.9777 - val_loss: 0.0844
Epoch 9/10
1875/1875 - 10s - 5ms/step - accuracy: 0.9930 - loss: 0.0215 - val_accuracy: 0.9777 - val_loss: 0.0941
Epoch 10/10
1875/1875 - 10s - 5ms/step - accuracy: 0.9939 - loss: 0.0179 - val_accuracy: 0.9748 - val_loss: 0.0973
313/313 ━━━━━━━━━━━━━━━━━━━━ 1s 4ms/step - accuracy: 0.9726 - loss: 0.1136
Test Accuracy: 0.97
1/1 ━━━━━━━━━━━━━━━━━━━━ 0s 75ms/step
Predicted classes: [np.int64(7), np.int64(2), np.int64(1), np.int64(0), np.int64(4)]
```



Practical 4

Write a program to implement deep learning Techniques for image segmentation.

Code :

```
import tensorflow as tf
from tensorflow.keras.models import Model
from tensorflow.keras.layers import Input, Conv2D, MaxPooling2D, UpSampling2D, concatenate
import numpy as np
import matplotlib.pyplot as plt

# Generate a small synthetic dataset
X_train = np.random.rand(10, 128, 128, 3)
y_train = np.random.randint(0, 2, (10, 128, 128, 1))
X_test = np.random.rand(2, 128, 128, 3)
y_test = np.random.randint(0, 2, (2, 128, 128, 1))

# Define a simple U-Net model
def build_simple_unet():
    inputs = Input(shape=(128, 128, 3))

    c1 = Conv2D(16, (3, 3), activation='relu', padding='same')(inputs)
    p1 = MaxPooling2D((2, 2))(c1)

    c2 = Conv2D(32, (3, 3), activation='relu', padding='same')(p1)
    p2 = MaxPooling2D((2, 2))(c2)

    c3 = Conv2D(64, (3, 3), activation='relu', padding='same')(p2)
```

```
    u1 = UpSampling2D((2, 2))(c3)
    u1 = concatenate([u1, c2])
    c4 = Conv2D(32, (3, 3), activation='relu', padding='same')(u1)

    u2 = UpSampling2D((2, 2))(c4)
    u2 = concatenate([u2, c1])
    c5 = Conv2D(16, (3, 3), activation='relu', padding='same')(u2)

    outputs = Conv2D(1, (1, 1), activation='sigmoid')(c5)

    model = Model(inputs, outputs)
    model.compile(optimizer='adam', loss='binary_crossentropy', metrics=['accuracy'])
    return model

model = build_simple_unet()
model.summary()

# Train the model
history = model.fit(X_train, y_train, epochs=10, batch_size=2, validation_data=(X_test,
y_test))

# Test on a new image
def visualize_segmentation(model, image):
    pred_mask = model.predict(np.expand_dims(image, axis=0))[0]
    pred_mask = (pred_mask > 0.5).astype(np.uint8)

    plt.figure(figsize=(10, 5))
    plt.subplot(1, 2, 1)
    plt.title('Original Image')
    plt.imshow(image)
```

```
plt.subplot(1, 2, 2)
plt.title('Predicted Mask')
plt.imshow(pred_mask.squeeze(), cmap='gray')
plt.show()
```

 # Test on a random image

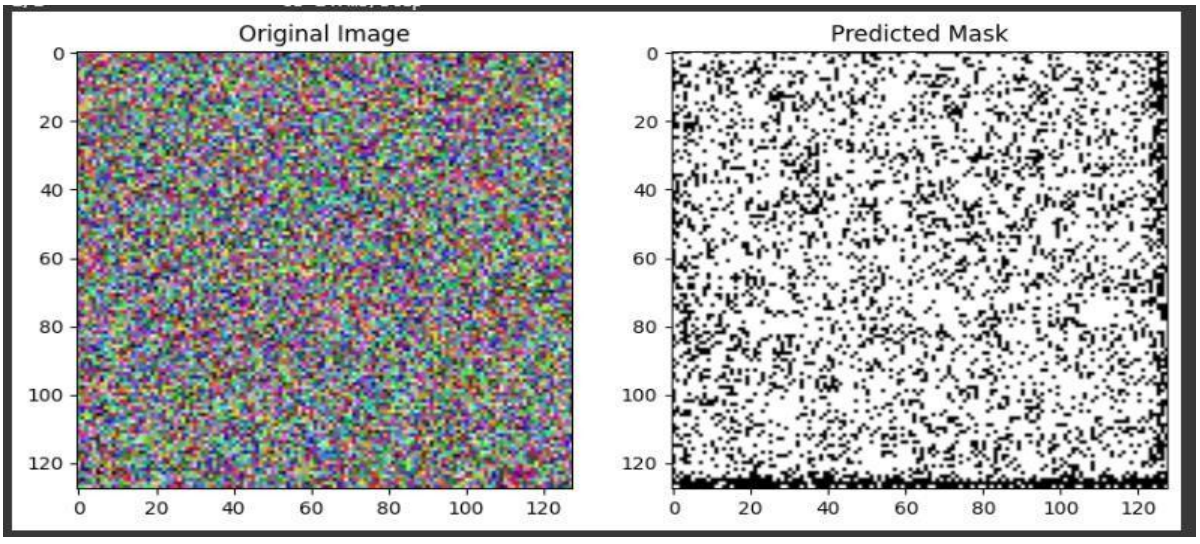
```
random_idx = np.random.randint(0, X_test.shape[0])
visualize_segmentation(model, X_test[random_idx])
```

Output :

Model: "functional"

Layer (type)	Output Shape	Param #	Connected to
input_layer (InputLayer)	(None, 128, 128, 3)	0	-
conv2d (Conv2D)	(None, 128, 128, 16)	448	input_layer[0][0]
max_pooling2d (MaxPooling2D)	(None, 64, 64, 16)	0	conv2d[0][0]
conv2d_1 (Conv2D)	(None, 64, 64, 32)	4,640	max_pooling2d[0][0]
max_pooling2d_1 (MaxPooling2D)	(None, 32, 32, 32)	0	conv2d_1[0][0]
conv2d_2 (Conv2D)	(None, 32, 32, 64)	18,496	max_pooling2d_1[0][0]
up_sampling2d (UpSampling2D)	(None, 64, 64, 64)	0	conv2d_2[0][0]
concatenate (Concatenate)	(None, 64, 64, 96)	0	up_sampling2d[0][0], conv2d_1[0][0]
conv2d_3 (Conv2D)	(None, 64, 64, 32)	27,680	concatenate[0][0]
up_sampling2d_1 (UpSampling2D)	(None, 128, 128, 32)	0	conv2d_3[0][0]
concatenate_1 (Concatenate)	(None, 128, 128, 48)	0	up_sampling2d_1[0][0], conv2d[0][0]
conv2d_4 (Conv2D)	(None, 128, 128, 16)	6,928	concatenate_1[0][0]
conv2d_5 (Conv2D)	(None, 128, 128, 1)	17	conv2d_4[0][0]

Total params: 58,209 (227.38 KB)
Trainable params: 58,209 (227.38 KB)
Non-trainable params: 0 (0.00 B)



Practical 5

Write a program to predict a caption for a sample image using LSTM.

Code :

```
import numpy as np
import matplotlib.pyplot as plt
from tensorflow.keras.models import Model
from tensorflow.keras.layers import Input, Dense, LSTM, Embedding, Dropout, add
from tensorflow.keras.preprocessing.text import Tokenizer
from tensorflow.keras.preprocessing.sequence import pad_sequences
from tensorflow.keras.preprocessing.image import load_img, img_to_array
from tensorflow.keras.applications.vgg16 import VGG16, preprocess_input
import tensorflow as tf

# Define a small dataset
images = ["/content/Dog.jpg", "/content/cat.jpg", "/content/bike.jpg"]
captions = [
    "startseq a dog running in the park endseq",
    "startseq a cat sitting on a couch endseq",
    "startseq a person riding a bike endseq"
]

# Load VGG16 model for image feature extraction
base_model = VGG16(weights='imagenet')
model_vgg = Model(inputs=base_model.input, outputs=base_model.layers[-2].output)

def extract_features(image_path):
    img = load_img(image_path, target_size=(224, 224))
    img_array = img_to_array(img)
```

```
    img_array = np.expand_dims(img_array, axis=0)
    img_array = preprocess_input(img_array)
    return model_vgg.predict(img_array)

# Tokenize the captions
tokenizer = Tokenizer()
tokenizer.fit_on_texts(captions)
max_length = max(len(c.split()) for c in captions)
vocab_size = len(tokenizer.word_index) + 1

# Convert captions to sequences
sequences = tokenizer.texts_to_sequences(captions)
padded_captions = pad_sequences(sequences, maxlen=max_length, padding='post')

# Define the model
embedding_dim = 256
hidden_units = 256
image_input = Input(shape=(4096,))
image_output = Dense(embedding_dim, activation='relu')(image_input)
caption_input = Input(shape=(max_length,))
embedding = Embedding(vocab_size, embedding_dim, mask_zero=True)(caption_input)
lstm_out = LSTM(hidden_units)(embedding)
combined = add([image_output, lstm_out])
decoder_output = Dense(vocab_size, activation='softmax')(combined)
model = Model(inputs=[image_input, caption_input], outputs=decoder_output)
model.compile(loss='categorical_crossentropy', optimizer='adam')

# Dummy training labels
y_train = np.zeros((3, vocab_size))
model.fit([np.random.rand(3, 4096), padded_captions], y_train, epochs=5, batch_size=1)
```

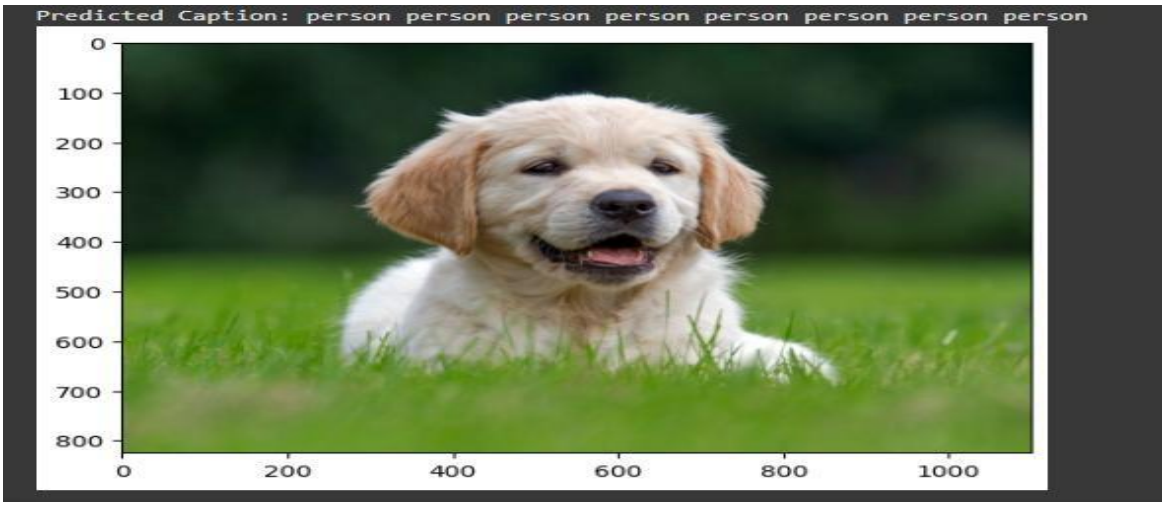
 # Generate a caption

```
def generate_caption(model, tokenizer, image_feature, max_length):
    in_text = 'startseq'
    for _ in range(max_length):
        sequence = tokenizer.texts_to_sequences([in_text])[0]
        sequence = pad_sequences([sequence], maxlen=max_length)
        yhat = np.argmax(model.predict([image_feature, sequence], verbose=0))
        word = tokenizer.index_word.get(yhat, None)
        if word is None:
            break
        in_text += ' ' + word
        if word == 'endseq':
            break
    return in_text.replace('startseq', '').replace('endseq', '').strip()
```

 # Test on a sample image

```
sample_image_path = images[0]
plt.imshow(load_img(sample_image_path))
sample_feature = extract_features(sample_image_path)
caption = generate_caption(model, tokenizer, sample_feature, max_length)
print("Predicted Caption:", caption)
```

Output :



Practical 6

Applying the Autoencoder algorithms for encoding real-world data

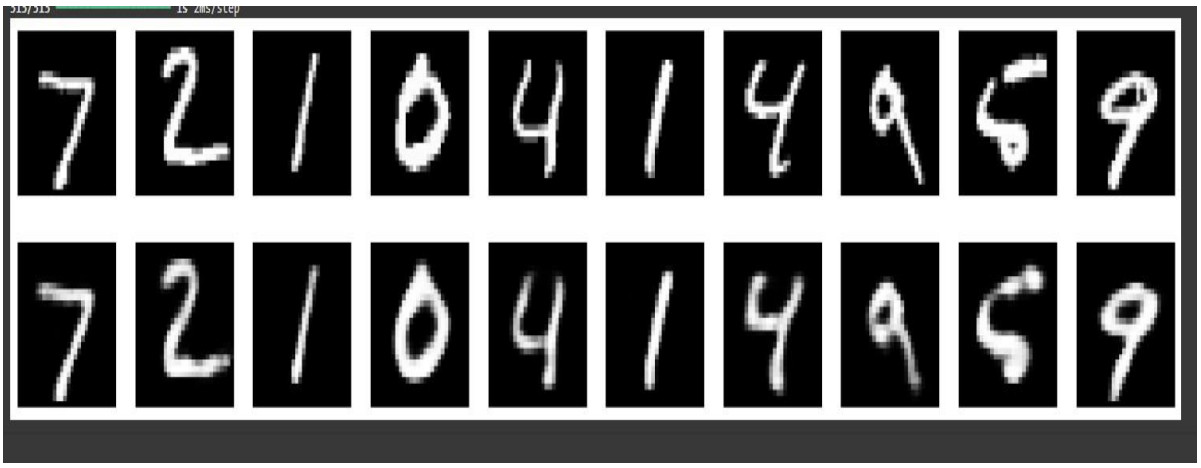
Code :

```
import numpy as np
import matplotlib.pyplot as plt
import tensorflow as tf
from tensorflow.keras.models import Model
from tensorflow.keras.layers import Input, Dense, Flatten, Reshape
from tensorflow.keras.datasets import mnist

# Load and preprocess the MNIST dataset
(x_train, _), (x_test, _) = mnist.load_data()
x_train = x_train.astype('float32') / 255.
x_test = x_test.astype('float32') / 255.
x_train = np.reshape(x_train, (len(x_train), 28, 28, 1))
x_test = np.reshape(x_test, (len(x_test), 28, 28, 1))

# Define the Autoencoder architecture
input_img = Input(shape=(28, 28, 1))

# Encoder
x = Flatten()(input_img)
x = Dense(128, activation='relu')(x)
x = Dense(64, activation='relu')(x)
encoded = Dense(32, activation='relu')(x)

# Decoder
x = Dense(64, activation='relu')(encoded)
```

```
x = Dense(128, activation='relu')(x)
x = Dense(28 * 28, activation='sigmoid')(x)
decoded = Reshape((28, 28, 1))(x)

# Define the Autoencoder model
autoencoder = Model(input_img, decoded)

# Compile the model
autoencoder.compile(optimizer='adam',  loss='binary_crossentropy')

# Train the Autoencoder
autoencoder.fit(
    x_train, x_train,
    epochs=50,
    batch_size=256,
    shuffle=True,
    validation_data=(x_test, x_test)
)

# Encode and decode some images
encoded_imgs = autoencoder.predict(x_test)

# Display original and reconstructed images
n = 10
plt.figure(figsize=(20, 4))
for i in range(n):
    # Original
    ax = plt.subplot(2, n, i + 1)
    plt.imshow(x_test[i].reshape(28, 28), cmap='gray')
    plt.axis('off')
```

```
    # Reconstructed
    ax = plt.subplot(2, n, i + 1 + n)
    plt.imshow(encoded_imgs[i].reshape(28, 28), cmap='gray')
    plt.axis('off')
plt.show()
```

Output :



Practical 7

Write a program for character recognition using RNN and compare it with CNN.

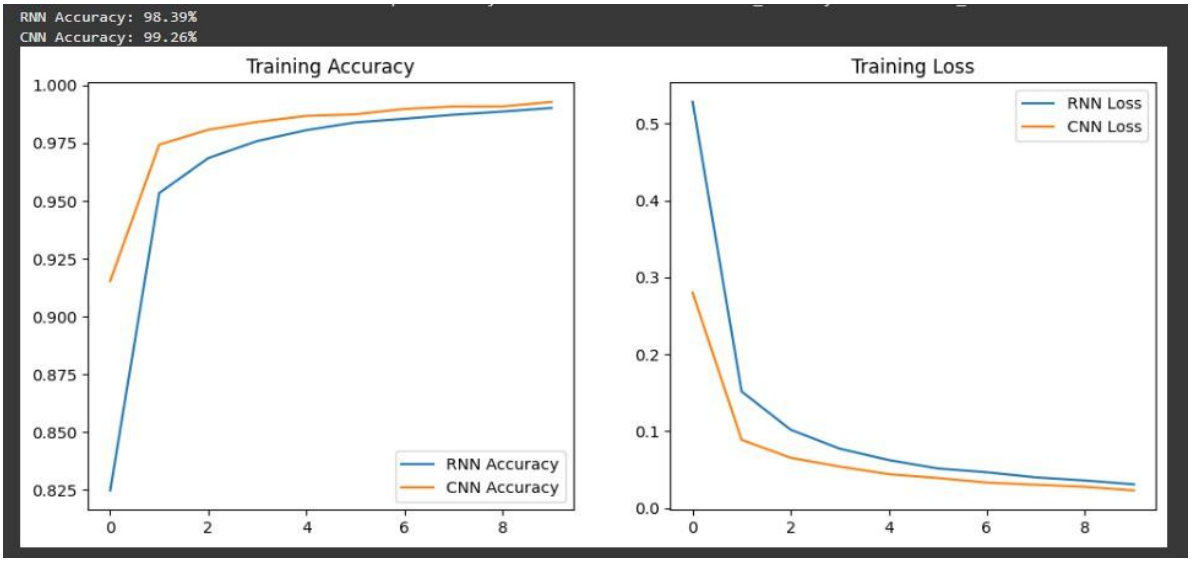
Code :

```
import numpy as np
import matplotlib.pyplot as plt
import tensorflow as tf
from tensorflow.keras.models import Sequential
from tensorflow.keras.layers import Dense, LSTM, Conv2D, MaxPooling2D, Flatten, Reshape, Dropout
from tensorflow.keras.datasets import mnist
from tensorflow.keras.utils import to_categorical

# Load and preprocess the MNIST dataset
(x_train, y_train), (x_test, y_test) = mnist.load_data()
x_train = x_train.astype('float32') / 255.0
x_test = x_test.astype('float32') / 255.0

# Reshape data for CNN
x_train_cnn = x_train.reshape(-1, 28, 28, 1)
x_test_cnn = x_test.reshape(-1, 28, 28, 1)
# Reshape data for RNN
x_train_rnn = x_train.reshape(-1, 28, 28)
x_test_rnn = x_test.reshape(-1, 28, 28)

# One-hot encode the labels
y_train = to_categorical(y_train, 10)
y_test = to_categorical(y_test, 10)
```

```
# Define RNN model
rnn_model = Sequential([
    LSTM(128, input_shape=(28, 28)),
    Dense(64, activation='relu'),
    Dense(10, activation='softmax')])

rnn_model.compile(optimizer='adam', loss='categorical_crossentropy', metrics=['accuracy'])

# Define CNN model
cnn_model = Sequential([
    Conv2D(32, kernel_size=(3, 3), activation='relu', input_shape=(28, 28, 1)),
    MaxPooling2D(pool_size=(2, 2)),
    Conv2D(64, kernel_size=(3, 3), activation='relu'),
    MaxPooling2D(pool_size=(2, 2)),
    Flatten(),
    Dense(128, activation='relu'),
    Dropout(0.5),
    Dense(10, activation='softmax')])

cnn_model.compile(optimizer='adam', loss='categorical_crossentropy', metrics=['accuracy'])

# Train the RNN model
print("Training RNN model...")
rnn_history = rnn_model.fit(x_train_rnn, y_train, epochs=10, batch_size=128,
validation_data=(x_test_rnn, y_test))
# Train the CNN model
print("Training CNN model...")
cnn_history = cnn_model.fit(x_train_cnn, y_train, epochs=10, batch_size=128,
validation_data=(x_test_cnn, y_test))

# Evaluate the models
```

```
rnn_score = rnn_model.evaluate(x_test_rnn, y_test, verbose=0)
cnn_score = cnn_model.evaluate(x_test_cnn, y_test, verbose=0)

print(f"RNN Accuracy: {rnn_score[1] * 100:.2f}%")
print(f"CNN Accuracy: {cnn_score[1] * 100:.2f}%")

# Plot training loss and accuracy
plt.figure(figsize=(12, 5))
plt.subplot(1, 2, 1)
plt.plot(rnn_history.history['accuracy'], label='RNN Accuracy')
plt.plot(cnn_history.history['accuracy'], label='CNN Accuracy')
plt.legend()
plt.title('Training Accuracy')

plt.subplot(1, 2, 2)
plt.plot(rnn_history.history['loss'], label='RNN Loss')
plt.plot(cnn_history.history['loss'], label='CNN Loss')
plt.legend()
plt.title('Training Loss')
plt.show()
```

Output :



Practical 8

Write a program to develop Autoencoders using MNIST Handwritten Digits

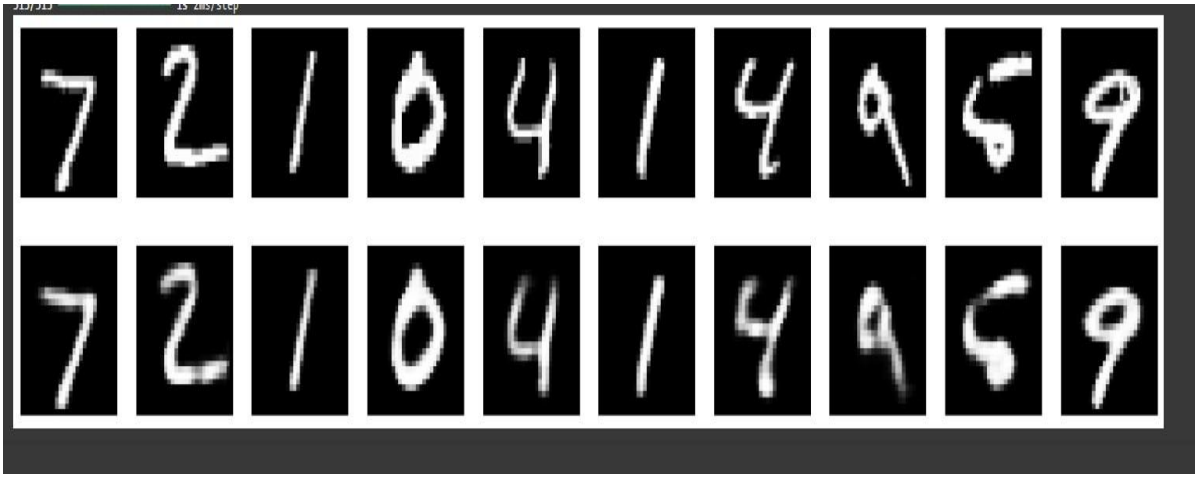
Code :

```
import numpy as np
import matplotlib.pyplot as plt
import tensorflow as tf
from tensorflow.keras.models import Model
from tensorflow.keras.layers import Input, Dense, Flatten, Reshape
from tensorflow.keras.datasets import mnist

# Load and preprocess the MNIST dataset
(x_train, _), (x_test, _) = mnist.load_data()
x_train = x_train.astype('float32') / 255.
x_test = x_test.astype('float32') / 255.
x_train = np.reshape(x_train, (len(x_train), 28, 28, 1))
x_test = np.reshape(x_test, (len(x_test), 28, 28, 1))

# Define the Autoencoder architecture
input_img = Input(shape=(28, 28, 1))

# Encoder
x = Flatten()(input_img)
x = Dense(128, activation='relu')(x)
x = Dense(64, activation='relu')(x)
encoded = Dense(32, activation='relu')(x)

# Decoder
```

```
x = Dense(64, activation='relu')(encoded)
x = Dense(128, activation='relu')(x)
x = Dense(28 * 28, activation='sigmoid')(x)
decoded = Reshape((28, 28, 1))(x)

# Define the Autoencoder model
autoencoder = Model(input_img, decoded)

# Compile the model
autoencoder.compile(optimizer='adam',  loss='binary_crossentropy')

# Train the Autoencoder
autoencoder.fit(
    x_train, x_train,
    epochs=50,
    batch_size=256,
    shuffle=True,
    validation_data=(x_test, x_test))

# Encode and decode some images
encoded_imgs = autoencoder.predict(x_test)

# Display original and reconstructed images
n = 10
plt.figure(figsize=(20, 4))
for i in range(n):
    # Original
    ax = plt.subplot(2, n, i + 1)
    plt.imshow(x_test[i].reshape(28, 28), cmap='gray')
    plt.axis('off')
```

```
    # Reconstructed
    ax = plt.subplot(2, n, i + 1 + n)
    plt.imshow(encoded_imgs[i].reshape(28, 28), cmap='gray')
    plt.axis('off')
plt.show()
```

Output :



Practical 9

Demonstrate recurrent neural network that learns to perform sequence analysis for stock price.(google stock price)

Code :

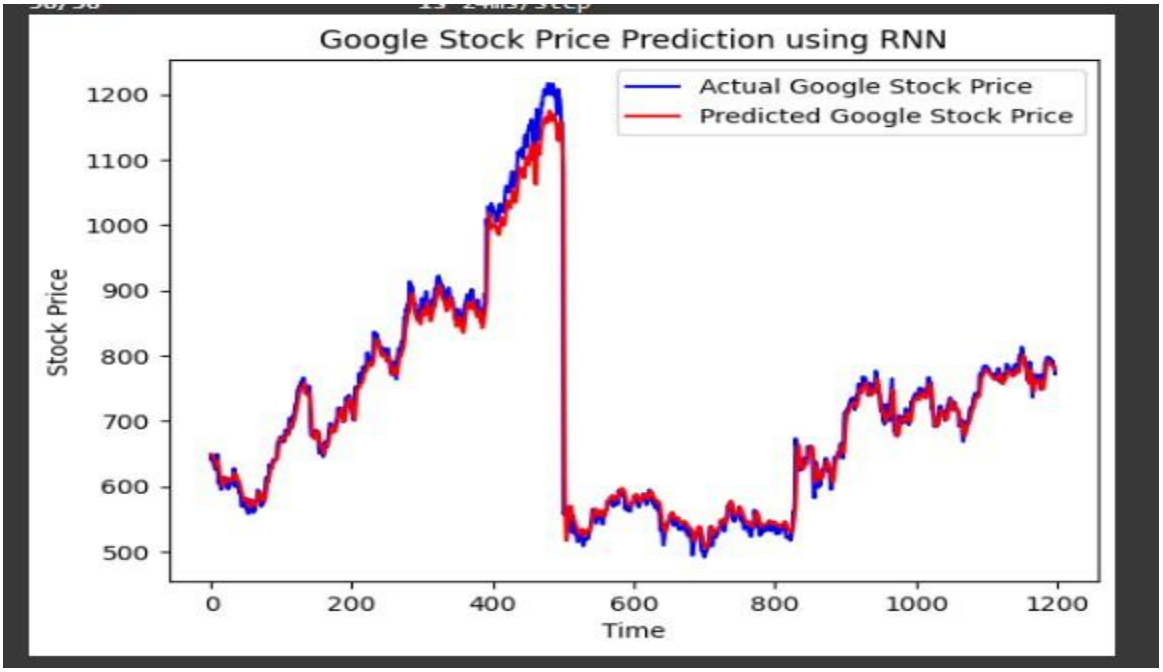
```
import numpy as np
import pandas as pd
import matplotlib.pyplot as plt
import tensorflow as tf
from tensorflow.keras.models import Sequential
from tensorflow.keras.layers import LSTM, Dense, Dropout
from sklearn.preprocessing import MinMaxScaler

# Load Google stock price data
import kagglehub
from kagglehub import KaggleDatasetAdapter

# Set the path to the file you'd like to load
file_path = "Google_Stock_Price_Train.csv"

# Load the latest version
df = kagglehub.load_dataset(
  KaggleDatasetAdapter.PANDAS,
  "vaibhavsxn/google-stock-prices-training-and-test-data",
  file_path,
  # Provide any additional arguments like
  # sql_query or pandas_kwargs. See the
  # documenation for more information:
```

```
  #
https://github.com/Kaggle/kagglehub/blob/main/README.md#kaggledatasetadapterpandas)

print("First 5 records:", df.head())

# Extract the 'Close' prices and preprocess
stock_prices = df['Close'].str.replace(',',",regex=True).astype(float).values
stock_prices = stock_prices.reshape(-1, 1)
scaler = MinMaxScaler(feature_range=(0, 1))
scaled_prices = scaler.fit_transform(stock_prices)

# Prepare data for RNN
sequence_length = 60
X, y = [], []
for i in range(len(scaled_prices) - sequence_length):
    X.append(scaled_prices[i:i+sequence_length])
    y.append(scaled_prices[i+sequence_length])
X, y = np.array(X), np.array(y)

# Reshape X for LSTM input
X = np.reshape(X, (X.shape[0], X.shape[1], 1))

# Build RNN model
model = Sequential([
    LSTM(units=50, return_sequences=True, input_shape=(X.shape[1], 1)),
    Dropout(0.2),
    LSTM(units=50, return_sequences=False),
    Dropout(0.2),
    Dense(units=1)])

# Compile and train the model
```

```
model.compile(optimizer='adam', loss='mean_squared_error')
model.fit(X, y, epochs=50, batch_size=32)

# Make predictions
predicted_prices = model.predict(X)
predicted_prices = scaler.inverse_transform(predicted_prices)

# Plot actual vs predicted stock prices
plt.plot(stock_prices[sequence_length:], color='blue', label='Actual Google Stock Price')
plt.plot(predicted_prices, color='red', label='Predicted Google Stock Price')
plt.title('Google Stock Price Prediction using RNN')
plt.xlabel('Time')
plt.ylabel('Stock Price')
plt.legend()
plt.show()
```

Output :

```
<ipython-input-3-6e5fd158cc1f>:17: DeprecationWarning: load_dataset is deprecated and will be removed in future version.
  df = kagglehub.load_dataset(
First 5 records:        Date    Open    High     Low   Close      Volume
0  1/3/2012  325.25  332.83  324.97  663.59   7,380,500
1  1/4/2012  331.27  333.87  329.08  666.45   5,749,400
2  1/5/2012  329.83  330.75  326.89  657.21   6,590,300
3  1/6/2012  328.34  328.77  323.68  648.24   5,405,900
4  1/9/2012  322.04  322.29  309.46  620.76  11,688,800
```



Practical 10

Applying Generative Adversarial Networks for image generation and unsupervised tasks.

Code :

```
import tensorflow as tf
from tensorflow.keras.layers import Dense, Reshape, Flatten, LeakyReLU, Dropout, BatchNormalization, Conv2DTranspose, Conv2D
from tensorflow.keras.models import Sequential
import numpy as np
import matplotlib.pyplot as plt

# Define the Generator
def build_generator():
    model = Sequential()
    model.add(Dense(7 * 7 * 256, input_dim=100))
    model.add(LeakyReLU(0.2))
    model.add(Reshape((7, 7, 256)))

    model.add(Conv2DTranspose(128, kernel_size=4, strides=2, padding='same'))
    model.add(BatchNormalization())
    model.add(LeakyReLU(0.2))

    model.add(Conv2DTranspose(64, kernel_size=4, strides=2, padding='same'))
    model.add(BatchNormalization())
    model.add(LeakyReLU(0.2))

    model.add(Conv2D(1, kernel_size=7, padding='same', activation='tanh'))
    return model
```

```
# Define the Discriminator
def build_discriminator():
    model = Sequential()
    model.add(Conv2D(64, kernel_size=3, strides=2, padding='same', input_shape=(28, 28,
1)))
    model.add(LeakyReLU(0.2))
    model.add(Dropout(0.3))

    model.add(Conv2D(128, kernel_size=3, strides=2, padding='same'))
    model.add(LeakyReLU(0.2))
    model.add(Dropout(0.3))

    model.add(Flatten())
    model.add(Dense(1, activation='sigmoid'))
    return model

# Compile the GAN
def build_gan(generator, discriminator):
    discriminator.compile(loss='binary_crossentropy', optimizer='adam', metrics=['accuracy'])
    discriminator.trainable = False
    model = Sequential([generator, discriminator])
    model.compile(loss='binary_crossentropy', optimizer='adam')
    return model

# Load dataset (MNIST for simplicity)
(X_train, _), (_, _) = tf.keras.datasets.mnist.load_data()
X_train = X_train / 127.5 - 1.0
X_train = np.expand_dims(X_train, axis=-1)

# Training loop
```

```
def train_gan(gan, generator, discriminator, epochs=100, batch_size=64,
sample_interval=1000):
    valid = np.ones((batch_size, 1))
    fake = np.zeros((batch_size, 1))

    for epoch in range(epochs):
        idx = np.random.randint(0, X_train.shape[0], batch_size)
        real_imgs = X_train[idx]

        noise = np.random.normal(0, 1, (batch_size, 100))
        fake_imgs = generator.predict(noise)

        d_loss_real = discriminator.train_on_batch(real_imgs, valid)
        d_loss_fake = discriminator.train_on_batch(fake_imgs, fake)
        d_loss = 0.5 * np.add(d_loss_real, d_loss_fake)

        noise = np.random.normal(0, 1, (batch_size, 100))
        g_loss = gan.train_on_batch(noise, valid)

        if epoch % sample_interval == 0:
            print(f"Epoch {epoch}, D Loss: {d_loss[0]}, G Loss: {g_loss}")
            sample_images(generator)
```

 # Generate and display images

```
def sample_images(generator, image_grid_rows=4, image_grid_columns=4):
    noise = np.random.normal(0, 1, (image_grid_rows * image_grid_columns, 100))
    gen_imgs = generator.predict(noise)
    gen_imgs = 0.5 * gen_imgs + 0.5

    fig, axs = plt.subplots(image_grid_rows, image_grid_columns, figsize=(4, 4), sharex=True,
sharey=True)
```

```
    count = 0
    for i in range(image_grid_rows):
        for j in range(image_grid_columns):
            axs[i, j].imshow(gen_imgs[count, :, :, 0], cmap='gray')
            axs[i, j].axis('off')
            count += 1
    plt.show()
```

 # Build and compile the GAN

```
generator = build_generator()
discriminator = build_discriminator()
gan = build_gan(generator, discriminator)
```

 # Train the GAN

```
train_gan(gan, generator, discriminator)
```

Output :

ROBOTIC PROCESS AUTOMATION

Practical : 1 Sequences and Flowcharts :

a. Create a simple sequence-based project.

Code :

Print message hello

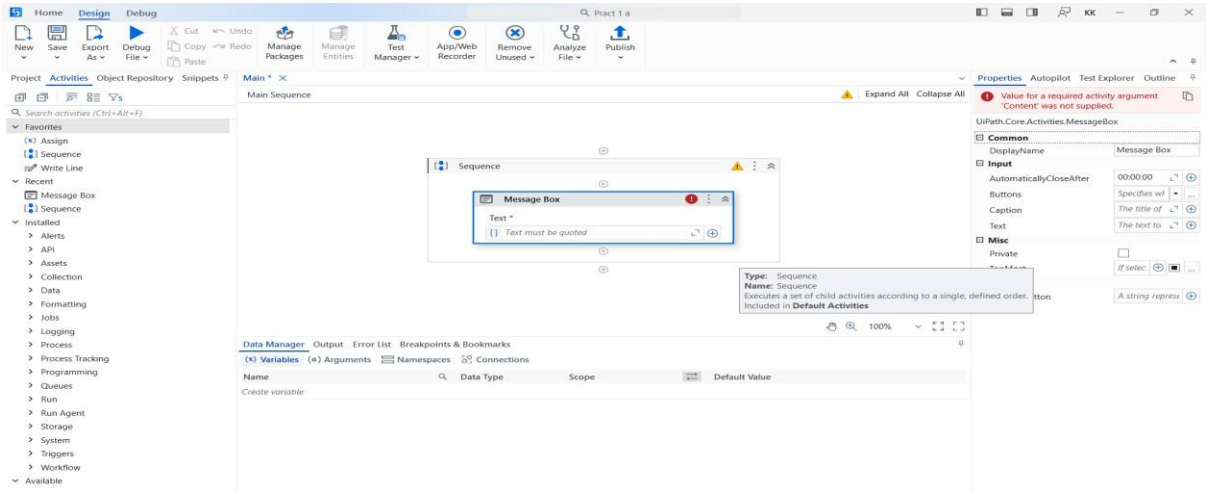
Step 1: Open a UiPath studio.

Step 2: Select blank process and give a name to create a project.

Step 3: Click on open main workflow.

Step 4: In activity panel search sequence and select sequence and drop in main workflow.

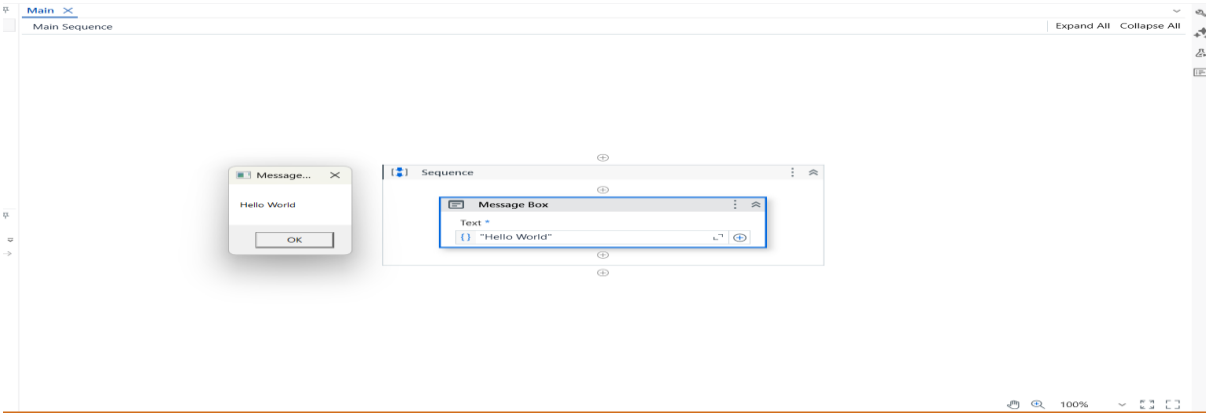
Step 5: Now search for message box and select message box and drop in main workflow.



Step 6: In message box type hello world.

Step 7: click on debug file and select run file.

Output :

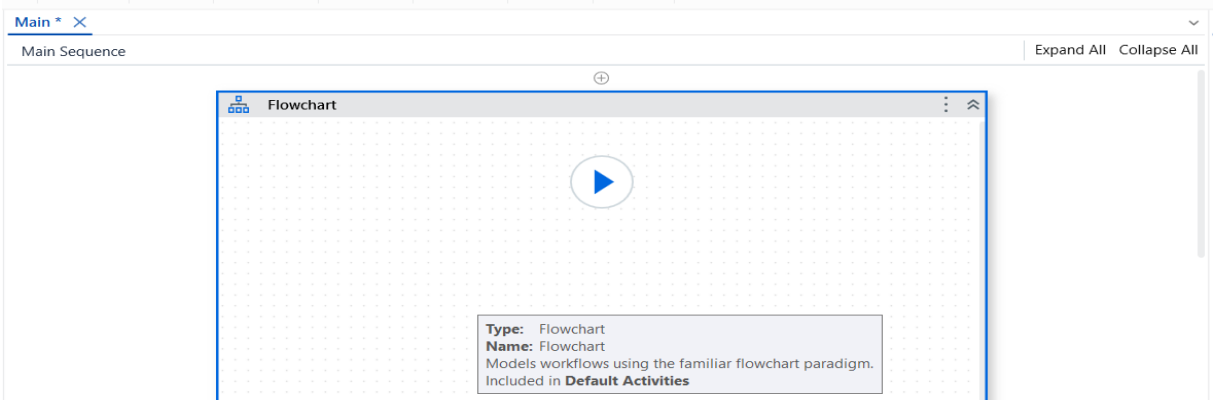


b. Create a flowchart-based project.

Code :

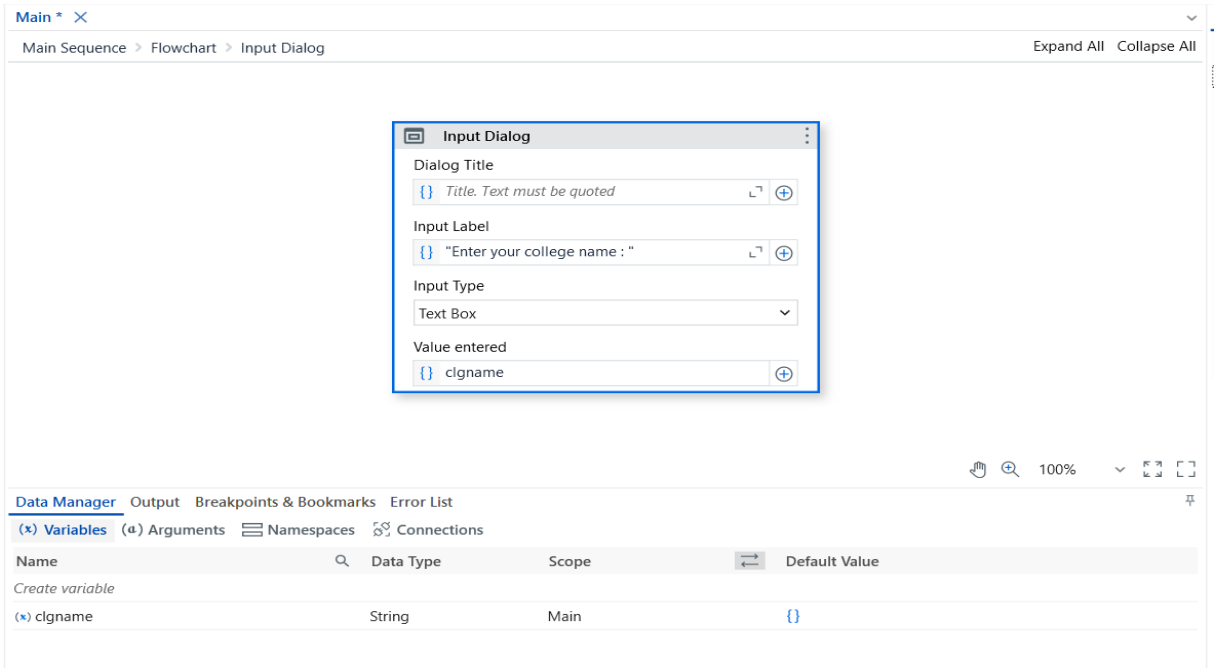
Step 1: Open UiPath studio and click on process give name to your project.

Step 2: Click on Open main workflow. Drag and drop flowchart from activities panel.

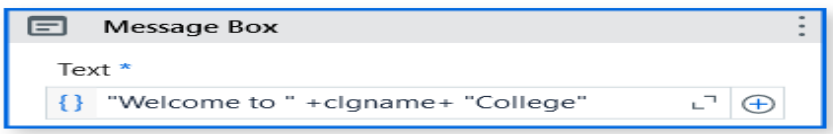


Step 3: Drag and drop input dailog box inside a flowchart.

Step 4: Create a variable “clgname” and give your input label

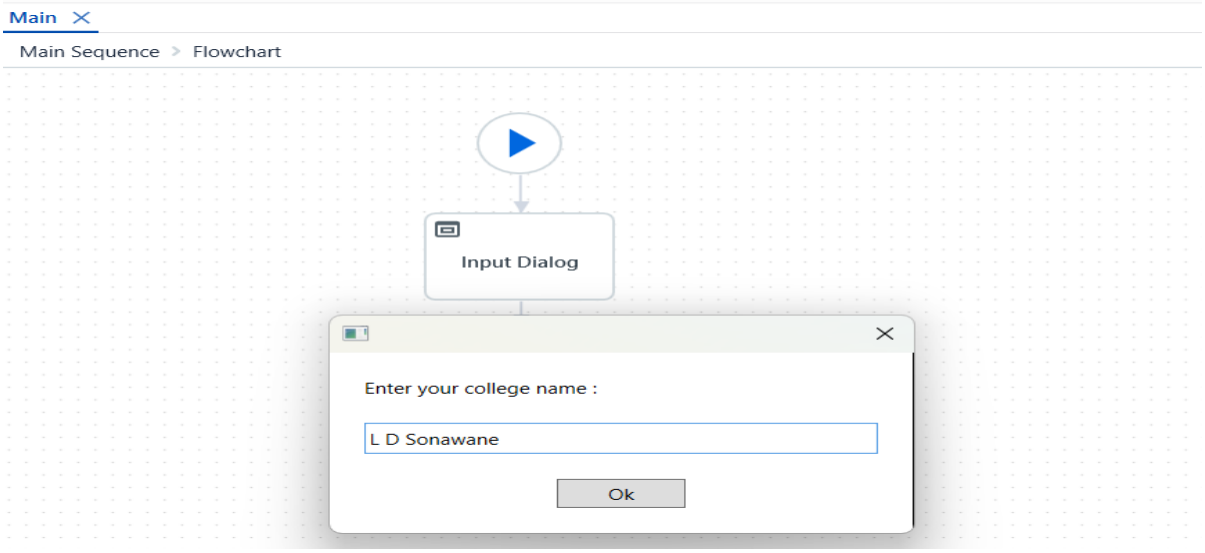


Step 5: Drag and drop a message box below input dialog box and enter your message inside message box.

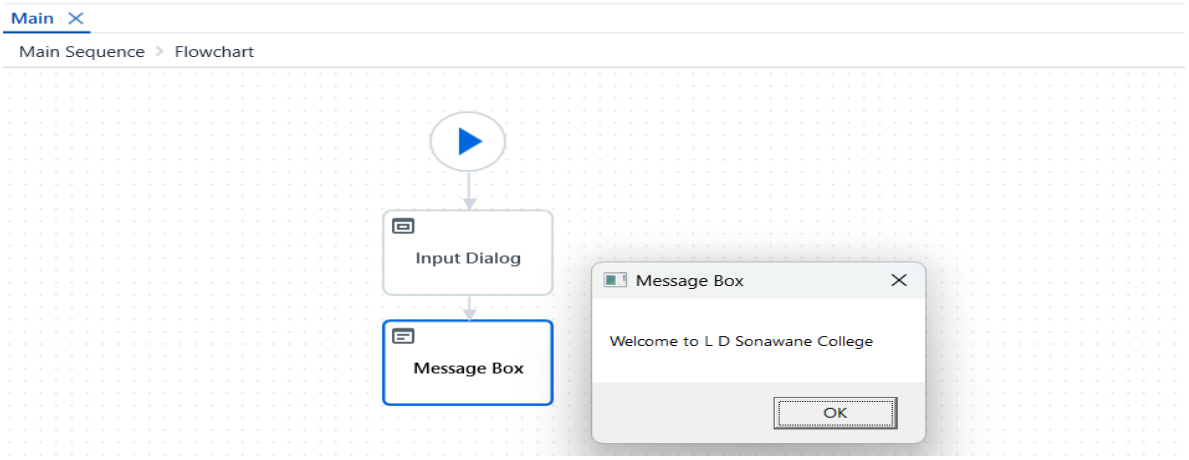


Step 6: Click on debug file and select run file.

Output :



Actual Output :



c. Automate UiPath Number Calculation (Addition,Subtraction, Multiplication, Division of numbers).

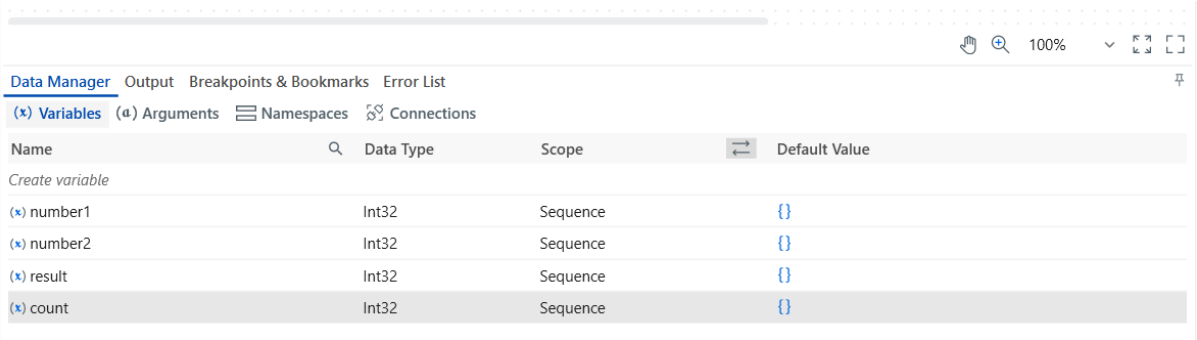
Code:

Step 1: Open UiPath studio select process and give name to your project and click on create.

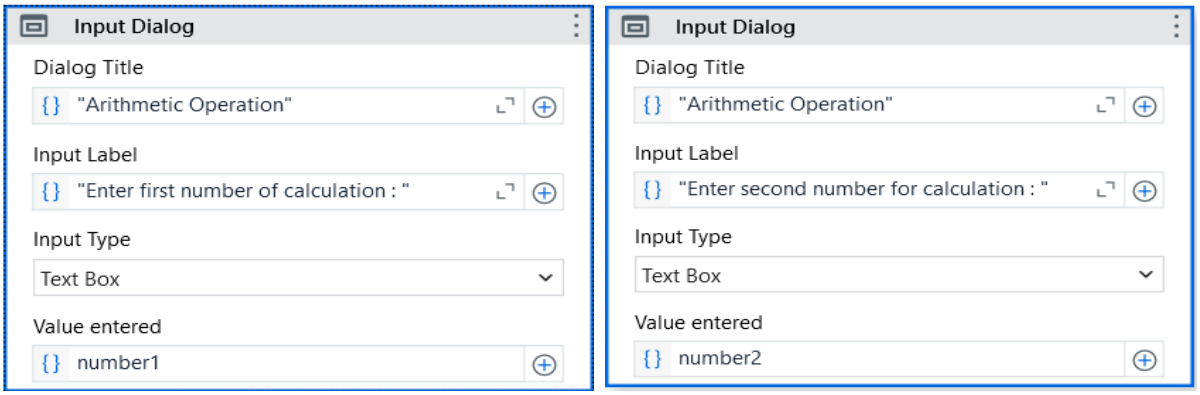
Step 2: Click on open main workflow

Step 3: go to activities and select sequence drag and drop.

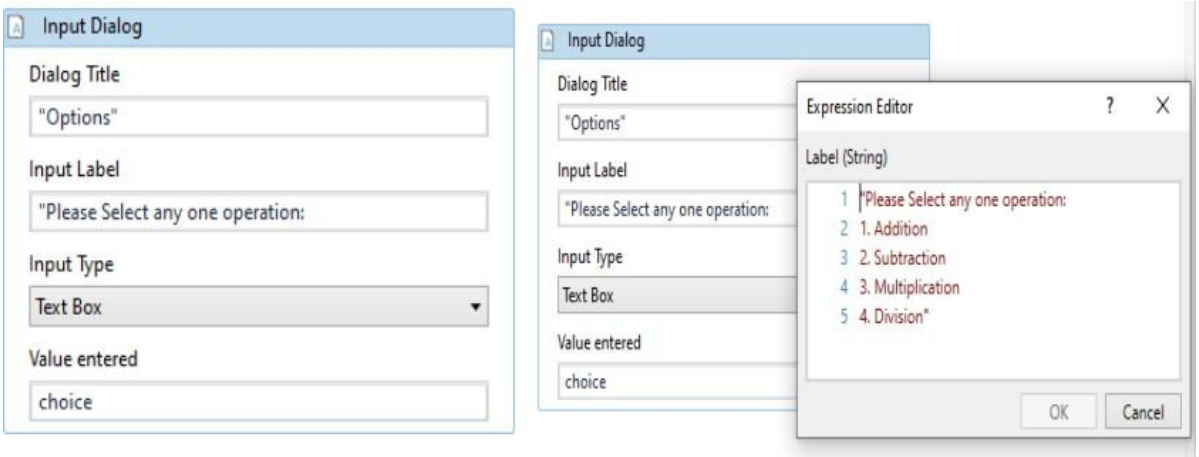
Step 4: Create 4 integer variable.



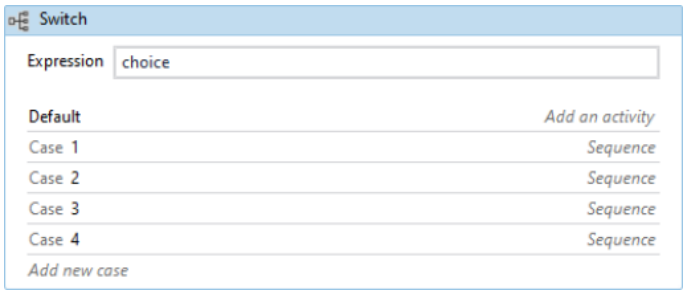
Step 5: Select 2 input dialogs from the activities drag and drop. Enter the values in dialog box.



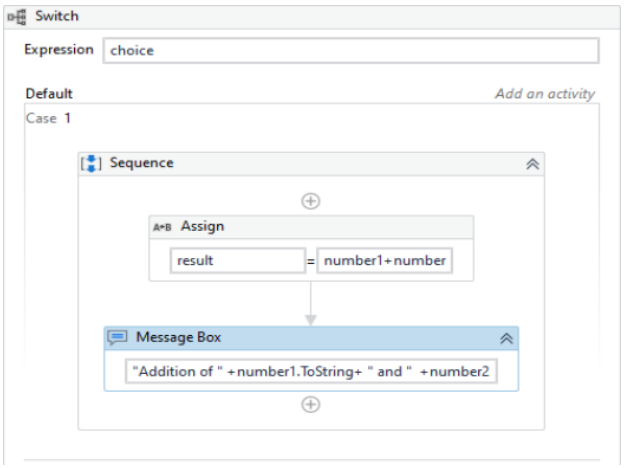
Step 6 : Select another dialog box for selecting options



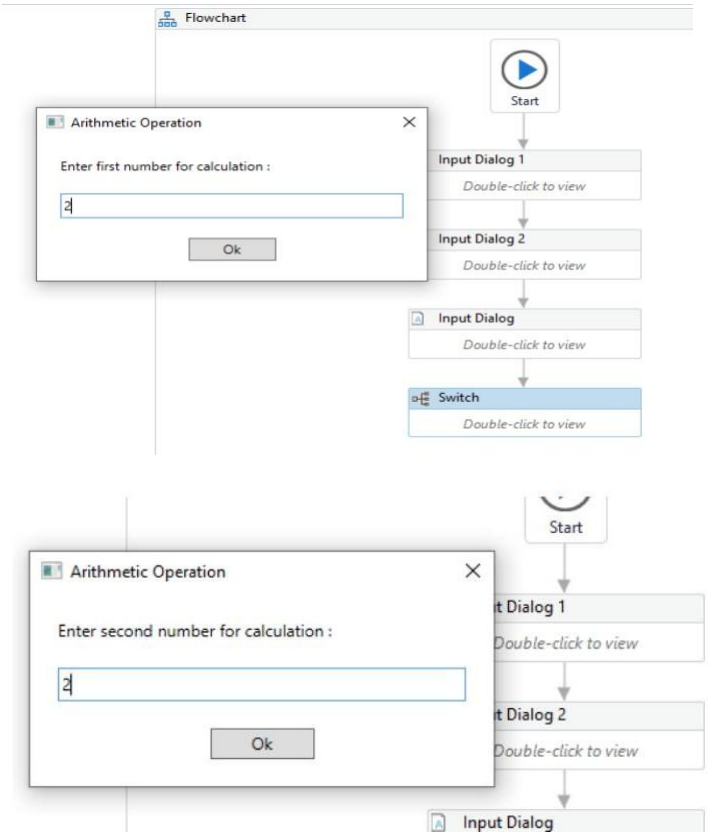
Step 7: Select switch activity and assign each case, required condition

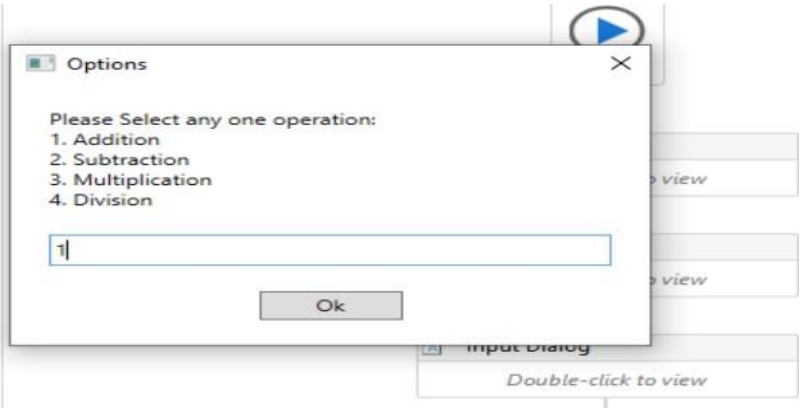


Step 8: Repeat the same step as below for all the case.



Step 9: Click on debug file and click on run file:




Options
Please Select any one operation:
1. Addition
2. Subtraction
3. Multiplication
4. Division
1
Ok
Double-click to view


Message Box
Addition of 2 and 2 is 4
OK

d. Create an automation UiPath project using different types of variables (number, datetime, Boolean, generic, array, data table)

Code :

Step 1: Create a blank project and give it a meaningful name.

Step 2: Drag and drop the Sequence activity and give it a name.

Step 3: Create two variables named variable1 and variable2 of int32.

Step 4: Create another variable named Result of int32.

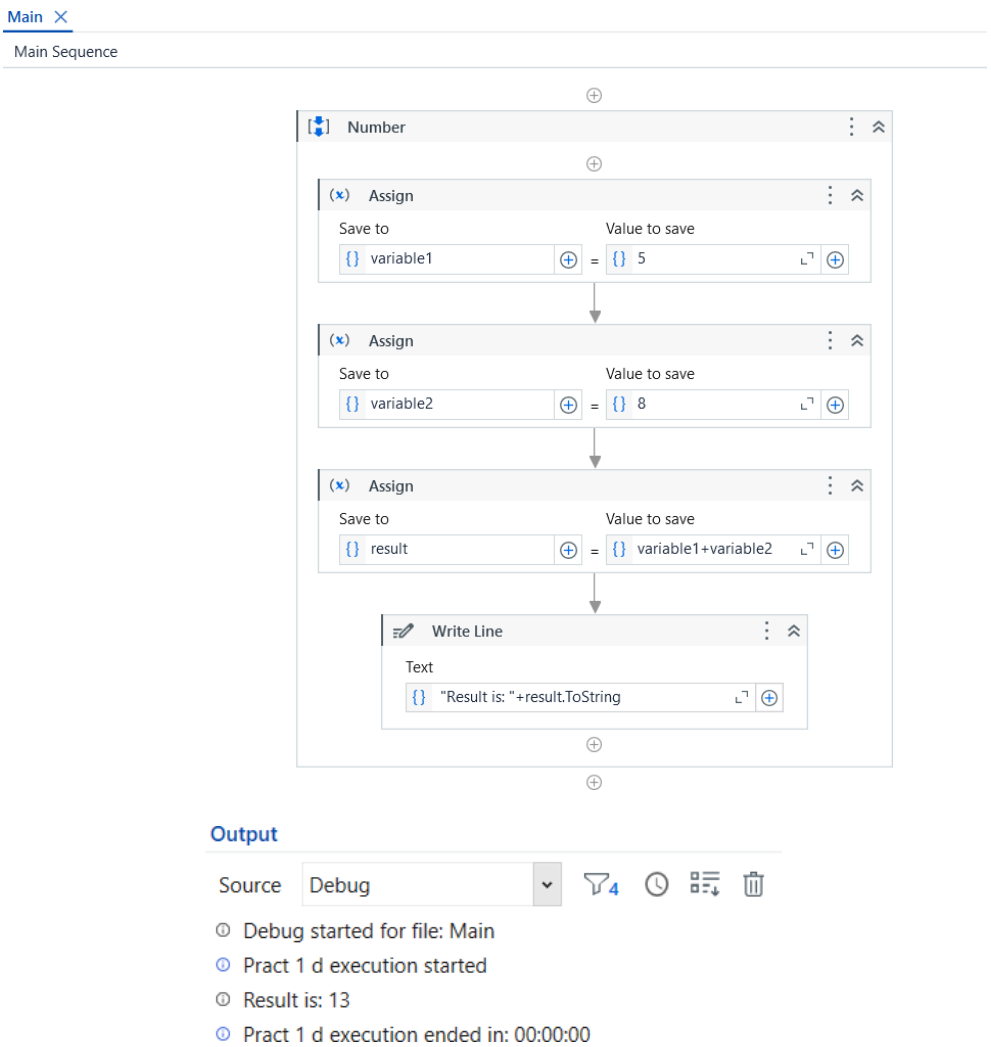
Step 5: Select the Assign activity and assign the variable1 as “5”.

Step 6: Select the Assign activity and assign the variable2 as “10”.

Step 7: Select the Assign activity and assign the Result as “variable1+variable2”.

Step 8: Select the Write Line activity and print the Result value.

Step 9: Run.



String:

Step 1: Create a blank project and give it a meaningful name.

Step 2: Drag and drop the Sequence activity and give it a name.

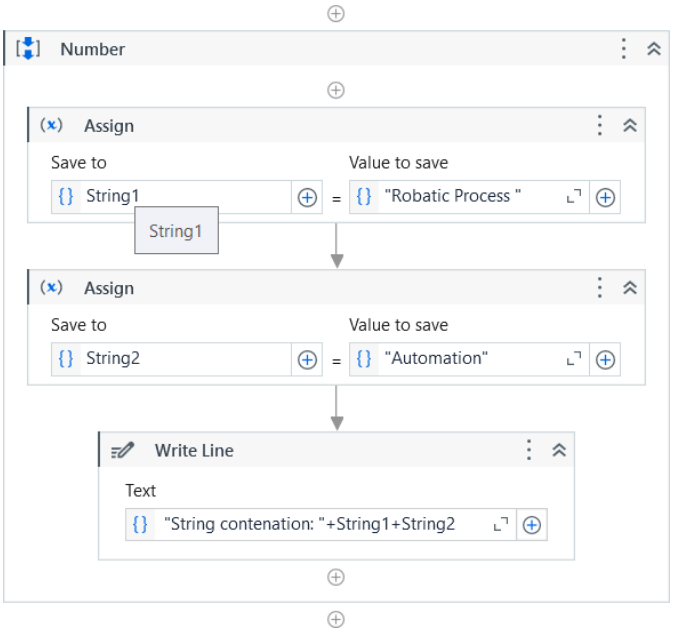
Step 3: Create two variables named String1 and String2 of String.

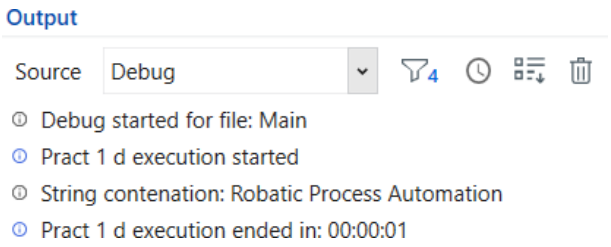
Step 4: Select the Assign activity and assign the String1 as “Robotic Process”.

Step 5: Select the Assign activity and assign the String2 as “Automation”.

Step 6: Select the Write Line activity and perform the concatenation method in it.

Step 7: Run.





DateTime:

Step 1: Create a blank project and give it a meaningful name.

Step 2: Drag and drop the Sequence activity and give it a name.

Step 3: Create a variables named Date1 of String.

Step 4: Select Assign activity and assign “Now.ToString” to the variable Date1.

Step 5: Select Write Line activity and Print the above.

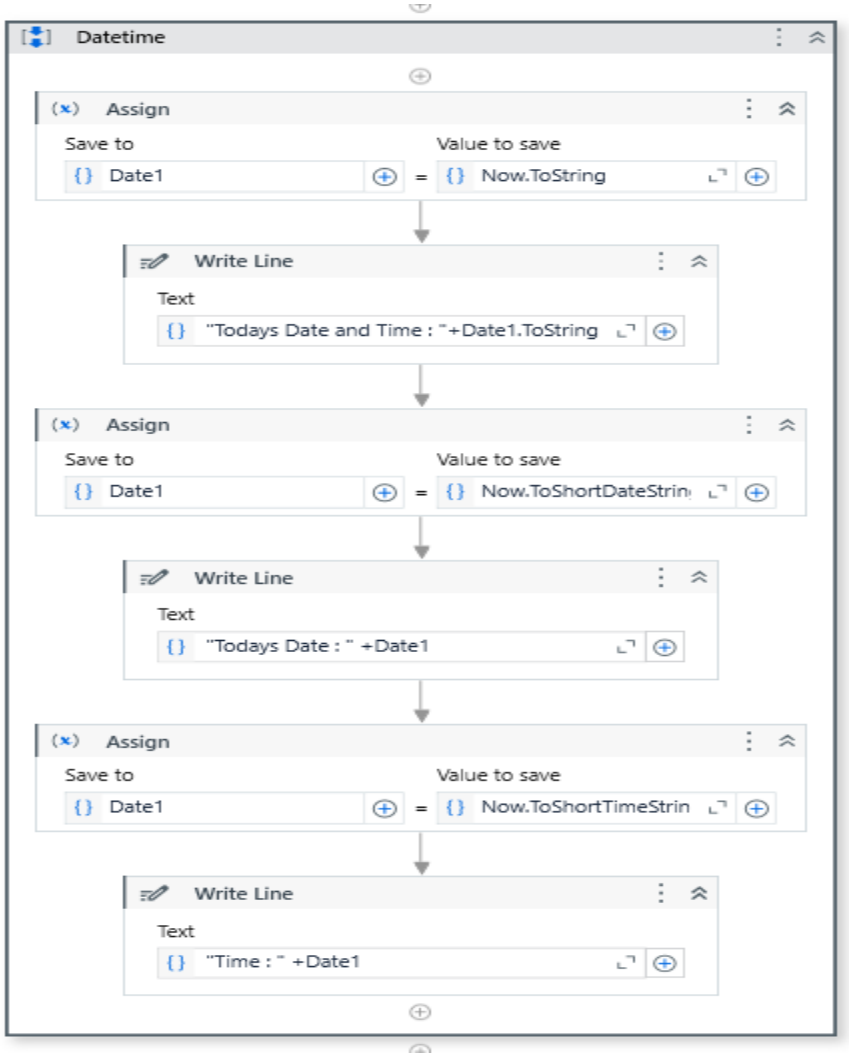
Step 6: Select Assign activity and assign “Now.ToShortDateString” to the variable Date1.

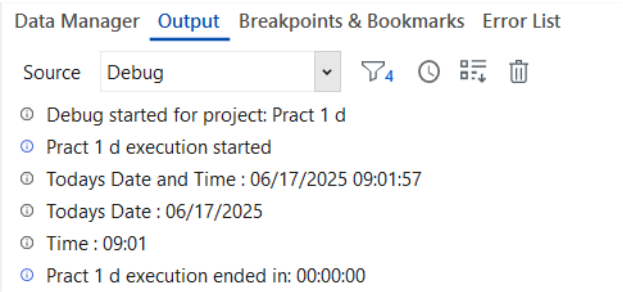
Step 7: Select Write Line activity and Print the above.

Step 8: Select Assign activity and assign “Now.ToShortTimeString” to the variable Date1.

Step 9: Select Write Line activity and Print the above.

Step 10: Run.





Practical 2 : Decision making and looping

a. **Consider an array of names. We have to find out how many of them start with the letter "a". Create an automation where the number of names starting with "a" is counted and the result is displayed.**

Code :

Step 1: Open uipath studio and give name to your project.

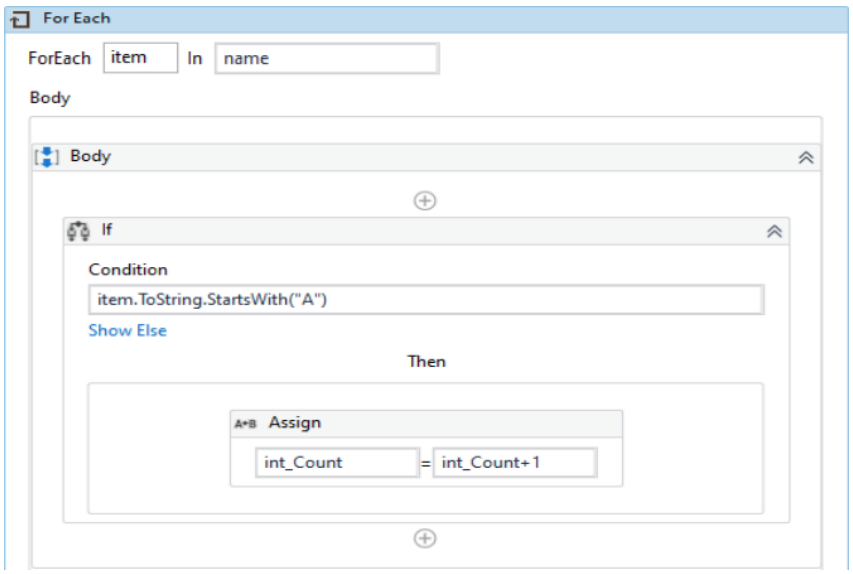
Step 2: Click on open main workflow. click on new and select sequence.

Step 3 : Select a flowchart and drag and drop multiple assign activity in it.

Step 4: Create 2 variables. One for storing the array of names and other for counting the number of names in array.

Step 5: Drag and drop for each activity

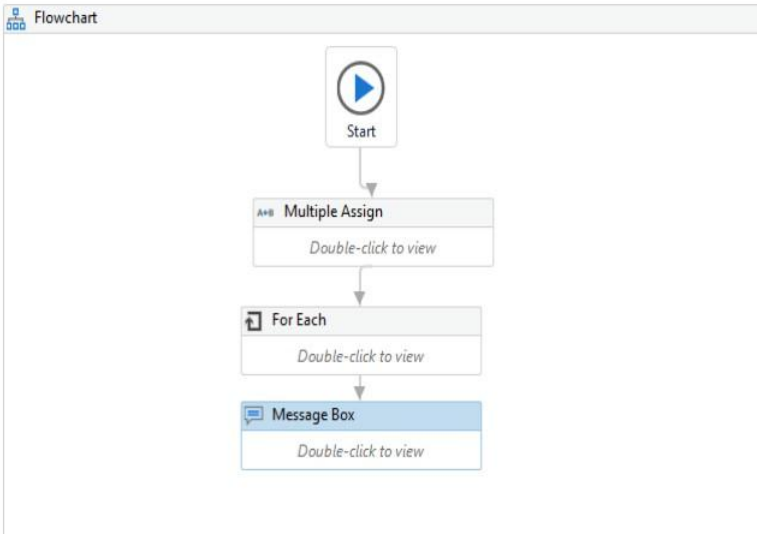
Step 6: Inside the body section of for each activity, drag and drop if activity and give the condition for counting the number of occurrence of character ‘a’.



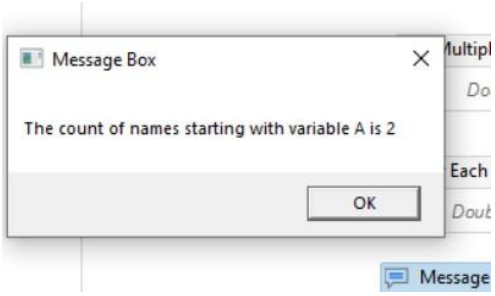
Step 7: Drag and drop a message box below for each activity. Enter the value to be displayed in the message box.

Output:

Flow of Activity



Result



b. Demonstrate switch statement with an example

The Switch activity The Switch activity can be used to make a choice. When we have various options available and want to execute one option, we frequently use the Switch activity. By default, the Switch activity takes an integer argument. If we want to take a desired argument, then we can change it from the Properties panel, from the TypeArgument list. The Switch activity is very useful in the categorization of data according to one's own choice.

Perform the following steps:

1. Add a Sequence activity.

2. Add an Input dialog activity inside the Sequence.

3. Now, create an integer type variable L.

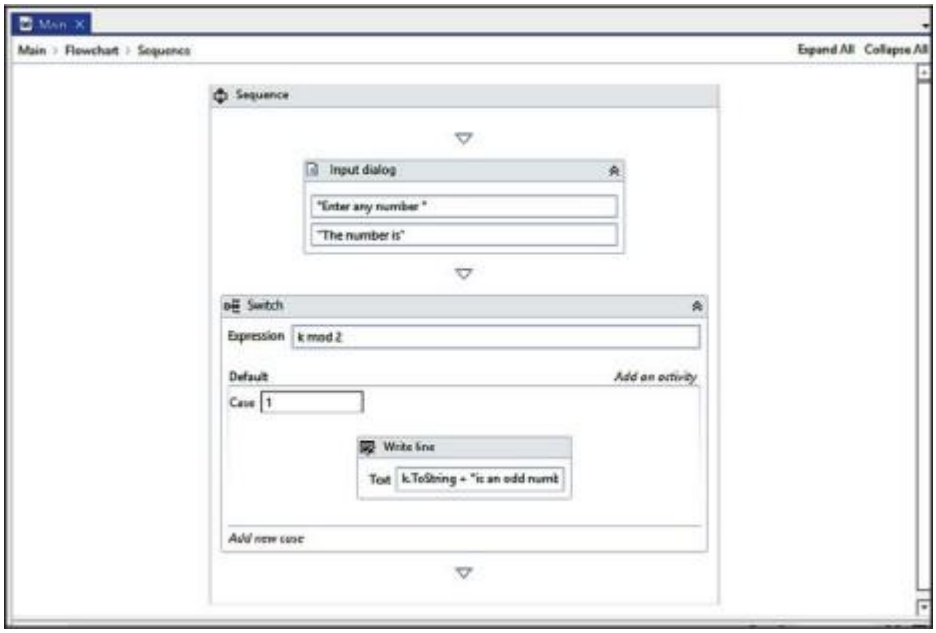
4. Specify the newly created variable's name in the Result property inside the Properties panel.

5. Add the Switch activity under the Input dialog activity.

6. In the Expression field, set LNPE to check whether the number is divisible by 2 or not.

7. Add a Write line activity to the Default section and type the L5P4USJOH JTBOFWFOOVNCFS in the text field.

8. Now, create Case 1, add the one other Write line activity to it, and type L5P4USJOH ——— JTBOPEEOVNCFS——————————————————————— in the text field:



e. Create an automation using Delay Activity between two writeline activities to separate their execution by 5 seconds

To better understand how the Delay activity works, let us see an example of an automation that writes two messages to the Output panel with a delay of 50 seconds.

Perform the following steps:

1. First, create a new Flowchart.

2. Add a Write line activity from the Activities panel and connect it to the Start node.

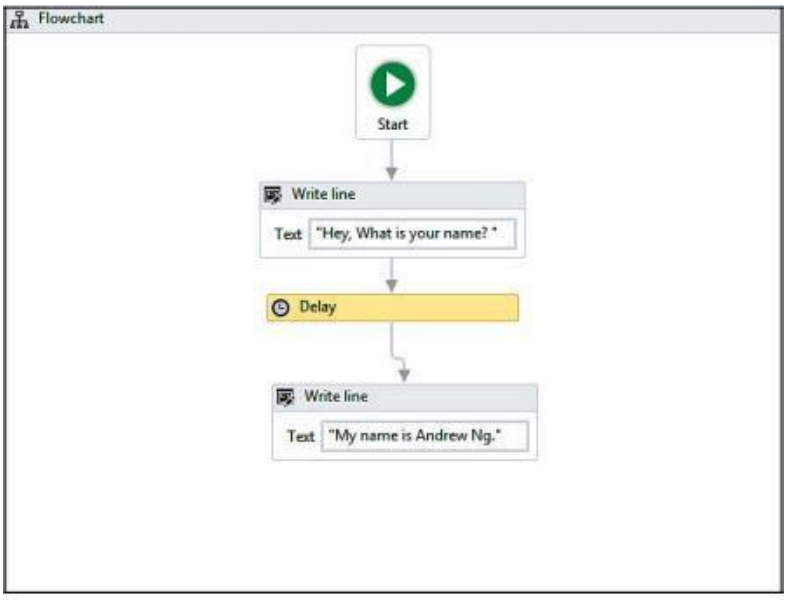
3. Select the Write line activity. Now, type the following text into the Text box:

“Hey, what is your name?”

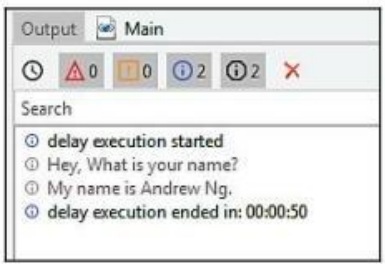
4. Next, add a Delay activity and connect it to the Write line activity.

5. Select the Delay activity and go to the Properties panel. In the Duration field, set 00:00:50. This is a 50-second delay between the two logged messages.

6. Take another Write line activity and connect it to the Delay activity. In the Text field, write “My name is Andrew Ng”:



7. After clicking on the Run button, the Output panel shows the message that delays it by 50 seconds:



f. Create an automation to demonstrate use of decision statements (if)

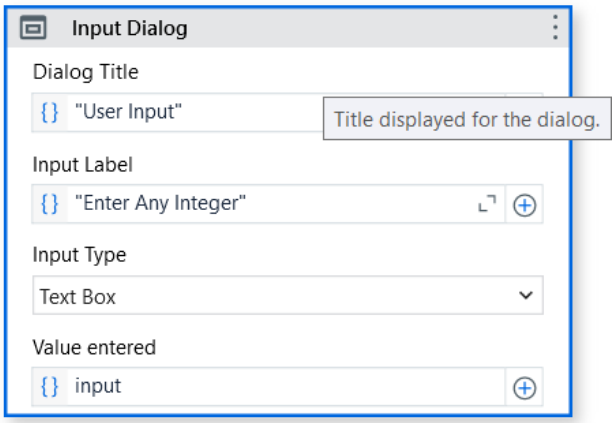
If-else Activity

Step 1: Create a blank project and give it a name.

Step 2: Drag and drop the Flowchart activity and give it a name.

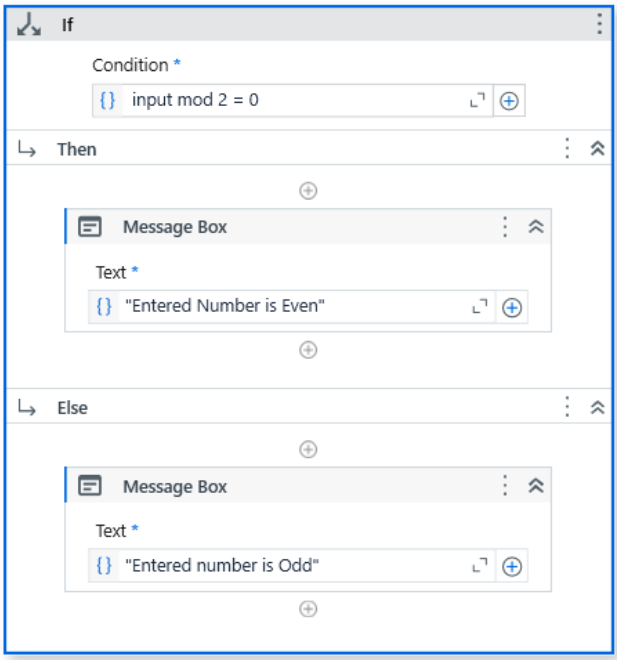
Step 3: Create a variable name for storing user input.

Step 4: Drag and drop input dialog box.



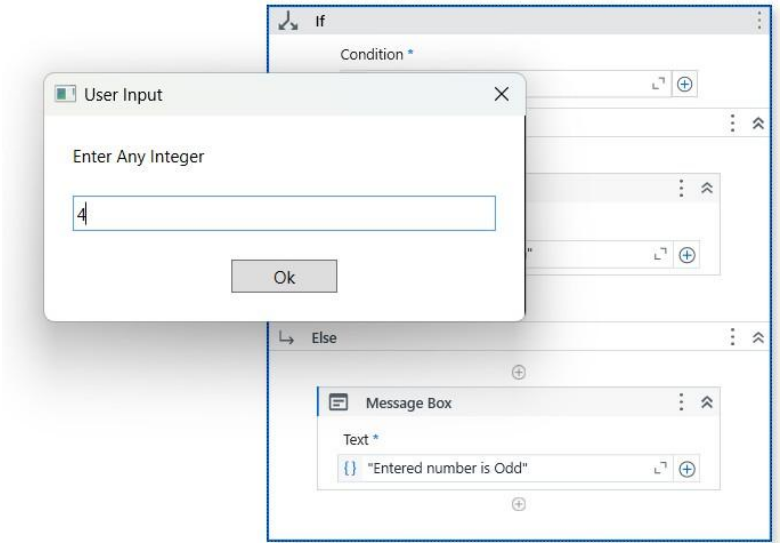
Step 5: Drag and drop if activity and give the condition.

Step 6: Drag and drop message box inside if activity for displaying the output.

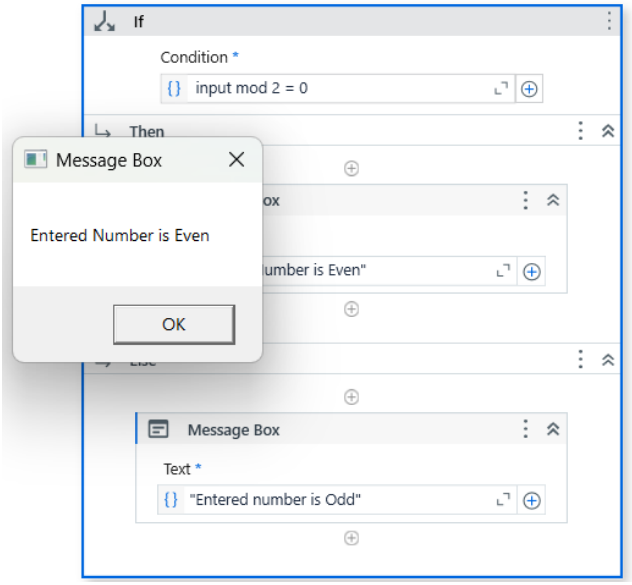


Step 8: Run.

Output:



Result of activity:

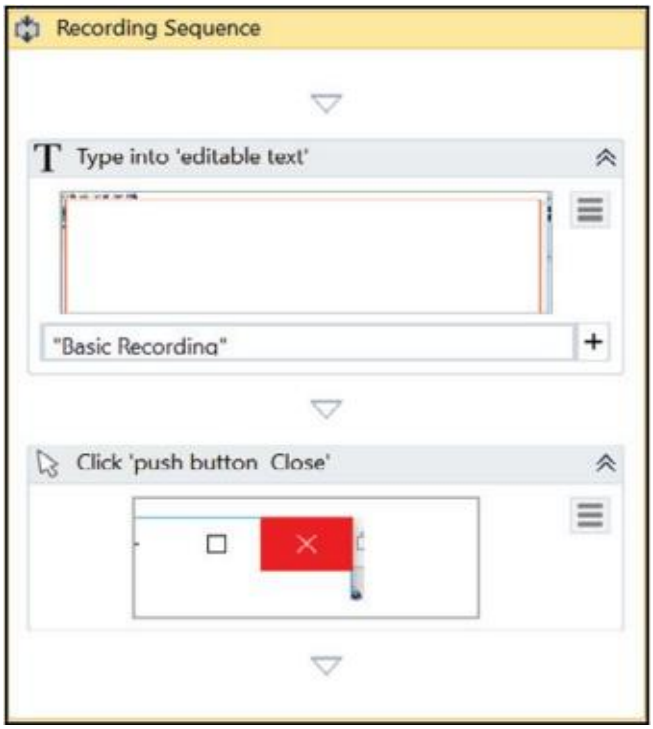


Practical 3 : Types of Recording:

a. Basic Recording using Toolbar

This is used to record the actions of applications that have a single window. Basic Recording uses a full Selector. It works better for applications performing a single action. It is not suitable for applications with multiple windows.

There are two types of selectors, partial selectors and full selectors. A Full selector has all the attribute to recognize a control or application. The Basic recording uses full selectors

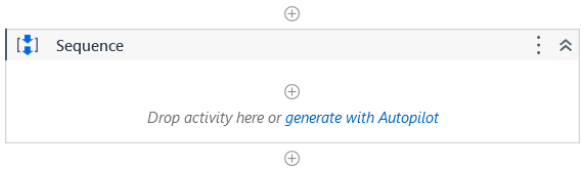


Please note that, in the preceding image that there are different activities but those activities are not wrapped inside containers, it is generated by Basic recorder. Basic recording generates different activities and places them directly in the sequence with full selector. You have already seen how to automate tasks using the Basic recorder; now, let us cover other recorders.

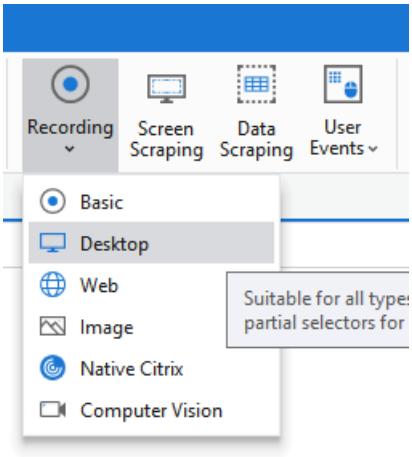
b. Basic Recording using Notepad

Steps:

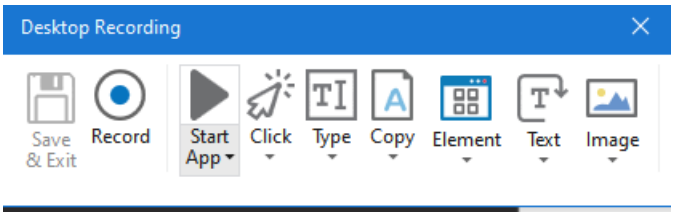
1. Create a new Blank Project and give it an appropriate name. Drag a Sequence activity from Activity tab.



2. Select Desktop Recording under Recording.



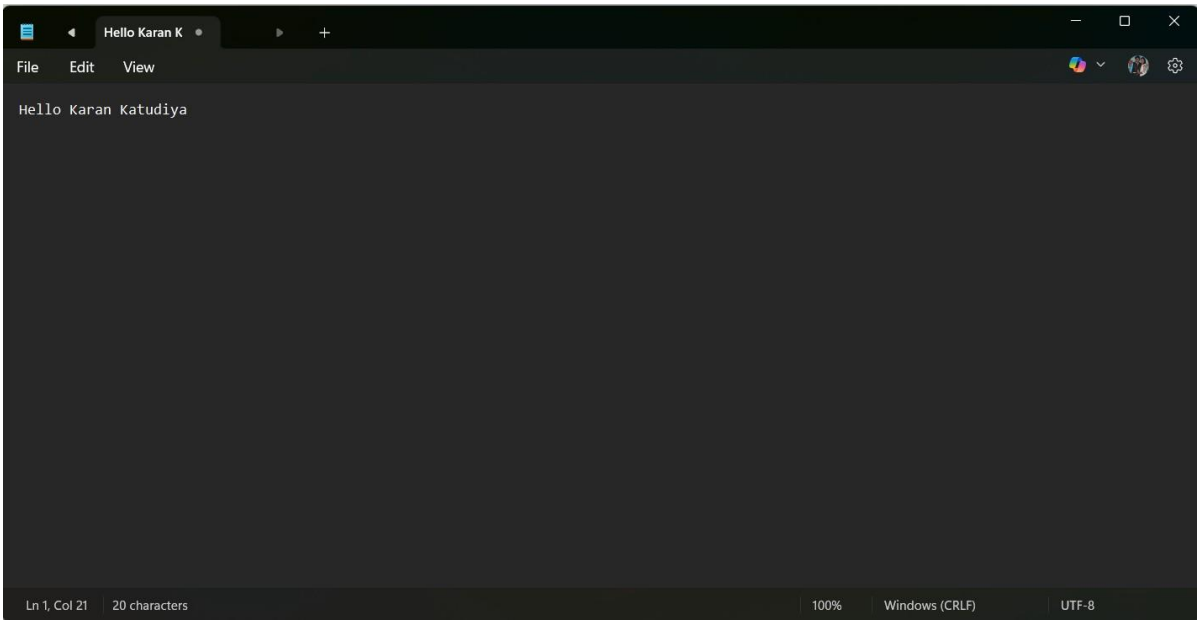
3. Open a new notepad, then on desktop recording click on open application and select notepad then click ok on the prompt that appears



4. Start recording by clicking on record button in recording panel, then click in the text area of notepad.

5. In the type into prompt enter the text you want to be typed.

Output:

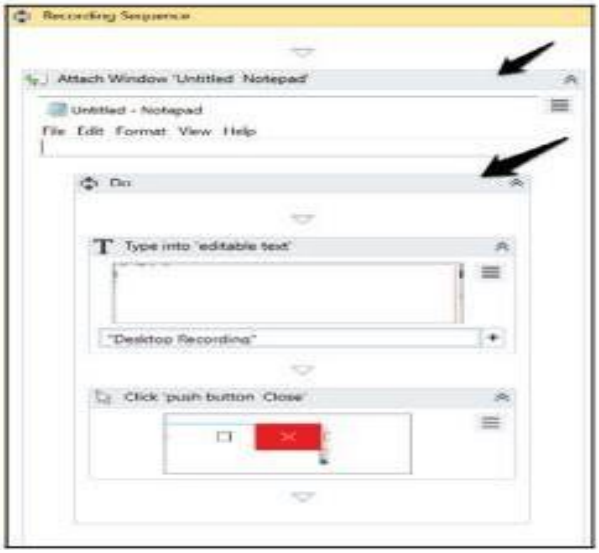


c. Desktop Recording using Tool bar

This is similar to Basic recording with the added advantage of working with multiple actions. It is most suitable for automating Desktop applications. Desktop recorder generates Partial selectors. The Partial selectors, have a hierarchical structure. They are split into parent child views for recognizing the UI element properly.

Please note in the preceding image there is a Attach Window activities and other activities are nested under it. This flow is generated Desktop recorder:

Output:



d. Desktop Recording by creating a workflow

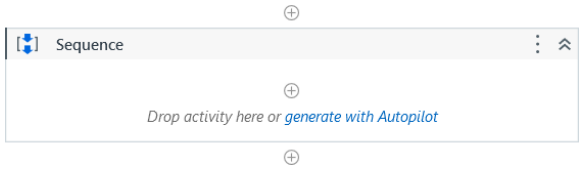
Use "double Ui" and automate stuff (Scrape Text, Input Text, Click Button)

Insert the data from the following excel file.

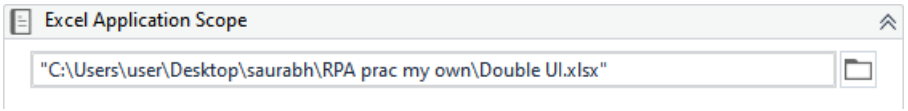
A	B	C	D	E	F	G
Sr no.	Cash In	Check_1	Check_2	Total	Transactic	Status
1	100	200	400			
2	200	300	600			
3	300	400	800			
4	400	500	1000			
5	500	600	1200			
6	600	700	1400			
7	700	800	1600			
8	800	900	1800			

Steps:

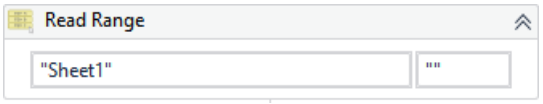
1. Create a new Blank Project and give it an appropriate name. Drag a Sequence activity from Activity tab.

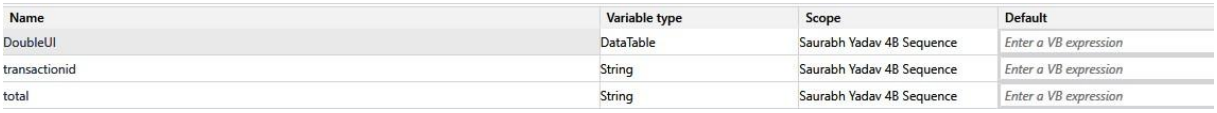


2. Add Excel Application Scope Activity and enter the path of the excel file.



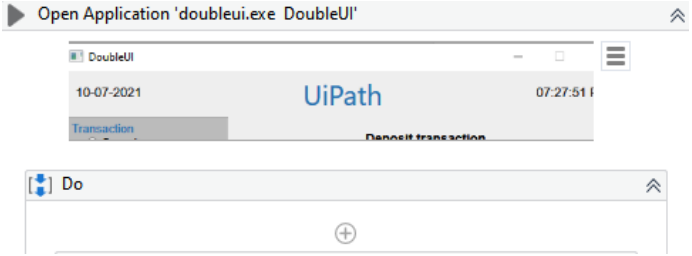
3. Add Read Range and create a DataTable to store the data that will be read by read range.





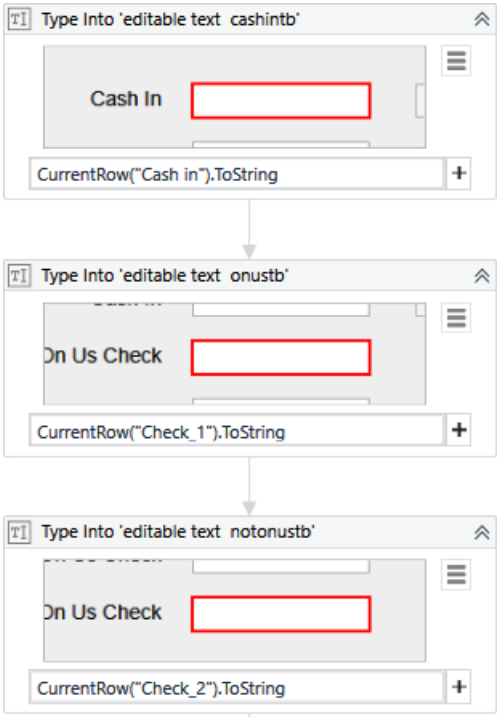
Name	Variable type	Scope	Default
DoubleUI	DataTable	Saurabh Yadav 4B Sequence	Enter a VB expression
transactionid	String	Saurabh Yadav 4B Sequence	Enter a VB expression
total	String	Saurabh Yadav 4B Sequence	Enter a VB expression

4. Add Open Application activity, start Double UI then click on “Indicate window on screen” option and select Double UI.

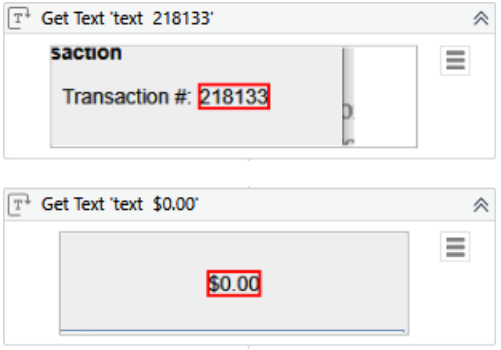


5. Add For each row in DataTable activity and iterate over DoubleUI datatable.

6. Add three type into activity in the for each activity. Indicate to the three textboxes in the Double UI app. Enter the DataTable element you wan to enter in the Text attribute.

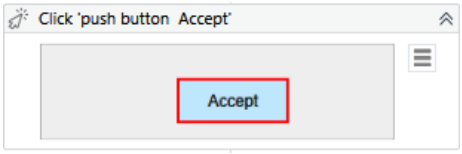


7. Add two get text activities and create two variables to store the transaction is andtotal. Indicate these elements to the Get text activities.

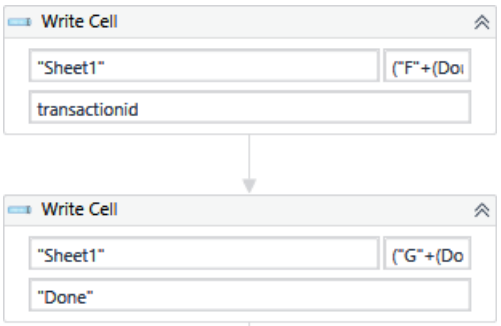


In case of Total remove the name attribute from the Edit Selector.

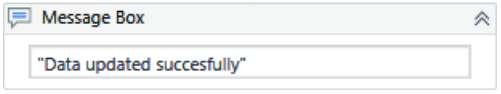
8. Add Click activity and indicate to Accept Button in Double UI.



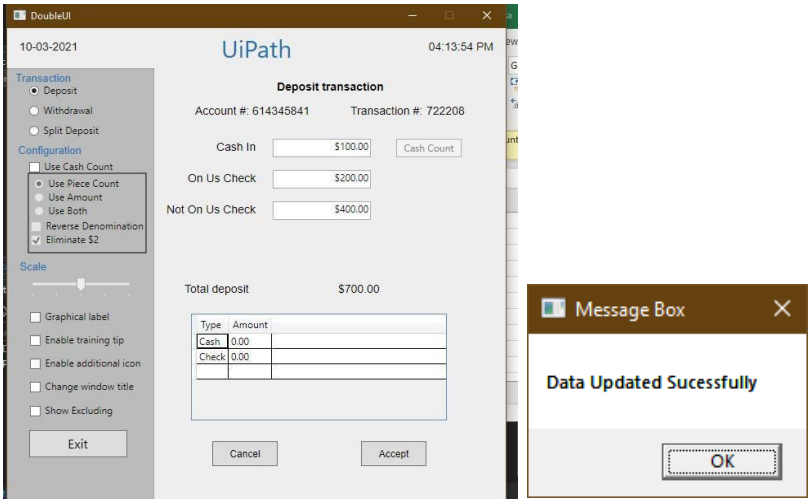
9. Add three Write Cell Activities to enter the transaction id and total and to Update the status column. ("E"+(DoubleUI.Rows.IndexOf(CurrentRow)+2).ToString)



10. Finally add a Message Box to print the success of the updation of Excel file.



Output:

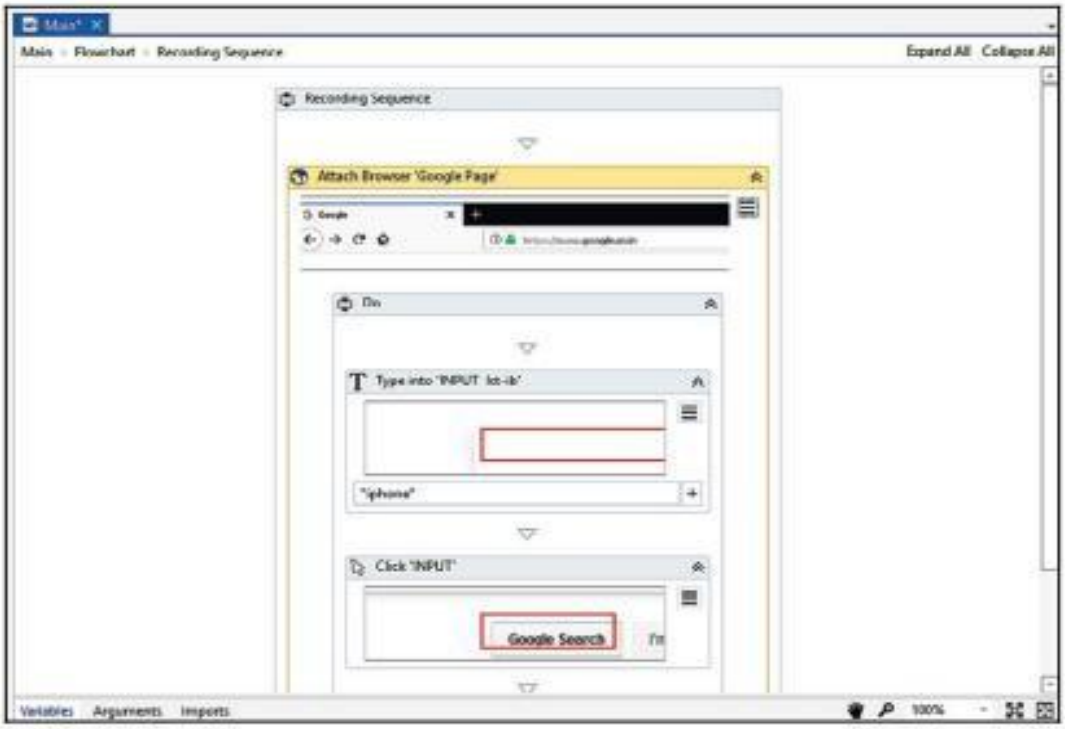


	A	B	C	D	E	F	G
1	Sr no.	Cash In	Check_1	Check_2	Total	Transactic	Status
2	1	100	200	400	700	722208	Done
3	2	200	300	600	1100	722209	Done
4	3	300	400	800	1500	722210	Done
5	4	400	500	1000	1900	722211	Done
6	5	500	600	1200	2300	722212	Done
7	6	600	700	1400	2700	722213	Done
8	7	700	800	1600	3100	722214	Done
9	8	800	900	1800	3500	722215	Done

e. Web Recording e.g. Find the rating of the movie from imdb web site

Web Recording can be done by using the Web recorder. For recording web actions, the UiPath extension for that browser should be installed. Otherwise, you will not able to automate tasks or actions using Web recording. You just have to click on the Setup icon and then click on Setup Extensions. Now, choose your browser and click on it. The UiPath extension will be added to your specified browser. Web Recording is similar to Desktop Recording. You just have to record the actions and save it.

Create a Blank project. Drag and drop a Flowchart activity. Now, click on the Recording icon and choose Web recording. You can record your actions on the web on your own and then save it. In our case, we have opened a web page using Google Chrome and logged in to www.google.com Then, we started the recording by clicking on the Record button of the web recorder. Next, we typed some text in the search bar of Google and performed the Click activity. Then, we pressed the Esc key to exit the recording and clicked on the Save and Exit button. Now, a recording sequence is generated in our Designer panel. Connect this sequence to the Start node. Hit the Run button to see the result. In the following screenshot, you can see the sequence generated by the Web recorder:



Before running the UiPath workflow, make sure you are on the Google homepage.

We have seen Web recording and it is very easy. There is also another option to extract information from websites.

We can easily extract information from websites using data scraping.

Suppose we want to extract data from Amazon's website. Say we want to search for books on Amazon and extract the search results. Extracting data from websites becomes very easy with data scraping:

1. Create a blank project and give it a meaningful name. Click Create.

2. Log on to Amazon's website and search for books. A detailed list of books is listed on your screen:

3. Drag and drop a Flowchart activity on the Designer panel. Now, click on the Data Scraping icon. A window will pop up.

4. Click on the Next button.

5. You have to indicate the first book's entities. Entities can be name, price, author, and so on. It is your choice.

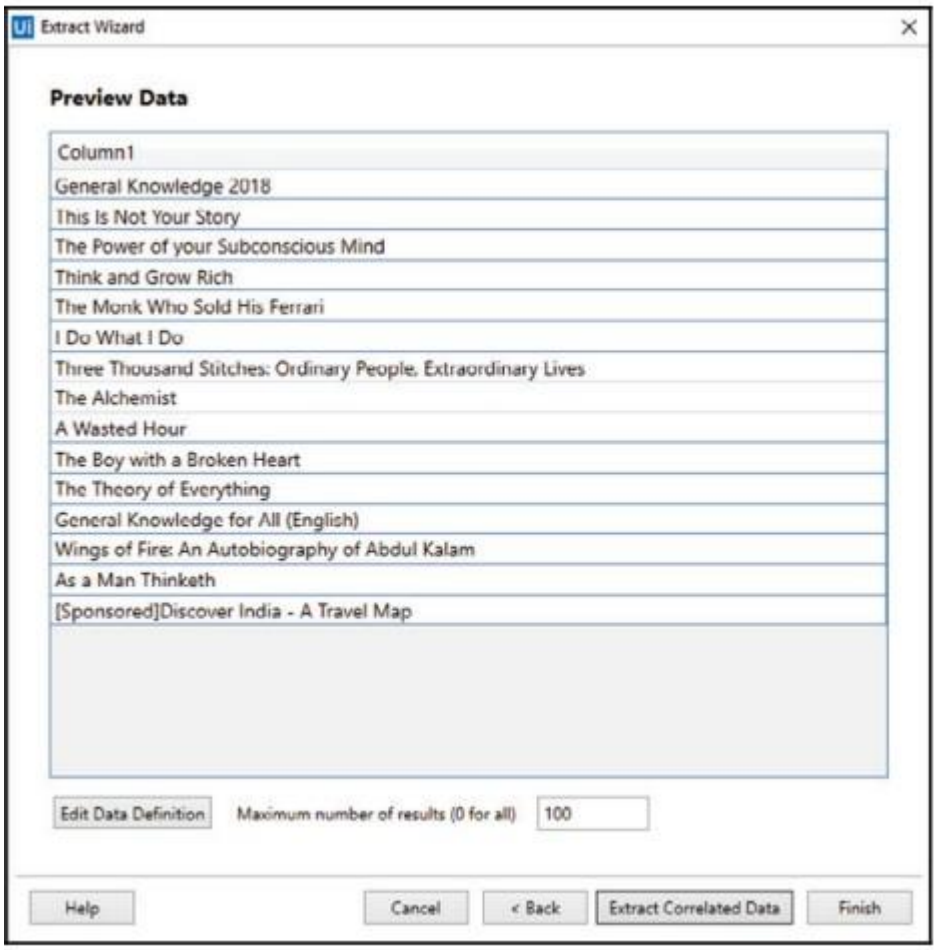
6. Lets's, indicate the book's name. After that, it will ask for the next book's entities. Indicate the second book entity as well. Click on Next.

7. This means you have to indicate the second book's entities: however, the entities will be the same. If you choose name as the first book's entity then you have to be specific and choose name as the second book's entity. You should not choose name as the first book's entity and then choose price as the second book's entity.

8. Again, a window will pop up asking you to configure the columns. You can also extract the URL. If you want to do this, check the Extract URL checkbox.

9. You can specify the column name as well. Click on the Next button.

10. As you can see, all the book names are extracted to a window. If you want to extract more columns or more entities, then click on Extract Correlated Data and you have to again indicate another entity of the book to extract more columns, as we have done previously. After that, all the data will be extracted and will be added to this table. Here, we have one column but if you extract more entities, then more columns will be added to this table:



11. Click on the Finish button. If the results of your query span multiple pages, it will ask you to indicate the page navigation link on the website (Next button of the website that we used to navigate to another/next page). If the results of your query span multiple pages, click on the Yes button and indicate the link, otherwise click on the No button.

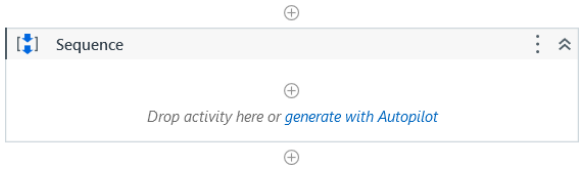
12. We have clicked on the No button. A data scraping sequence is generated in our Flowchart. It will also generate a data table. You can retrieve the information from the data table

f. Web Recording manually

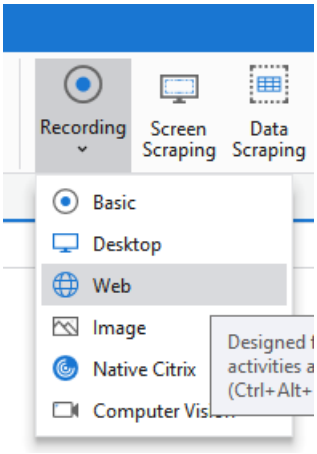
Use "google.com" and automate stuff (Scrape Text, Input Text, Click Button)

Steps:

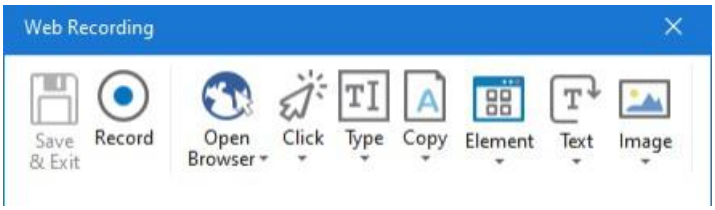
1. Create a new Blank Project and give it an appropriate name. Drag a Sequence activity from Activity tab.



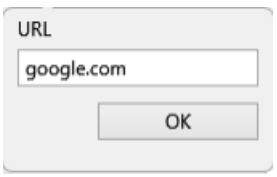
2. Select web recording under the recording option.



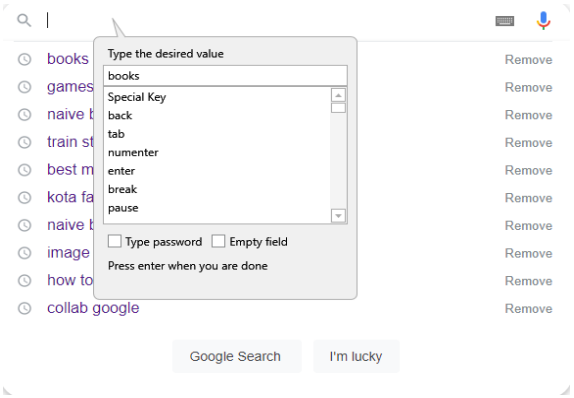
3. Open a Chrome window and from the web recording dialog select open browser and click on the Chrome window.

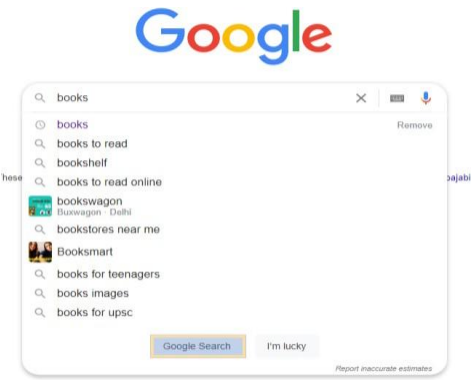


4. In the url dialog enter google.com and press enter.

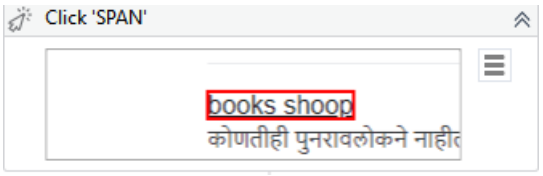


5. Now start recording by clicking on Record and click on the search button. Type the desired search and click on the Google search button. The press Esc.

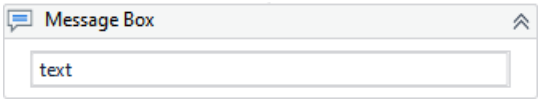


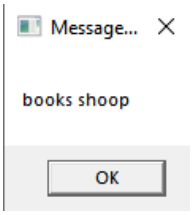


6. Now press save and exit. Add get text activity and select the text you want to scrape.



7. Add message box to print scrapped text.





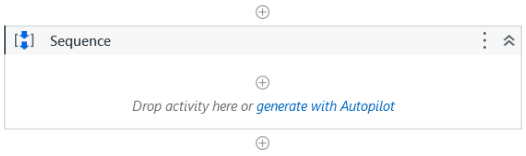
Practical 4 : Excel Automation

a. Automate the process to extract data from an excel file into a data table and vice versa

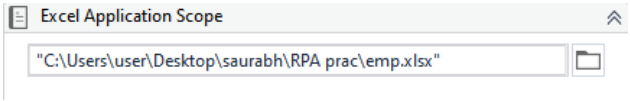
Emp_Id	F_name	L_name	Salary	Expenses	Saving
1001	Saurabh	Yadav	100000	10000	90000
1002	Pankaj	Gavali	200000	20000	180000
1003	Bharat	Bhagat	300000	30000	270000
1004	Virat	Kohli	400000	40000	360000
1005	Mahendra	Dhoni	500000	50000	450000
106	Raju	Pal	60000	1500	58500
107	Mihir	Gandhi	70000	9600	60400

Step:

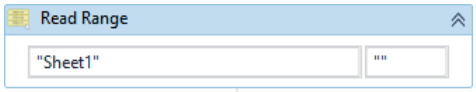
1. Start project with sequence.

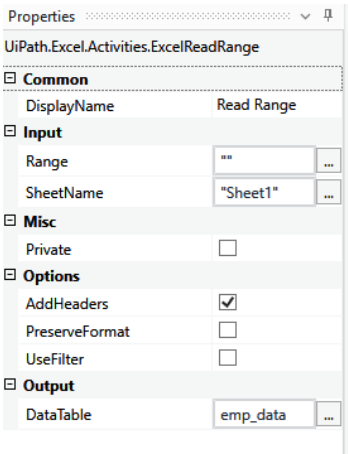


2. Add “Excel Application Scope” and enter the path of excel file

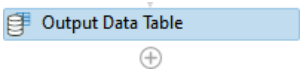


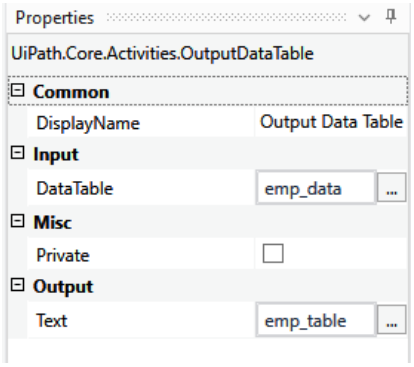
3. Inside body add “Read Range” variable name and datatype as datatable(emp_data) and range to extract data from excel (blank means entire sheet)



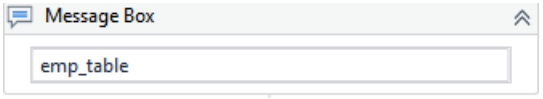


4. Add “Output Data Table” input as “emp_data” output as “emp_table”.

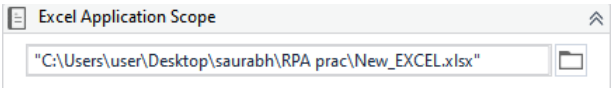




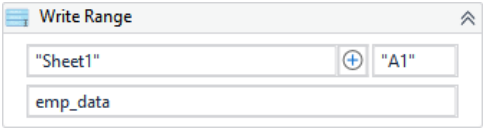
5. "Message Box" to print the result adding variable "emp_table" (here extracted data will be printed).



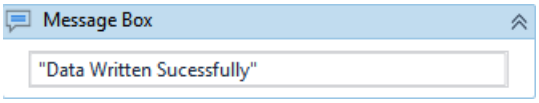
6. Insert "excel application scope" and new excel sheet path



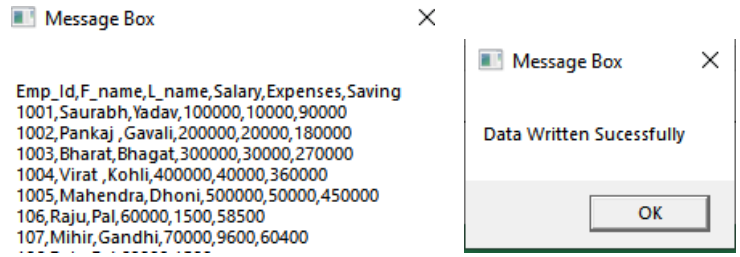
7. Insert "Write Range" range from where the data should be pasted and variable "emp_data".



8. Message Box to print confirmation.



Output :



	A	B	C	D	E	F	G
1	1001	Saurabh	Yadav	100000	10000	90000	
2	1002	Pankaj	Gavali	200000	20000	180000	
3	1003	Bharat	Bhagat	300000	30000	270000	
4	1004	Virat	Kohli	400000	40000	360000	
5	1005	Mahendra	Dhoni	500000	50000	450000	
6	106	Raju	Pal	60000	1500	58500	
7	107	Mihir	Gandhi	70000	9600	60400	
8	106	Raju	Pal	60000	1500		
9	107	Mihir	Gandhi	70000	9600		
10							

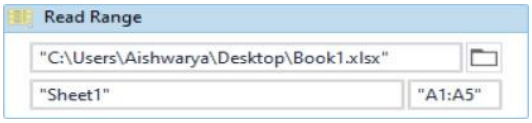
b,c,d . Create an application automating the read, write and append operation on excel file.

c. Read cell:

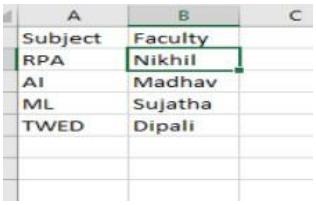
Step 1 : Drag and drop a flowchart activity.

Step 2: Drag and drop read range activity.

Step 3: Specify the path of excel sheet, sheet name as well as the range of cells to read.



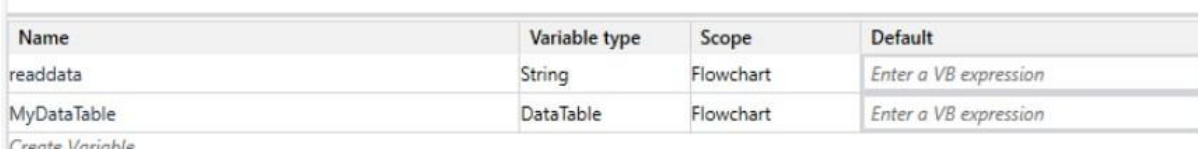
Value in excel:



	A	B	C
	Subject	Faculty	
	RPA	Nikhil	
	AI	Madhav	
	ML	Sujatha	
	TWED	Dipali	

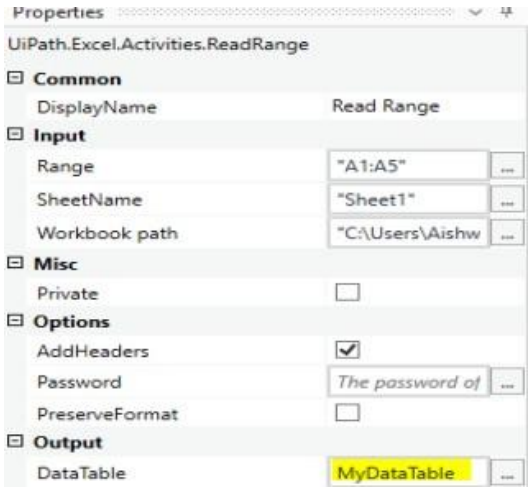
Step 4: Create a variable of type “string” to hold the read data.

Step 5: Create a datatable variable “MyDataTable” of DataTable type.



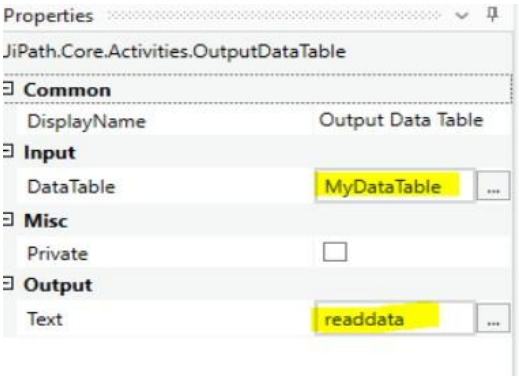
Name	Variable type	Scope	Default
readdata	String	Flowchart	Enter a VB expression
MyDataTable	DataTable	Flowchart	Enter a VB expression

Step 6: Set the output of Read Range activity to MyDataTable



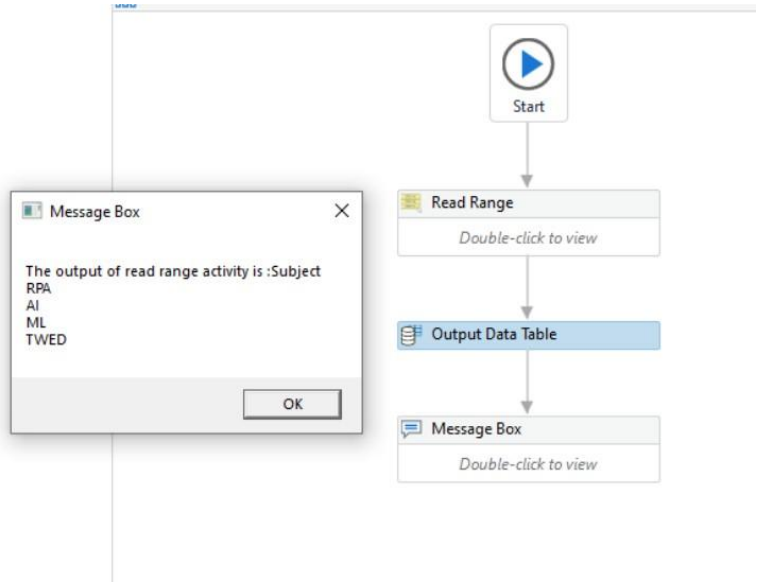
Step 7: Drag and drop Output Data table activity

Step 8: Select the Activity Output Data Table and set its input to “mydatatable” and output to “result”



Step 9: Select Message Box activity and configure it to display the “Result” variable contents.

Step 10: Run the file.



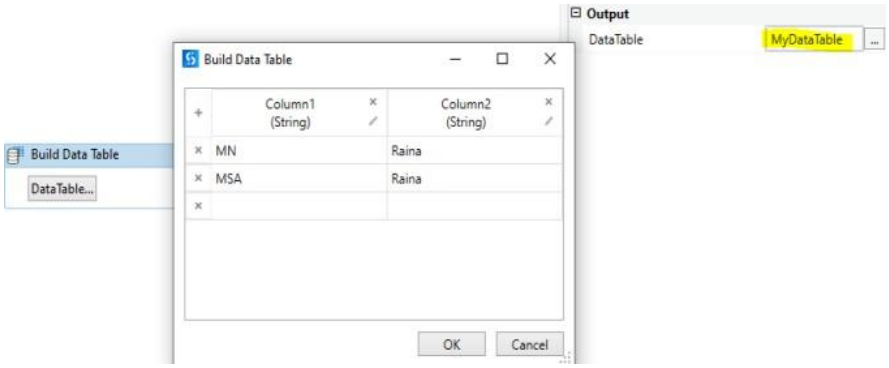
b. Write cell:

Step 1 : Drag and drop a flowchart activity.

Step 2: Select activity “Build Data Table” and enter some data into it

Step 3: Create a data table variable MyDataTable MyDataTable of DataTable type

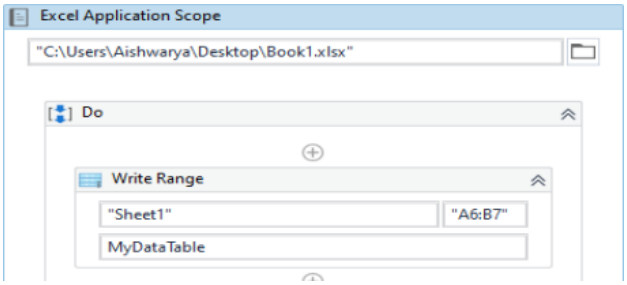
Step 4: Set the output of Build Data Table activity to MyDataTable



Step 5: Select Excel Application Scope .Specify the path of the excel sheet

Step 6: Select Write Range Activity.

Step 7: Specify the sheet name and range of cells to write Step 8: Set the data table value to MyDataTable



Step 9: Run

Output:

	A	B
1	Subject	Faculty
2	RPA	Nikhil
3	AI	Madhav
4	ML	Sujatha
5	TWED	Dipali
6	MN	Raina
7	MSA	Raina

d. Append range:

Step 1 : Drag and drop a flowchart activity.

Step 2: Select activity “Build Data Table” and enter some data into it

Step 3: Create a data table variable MyDataTable MyDataTable of DataTable type

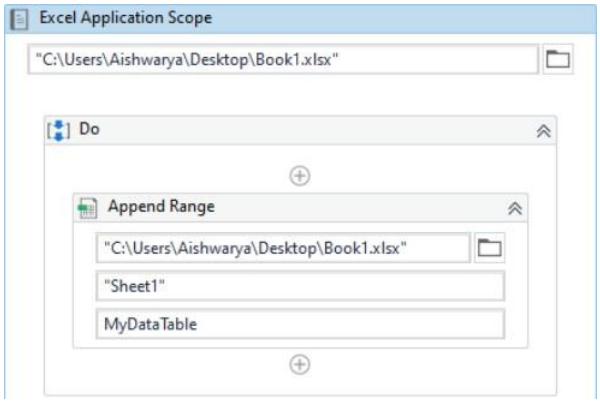
Step 4: Set the output of Build Data Table activity to MyDataTable

Step 5: Select Excel Application Scope .Specify the path of the excel sheet

Step 6: Select Append Range Activity.

Step 7: Specify the sheet name and range of cells to write

Step 8: Set the data table value to MyDataTable



Step 9: Run

Output:

A	B
Subject	Faculty
RPA	Nikhil
AI	Madhav
ML	Sujatha
TWED	Dipali
MN	Raina
MSA	Raina
MN	Raina
MSA	Raina

Practical 5 : Different controls in UiPath

a. Implement the attach window activity.

Step 1. Create a blank project and give it a meaningful name.

Step 2: Drag and drop a Sequence activity on the Designer panel. Also, drag and drop a Click activity inside the Designer panel.

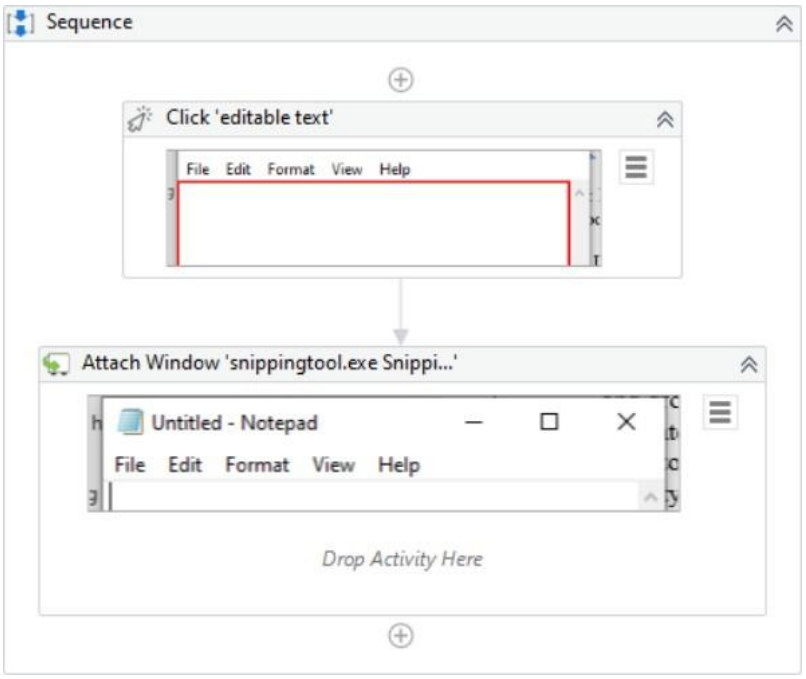
Step 3 : Open a notepad

Step 4: Double-click on the Click activity and then click on Indicate on screen. Locate the Notepad icon.

Step 5: Drag and drop the Attach Window activity on the main Designer panel.

Step 6: Double-click on the Attach Window activity. Click on Click Window on Screen and indicate the Notepad window

Output:



b. Automate using Anchor Base

This control is used for locating the UI element by looking at the UI element next to it. This activity is used when we have no control over the selector. That means when we do not have a reliable selector, then we should use the Anchor base control to locate the UI element.

We can use the Anchor base control as explained in the following section:

1. Drag and drop a Flowchart activity on the Designer panel of a blank project. Also, drag and drop an Anchor base control from the Activities panel. Connect the Anchor base control with Start.

2. Double-click on the Anchor base control:

3. There are two activities that we have to supply to the Anchor base control: Anchor and action activities.

4. Drag and drop the Anchor base activity (for example; Find Element activity) in the Anchor field and Action activity (for example; Type into) in the Drop Action Activity Here field of the Anchor base control.

The Anchor base activity will find the relative element nearby the element on which you want to perform the Action, and the Action activity will perform the appropriate action that you have specified

c. Automate using Element Exists.

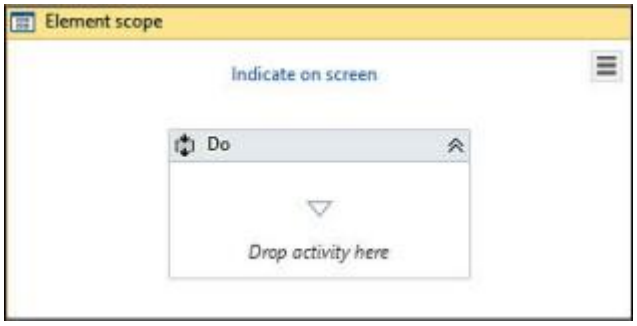
This control is used to check the availability of the UI element. It checks if the UI element Exists or not. It also returns a Boolean result if the UI Element Exists, then it returns true: otherwise, it returns false.

You can use this control to check for the UI element. In fact, it is good practice to use this control for UI elements whose availability is not confirmed or those that change frequently

Just drag and drop the Element Exists control from the Activities panel. Double-click on it. You can see there is an Indicate on screen option. Click on it to indicate the UI element. It returns a Boolean result, which you can retrieve later from the Exists property. You just have to supply a Boolean variable in the Exists property in the Properties panel.

Element scope

This control is used to attach a UI element and perform multiple actions on it. You can use a bunch of actions within a single UI element. Drag and drop the Element scope control and double-click on this control:

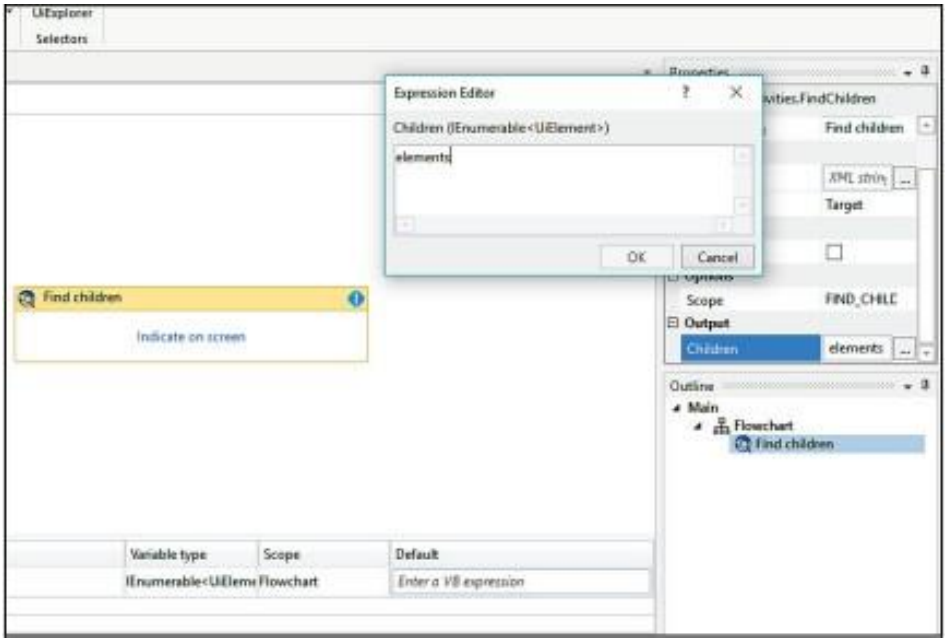


You can clearly see that you have to indicate the UI element by clicking on Indicate on screen and specifying all the actions that you want to perform in the Do sequence. You can add many activities inside the Do sequence.

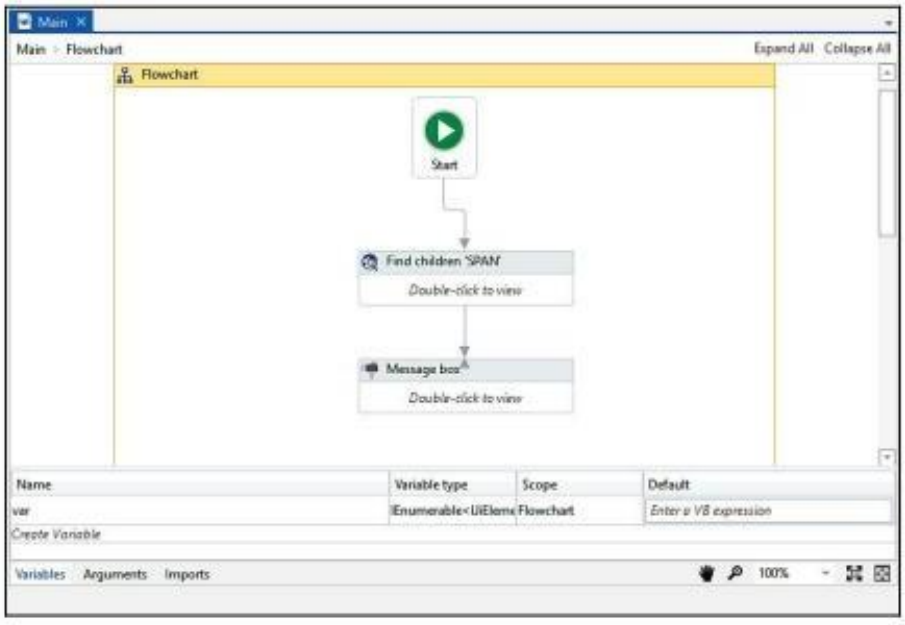
d. Automate using Find Children control

This control is used to find all the children UI elements of a specified UI element. It also retrieves a collection of children UI elements. You can use a loop to inspect all the children UI elements or set up some filter criteria to filter out the UI elements.

Drag and drop the Find children control from the Activities panel. Double-click on it to indicate the UI element that you want to specify. You can indicate it by clicking on Indicate on screen:



You have to supply a variable of type *&OVNFSBCMF-6*&MFNFOUT in the children property, as mentioned in the preceding screenshot. This variable is then used for retrieving the UI elements:



Find element

This control is used to find a particular UI element. It waits for that UI element to appear on the screen and returns it back.

You can use this control in the same way that you used the other controls. Just drag and drop this control, and indicate the UI element by clicking on Indicate on screen.

You can specify the variable of type UI element in the Found element property of the Find Element control to receive the UI element as output.

Find relative element

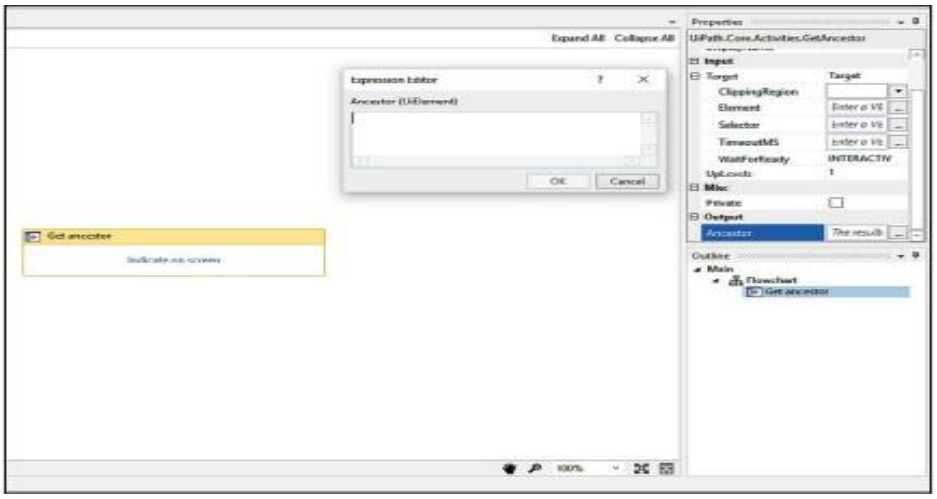
This control is similar to the Find element control. The only difference is that it uses the relative fixed UI element to recognize the UI element properly. This control can be used in scenarios where a reliable selector is not present. Just drag and drop this control, and indicate the UI element by clicking on Indicate on screen. You can also look for its selector property after indicating the UI element for better analysis.

e. Use Get Ancestor control

Get ancestor

This control is used to retrieve the ancestor of the specified UI element. You have to supply a variable to receive the ancestor element as output. You can specify the variable name in the Ancestor property of the Get ancestor control.

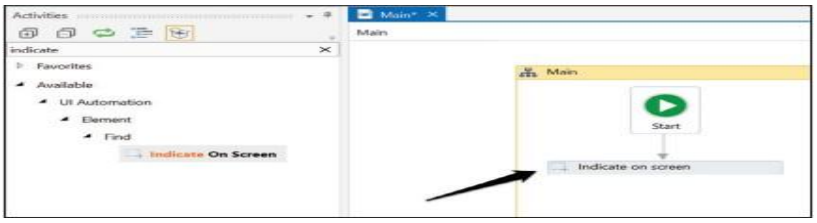
After receiving the ancestor element, you can retrieve its attributes, properties, and so on for further analysis.



Just drag and drop this control and indicate the UI element by clicking on Indicate on screen.

Indicate on screen

This control is used to indicate and select the UI element or region at runtime. It gives flexibility to indicate and select the UI element or region while running the workflow. You just have to drag and drop this control in your project:



Do not confuse this with Indicate on screen written inside any activity like Type into. In previous examples, we have used Indicate on screen inside various controls (as shown in the following screenshot). This button is used to locate the region or UI element before the execution of the workflow, while the Indicate on screen control executes its process after the execution of the workflow:

Practical 6 : Keyboard and Mouse Events

a. Demonstrate the following activities in UiPath:

i. Mouse (click, double click and hover)

ii. Type into

iii. Type Secure text

.i. Mouse (click, double click and hover)

1. Click Activity

Step 1: Go to uipath studio

Step 2: Click on Workflow and Drag Flow Chart from Activities panal.

Step 3: Double Click on FlowChart.

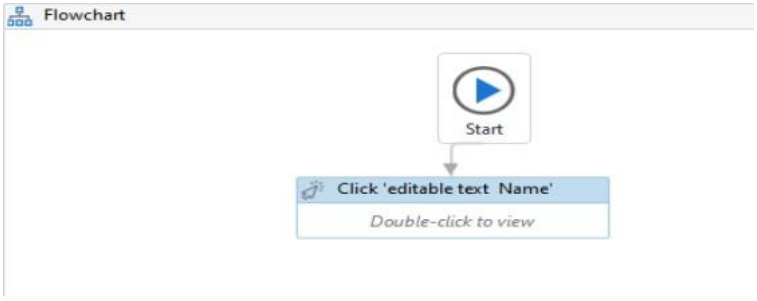
Step 4 : Drag and drop the Click activity

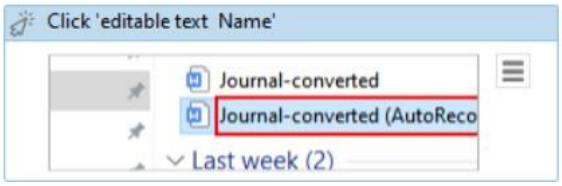
Step 5: Double click on click activity.

Step 6: Click on indicate on screen and indicate the UI element you want to click on.

Step 7: Now click on run.

Output:





2. Double Click Activity

Step 1: Go to uipath studio

Step 2: Click on Workflow and Drag Flow Chart from Activities panal.

Step 3: Double Click on FlowChart.

Step 4 : Drag and drop the Double Click activity

Step 5: Double click on double click activity.

Step 6: Click on indicate on screen and indicate the UI element you want to click on.

Step 7: Now click on run.

Output:

3. Hover Activity

Step 1: Go to uipath studio

Step 2: Click on Workflow and Drag Flow Chart from Activities panal.

Step 3: Double Click on FlowChart.

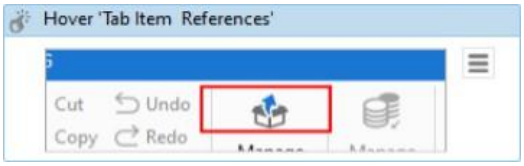
Step 4 : Drag and drop the Hover activity

Step 5: Double click on hover activity.

Step 6: Click on indicate on screen and indicate the UI element you want to click on.

Step 7: Now click on run.

Output:



ii Type into

Step1: Add a new sequence and name it as Type into Activity

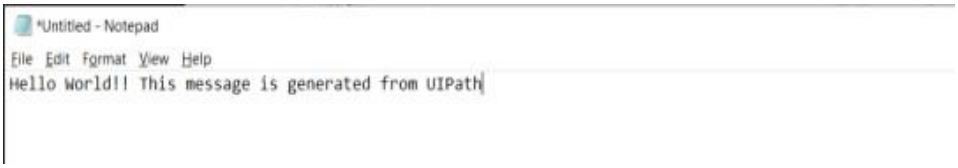
Step2: Search for Type into Activity in the activity panel and drag it inside the sequence.

Step3: Click on Indicate on Screen and indicate the pointer towards notepad editor.

Step4: Type the message to be printed on the notepad in the editable text section

Step5: Hit the Run Button to see the results.

Output:



iii Type secure text

Step1: Add a new flowchart

Step2: Search for Type secure text Activity in the activity panel and drag it inside the sequence.

Step3: Click on Indicate on Screen and indicate the pointer towards notepad editor.

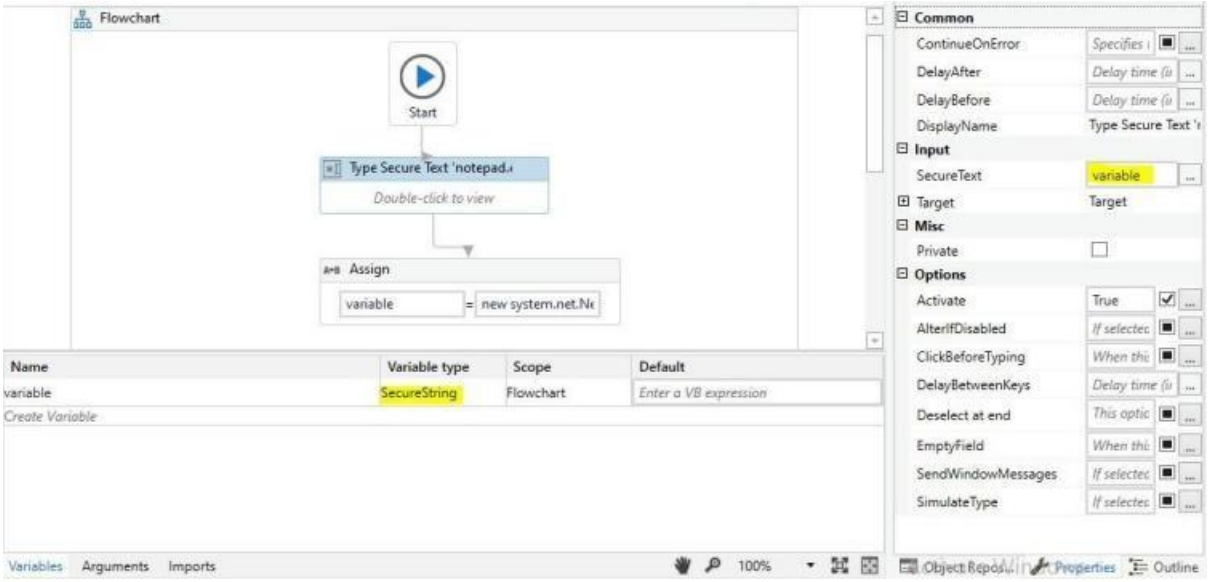
Step4: Create a variable of type “securestring” and assign it to SecureText property in the properties.

Step5:Drag and drop a assign activity.

Step6: Assign the variable created with this value “new system.net.NetworkCredential(String.Empty,"Test@123").SecurePassword”

Step7: Hit the Run Button to see the results.

Output:



b. Demonstrate the following events in UiPath:

i. Element Trigger

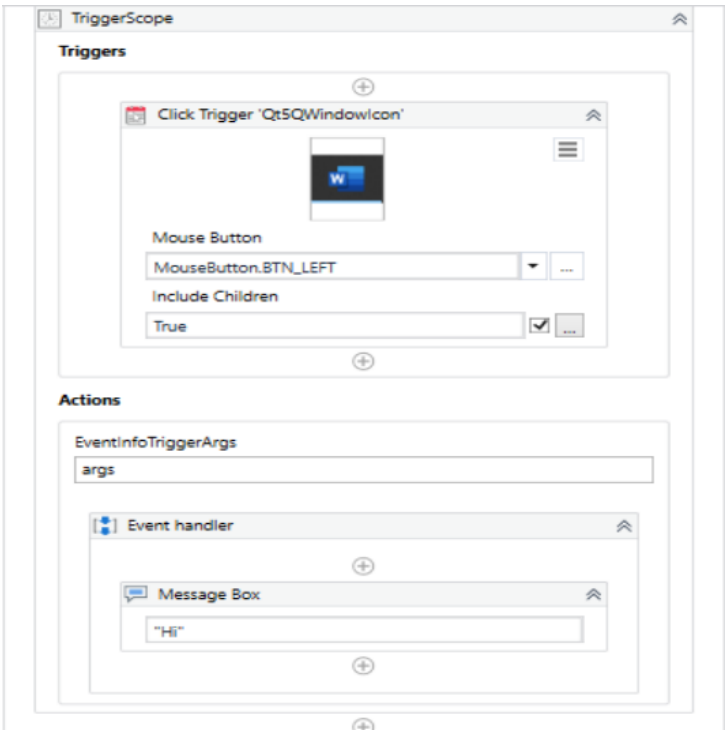
On click element

Steps1: Click on user events select on click element

Step 2: Single click on icon present in the toolbar.

Step 3: Drag and drop message box inside event handler.

Step 4: Write any message you want to display.



Step 5: Run the file.

Step 6: Click the icon which you selected in user event.

Output:

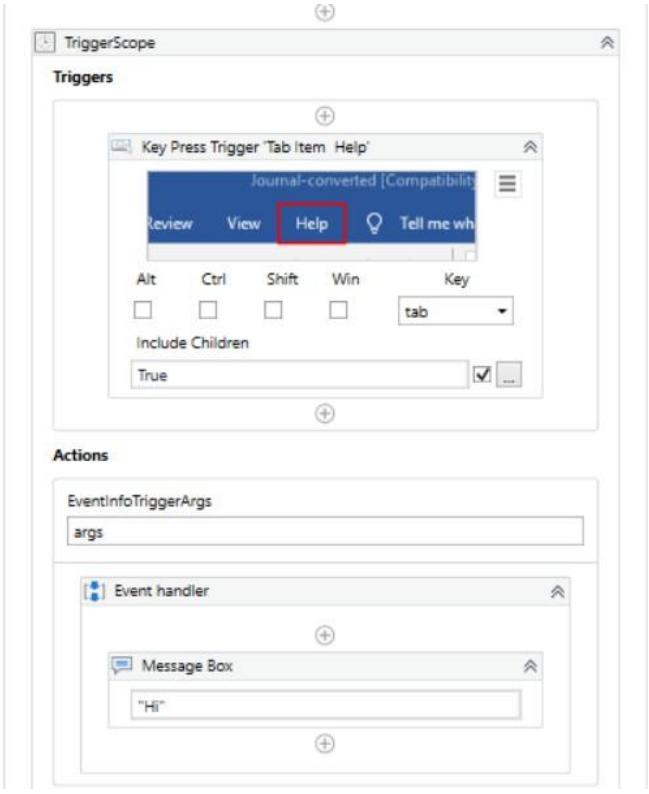
On keypress event

Step1: Click on user events select on key press element

Step 2: Indicate on screen and select the key.

Step 3: Drag and drop message box inside event handler.

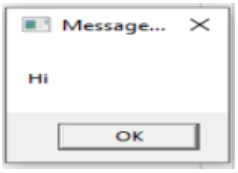
Step 4: Write any message you want to display.



Step 5: Run the file.

Step 6: Click the key which you selected in user event.

Output:



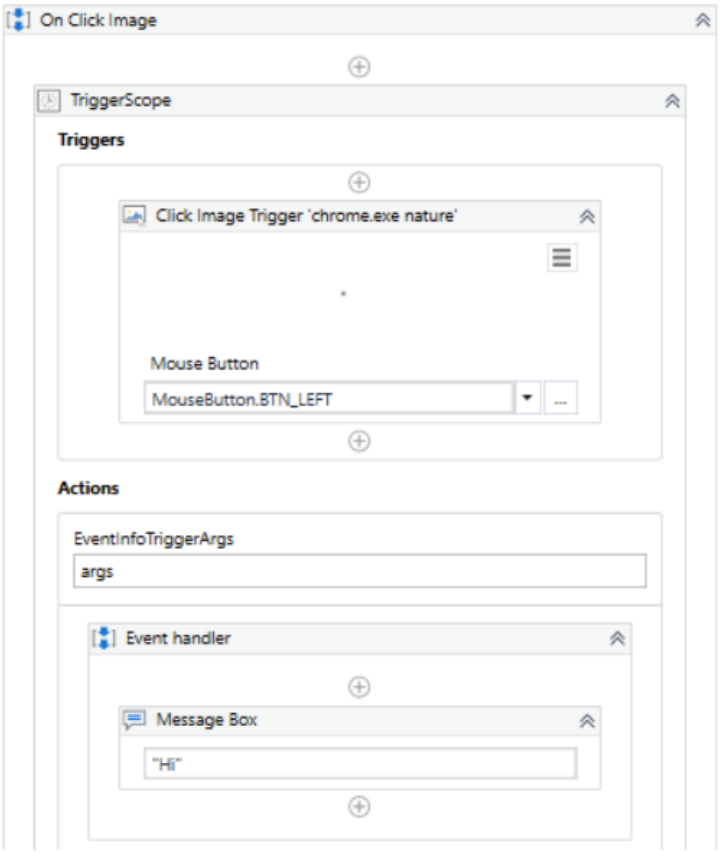
ii. Image trigger

Steps1: Click on user events select on click image element

Step 2: Single click on any image present in the screen.

Step 3: Drag and drop message box inside event handler.

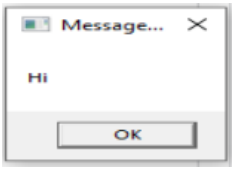
Step 4: Write any message you want to display.



Step 5: Run the file.

Step 6: Click the image which you selected in user event.

Output:



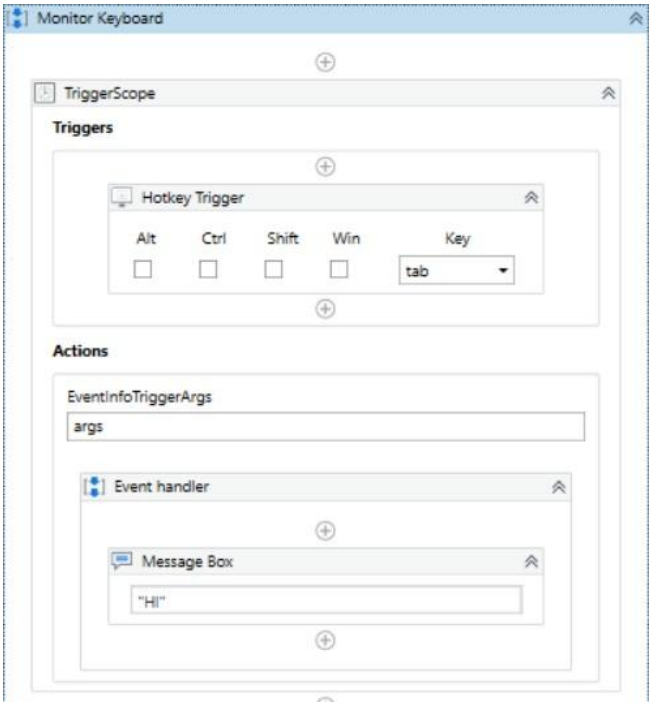
iii. System trigger

Step1: Click on user events select on monitor keyboard element

Step 2: Select any key.

Step 3: Drag and drop message box inside event handler.

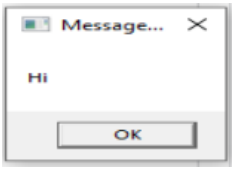
Step 4: Write any message you want to display.



Step 5: Run the file.

Step 6: Click the key which you selected in user event.

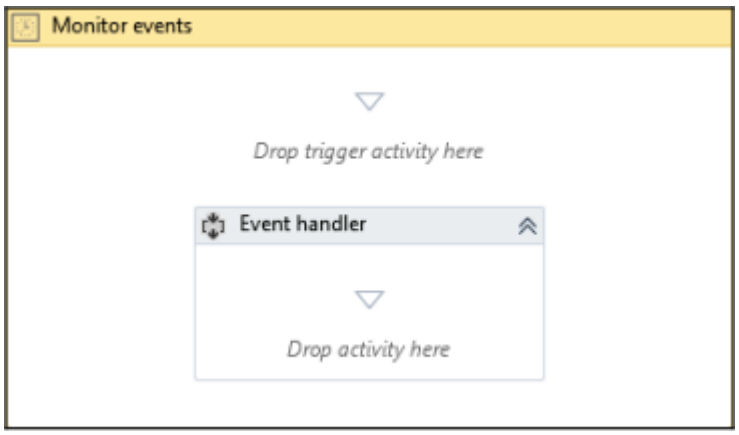
Output:



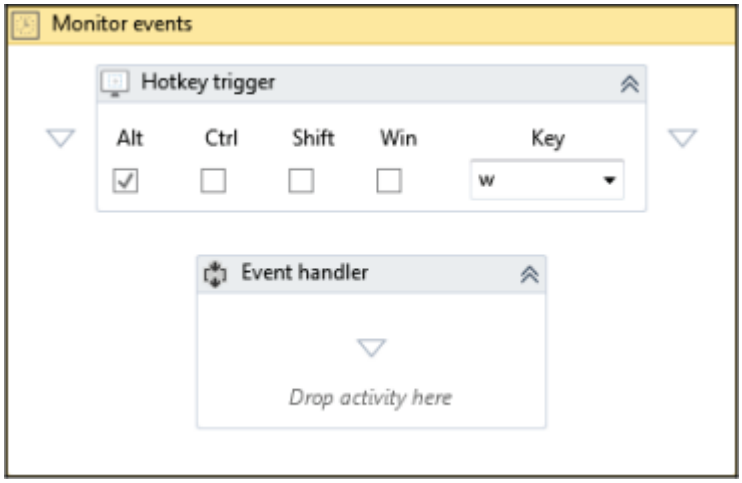
c. Automate the process of launching an assistant bot on a keyboard event.

Let us say we want our assistant bot to start automating only when we trigger an event. For example, the user wants his Robot to open and start typing in the Notepad window when he presses Alt + W. This can be achieved using the Hotkey trigger. Also, inside the Event handler, just create or record the sequence of steps to be followed. The detailed procedure has been explained in the following sections:

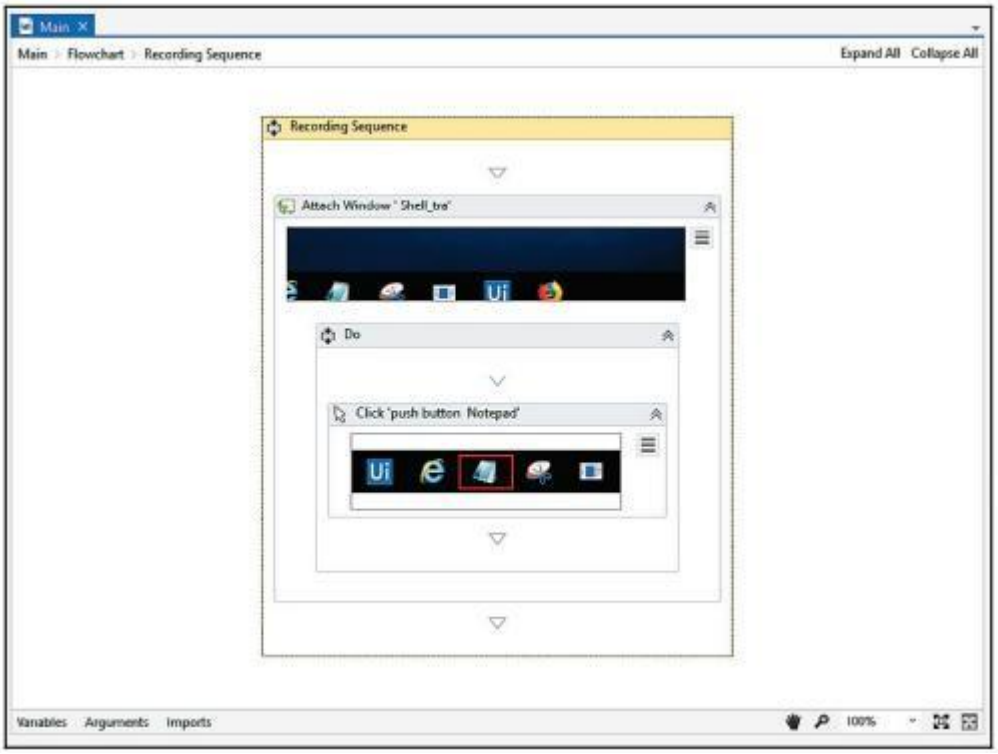
1. Drag and drop the Monitor events activity: In this step, we will just drag and drop the Monitor events activity into the workflow. When we double-click on it, it will look like this:



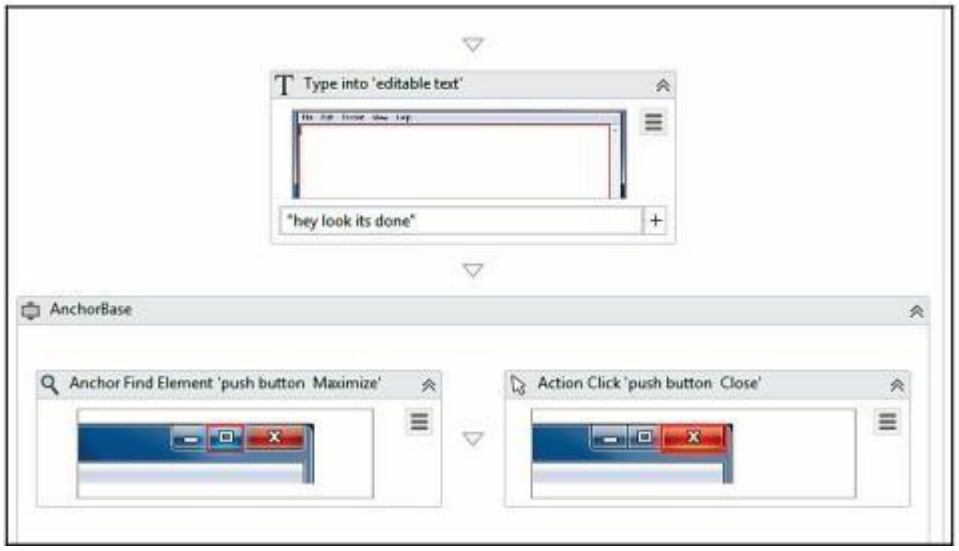
2. Drag the Hotkey trigger activity: In the next step, we will use the Hotkey trigger activity for the user to start the automation process. Assign Alt + W to the hotkey so that, when the user presses this hotkey, the event will be executed:



3. Open Notepad and type into it: Our final step is to record the sequence of the steps to be performed. In this case, this is to open Notepad and then type into it. For that just use the help of the Desktop recorder. First, we double-click on the Notepad application in the window as shown in the screenshot. Select the ClickType as CLICK_DOUBLE from the Properties panel:



After that, we record the typing action and close the Notepad window. Then click on Do not Save because you do not want to save your file. The sequence is shown in the following screenshot:



We have also indicated the anchor to recognize the correct button to be clicked (in this case, the close window button's anchor is the maximize button). This makes it easier for the Robot to find the UI element.

Now, on pressing Alt + W the Robot will start executing the sequence.

Practical 7 : Screen Scraping and Web Scraping methods

a. Automate the following screen scraping methods using UiPath:

A. Full Text
B. Native
C. OCR

Full Test

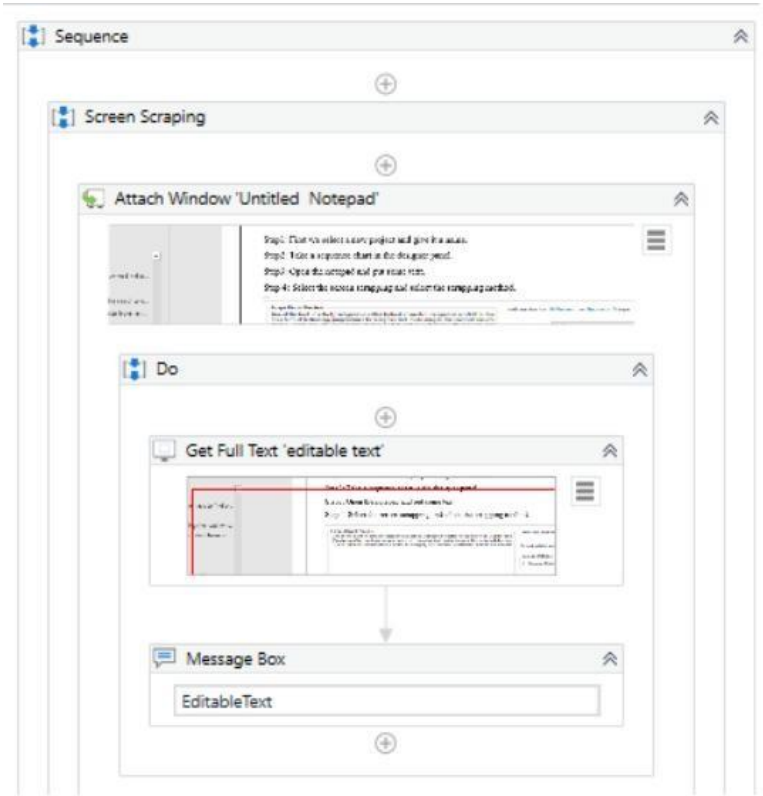
Step1: First we select a new project and give it a name.

Step2: Take a sequence chart in the designer panel.

Step3: Open the notepad and put some text.

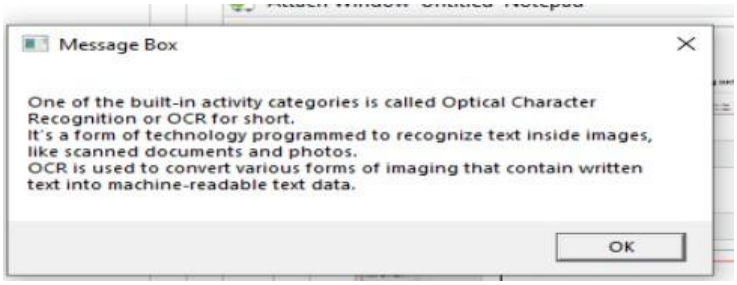
Step 4: Select the screen scrapping and select the scrapping method.

Step 5: Drag and drop a message box and give the variable name automatically created.



Step 6: Run the file.

Output:



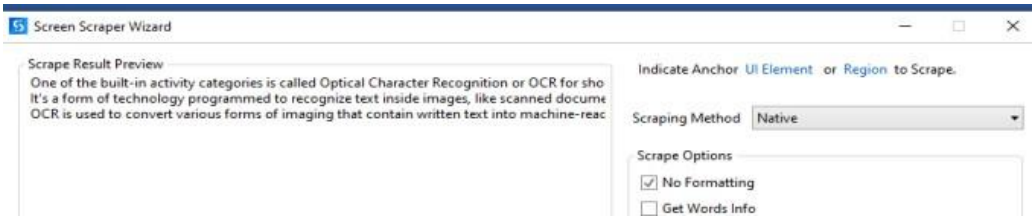
Native

Step1: First we select a new project and give it a name.

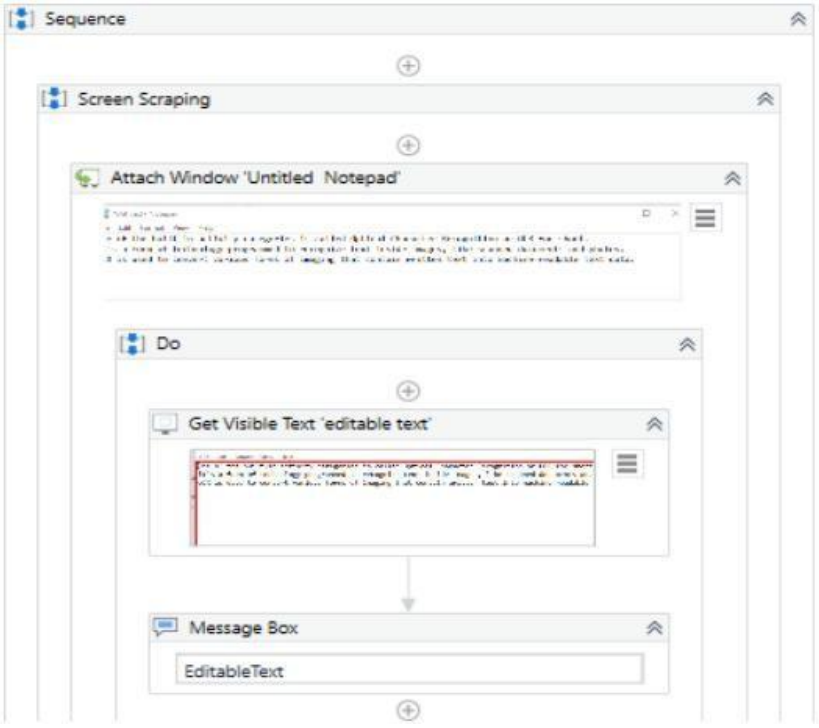
Step2: Take a sequence chart in the designer panel.

Step3: Open the notepad and put some text.

Step 4: Select the screen scrapping and select the scrapping method

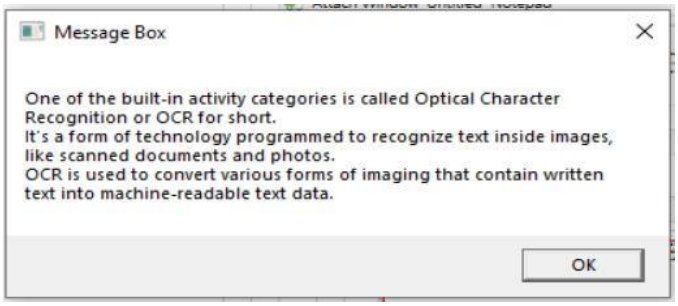


Step 5: Drag and drop a message box and give the variable name automatically created.



Step 6: Run the file.

Output:



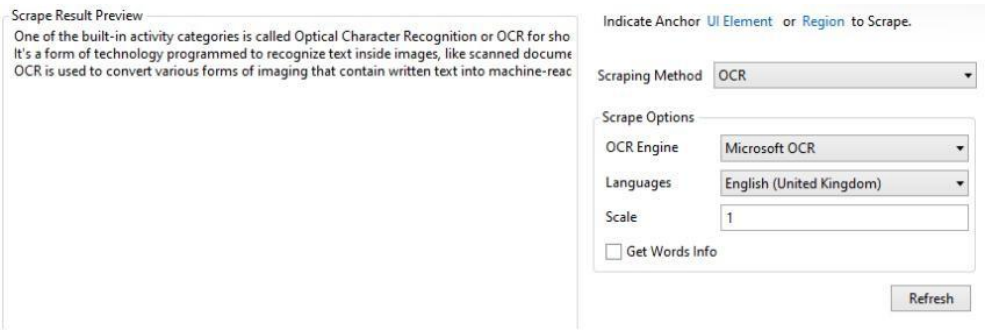
OCR

Step1: First we select a new project and give it a name.

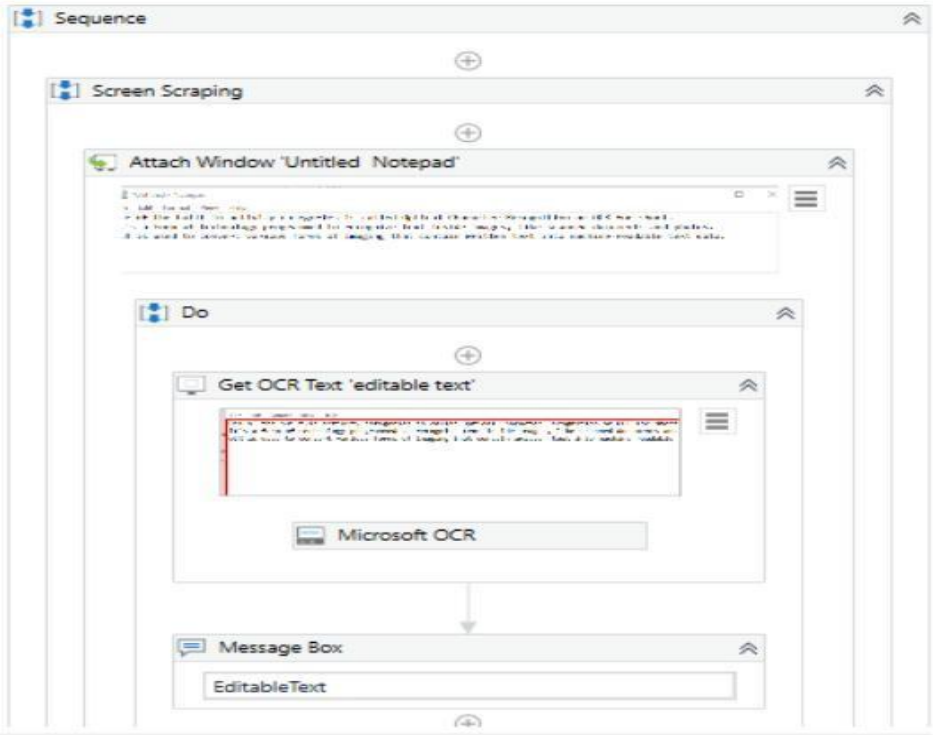
Step2: Take a sequence chart in the designer panel.

Step3: Open the notepad and put some text.

Step 4: Select the screen scrapping and select the scrapping method.

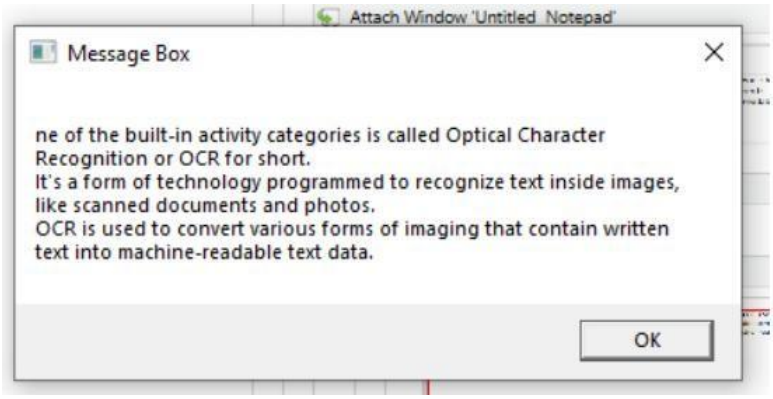


Step 5: Drag and drop a message box and give the variable name automatically created.



Step 6: Run the file.

Output:



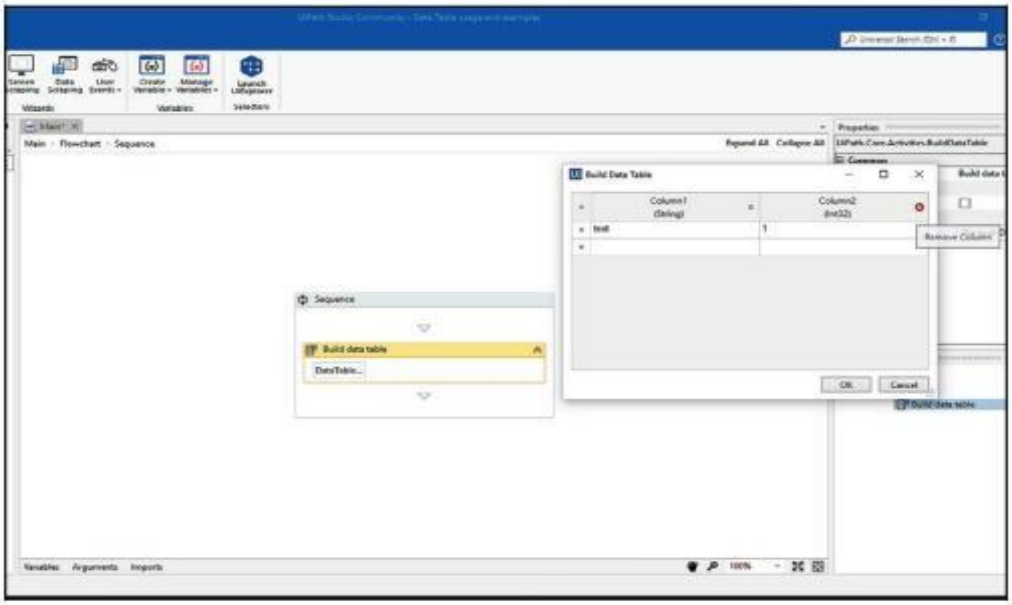
b. Demonstrate Data Scraping and display values in Message box.

Let us see, how to build a data table can be built. First, create an empty project. Give it a proper name:

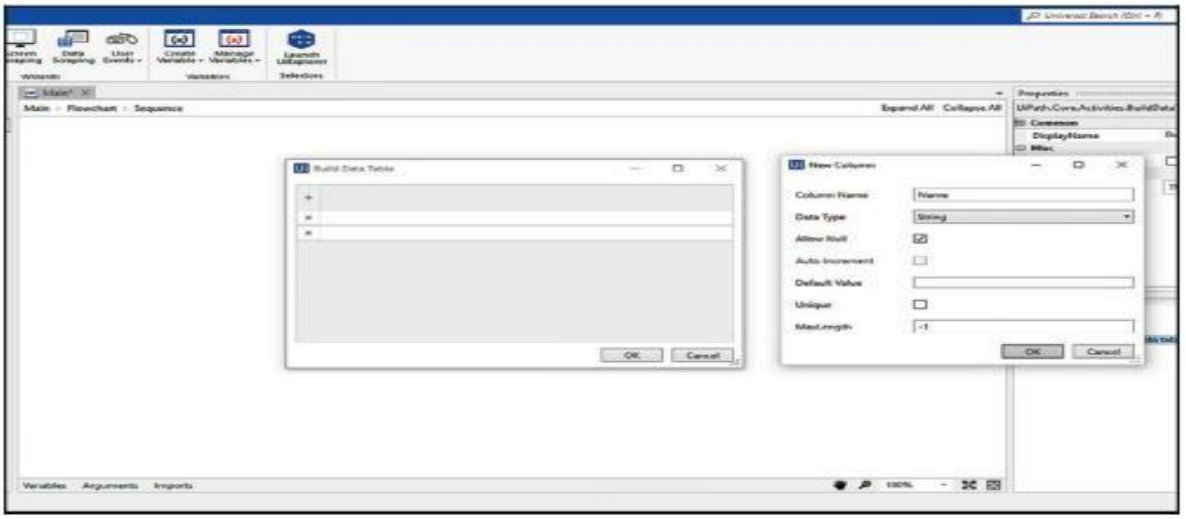
1. Drag and drop a Flowchart activity on the Designer panel. Also, drag and drop a Sequence activity and set it as the Start node.

2. Double click on the Sequence and drag and drop the Build Data Table activity inside the Sequence activity.

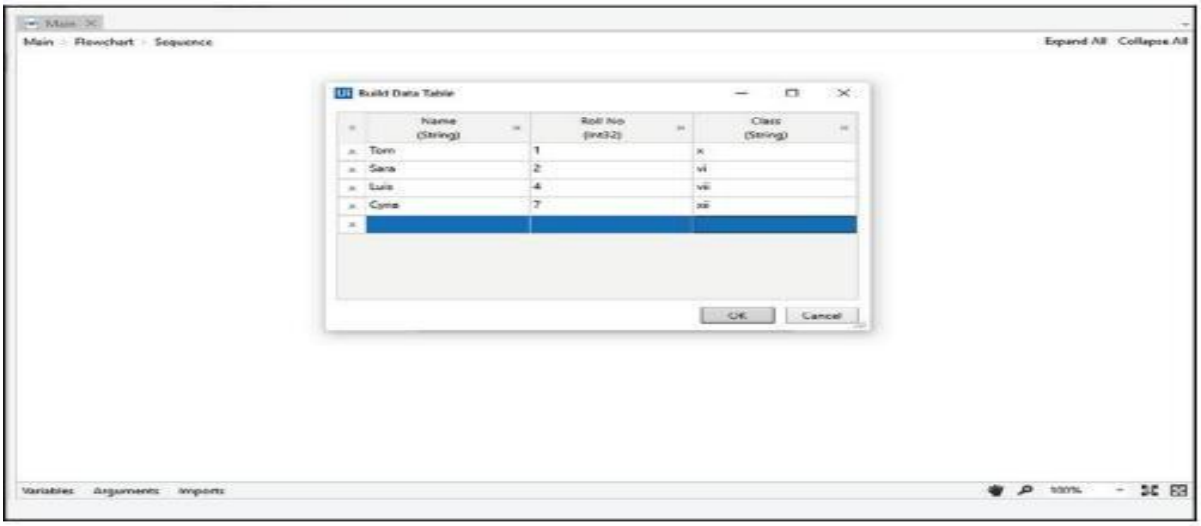
3. Click on the Data Table button. A pop-up window will appear on the screen. Remove both the columns (auto generated by the Build Data Table activity) by clicking on the Remove Column icon:



Now, we will add three columns by simply clicking on the + symbol. Specify the column names and select the appropriate data types from the drop-down list. Click on the OK button. We will add column /BNF of String Data Type, 3PMM@/P of Int32 type and finally Class of string type:



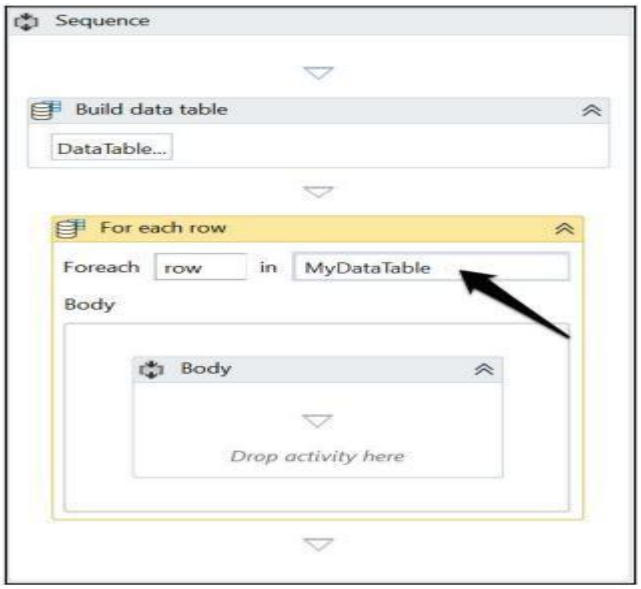
Now enter some random values just to insert the data into the rows:



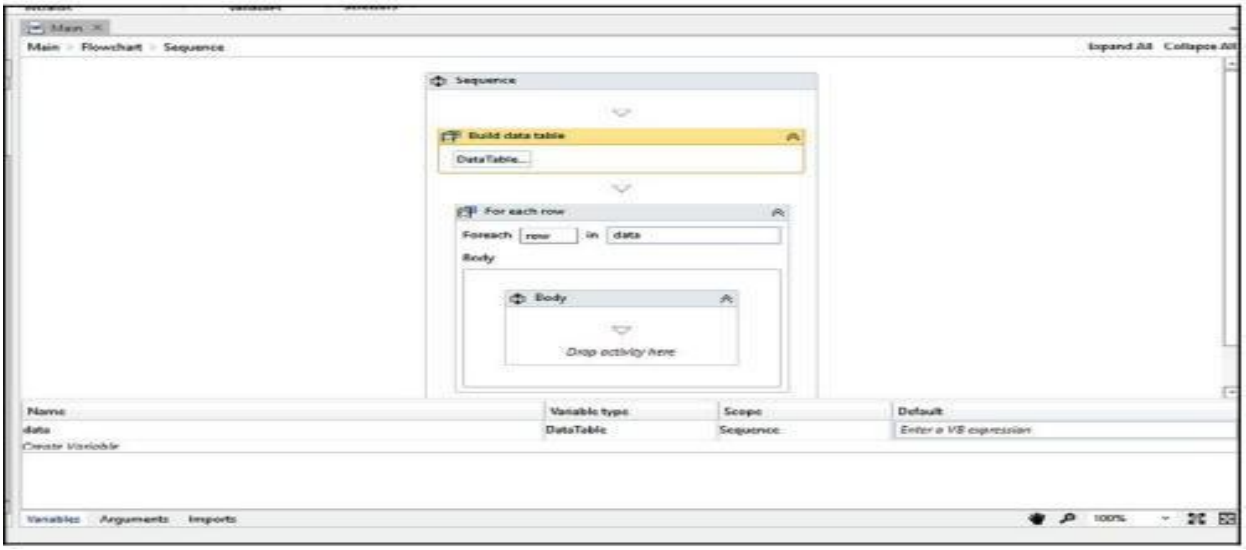
Click on the OK button and our data table is ready. We have to iterate over the data table's rows to make sure everything works correctly.

5. In order to store the Data Table created by Build Data Table activity, we have to create a data table variable Mydatatable of DataTable type and in order to store the result of the data table that we have dynamically built. Also, specify assign the Output property of the Build Data Table activity with this variable. Specify the data table variable's name there.

6. After our data table is ready, we will iterate the data table's rows to make sure everything works correctly. Drag and drop the For each row activity from the Activities panel inside the Sequence activity. Specify the data table variable's name (MyDataTable) in the expression text box of the For each row activity:

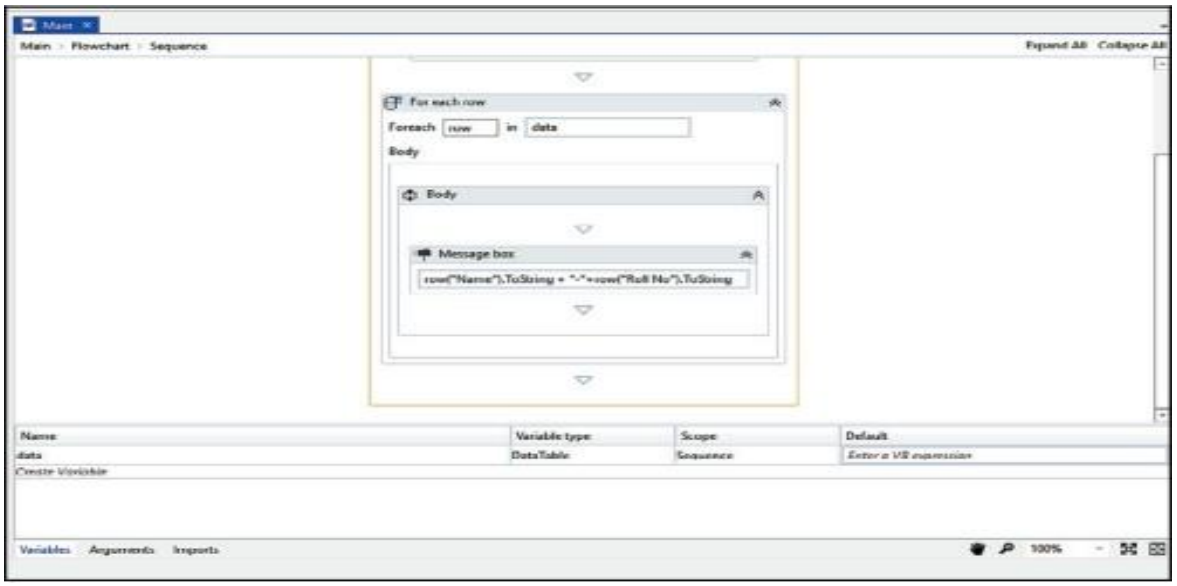


7. Drag and drop the For each row activity from the Activities panel inside the Sequence activity. Specify the data table variable's name in the expression text box of the For each row activity:



For each and For each row are two different activities. For each is used to iterate over the collections, while the For each row activity is used to iterate over the data table rows.

Drag and drop a Message box activity inside the For each row activity. In the Message box activity, Inside the message box we have to write following string:



This row variable contains all the columns of a particular row. Hence, we have to specify which column value we want to retrieve by specifying the column name. Instead of the column name, we can also specify the column index (the column index always starts from zero). Hit the Run button to see the result.

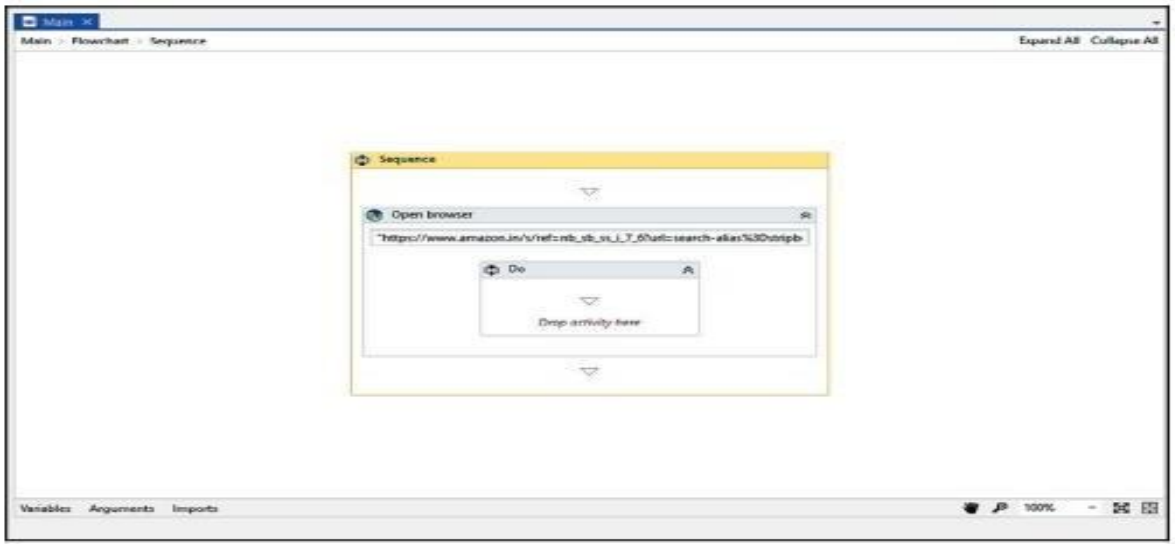
c. **Demonstrate Screen Scraping for a pdf, web page and image file**.

Using data scraping, we can build the data table at runtime. Let us consider an example of extracting data from Amazon's website. Perform the following steps:

1. Drag and drop the Flowchart activity from the Activities panel, and drag and drop the Sequence activity inside the Flowchart activity.

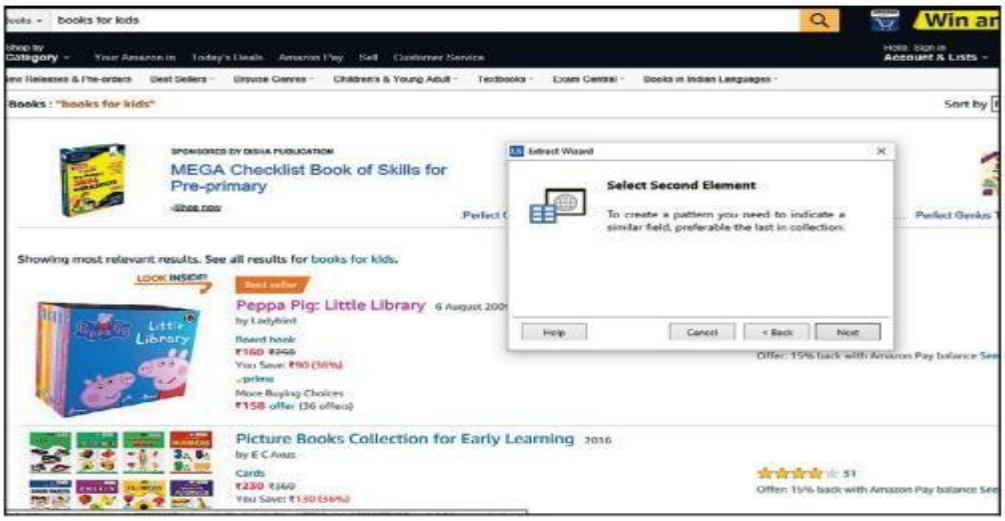
2. Double-click on the Sequence activity.

3. Drag and drop the Open Browser activity inside the Sequence activity. Specify the URL in the text box:

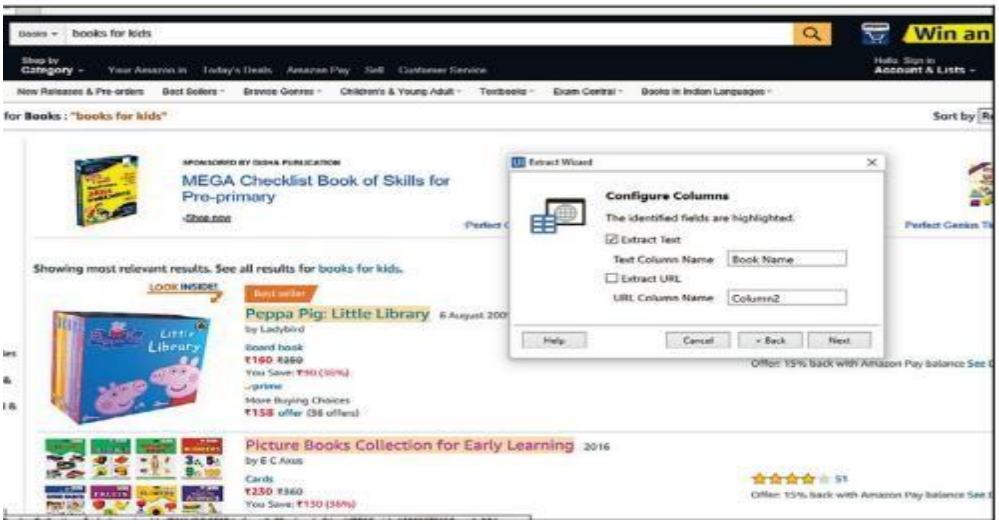


4. Click on the Data Scraping icon on the top left corner of UiPath Studio. A window will pop up. Click on the Next button.

5. Now, there will be a pointer pointing to the UI elements of the web page. Click on the name of the book:



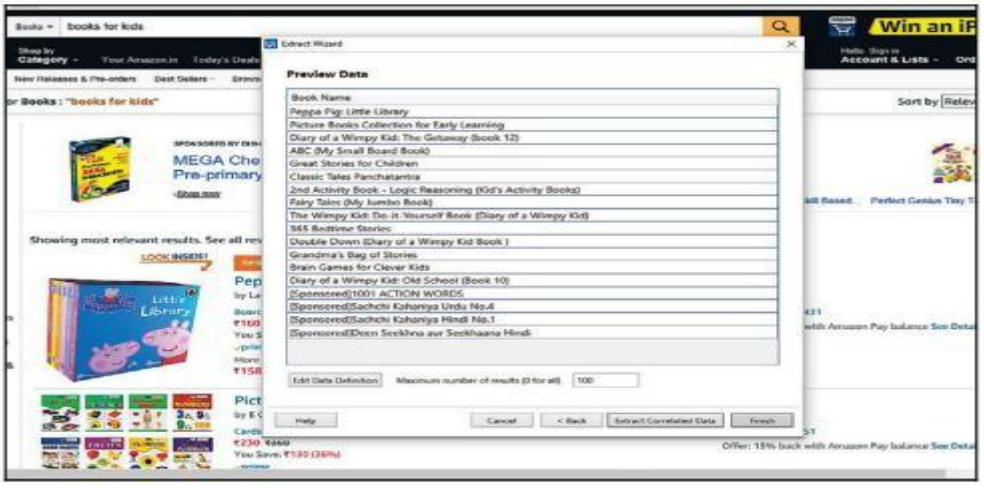
It will ask you to point to a second similar element on the web page:



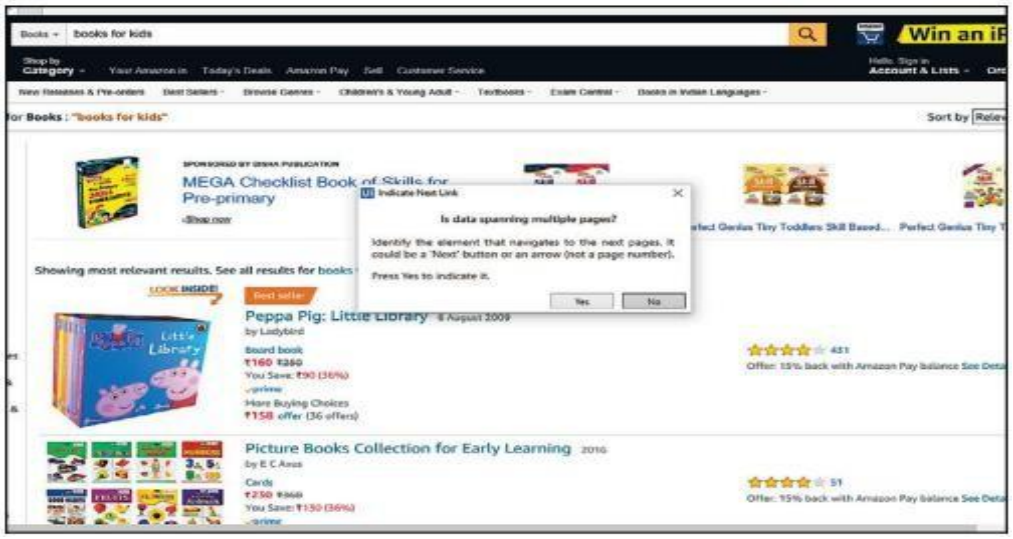
6. Point to a second similar element on that web page. Specify the name that you want to give for that extracted data column. (It will become the column name of the extracted data). Click on the Next button.

7. A list of names will appear in a separate window.

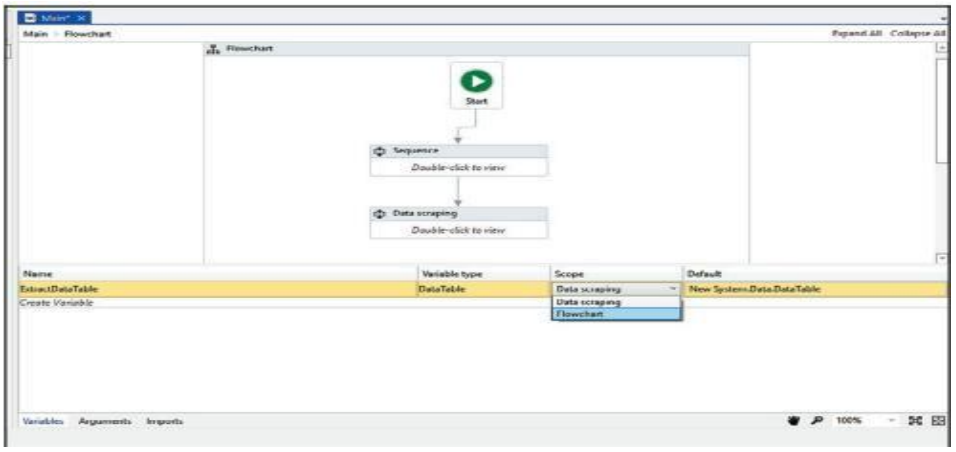
If you want to extract more information, then click on the Extract correlated data button and repeat the same process once again (just as we extracted the name of the book from Amazon's website). Otherwise, click on the Finish Button:



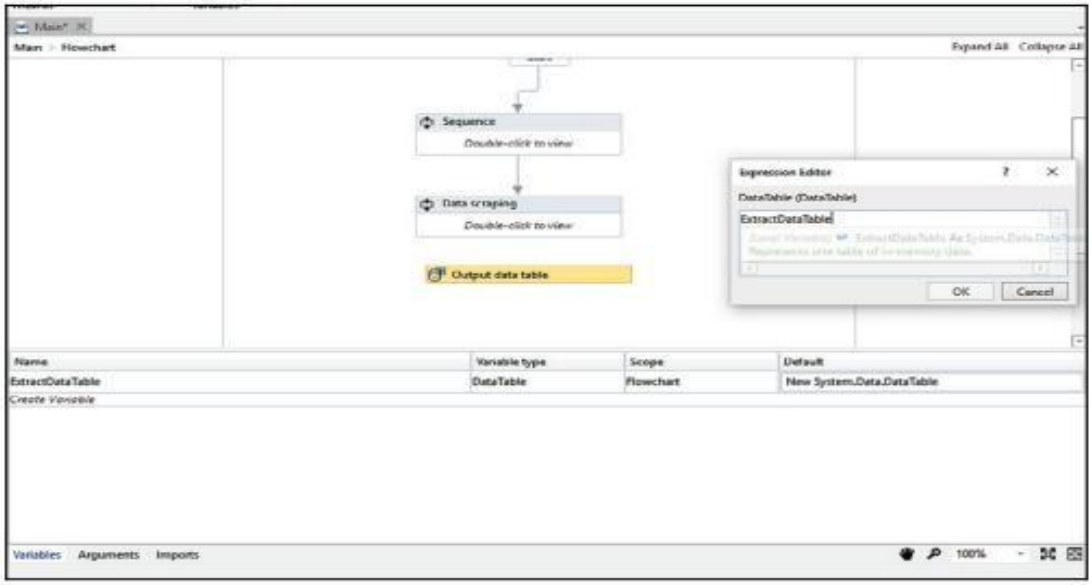
8. It will ask you to locate the next page's button/link. If you want to extract more information about the product and it spans across multiple pages, then click on the Yes button and point to the next page's button/link. Then, click on it. If you want to extract only the current page's data, click on the No button, (you can also specify the number of rows that you want to extract data from: By default it is 100):



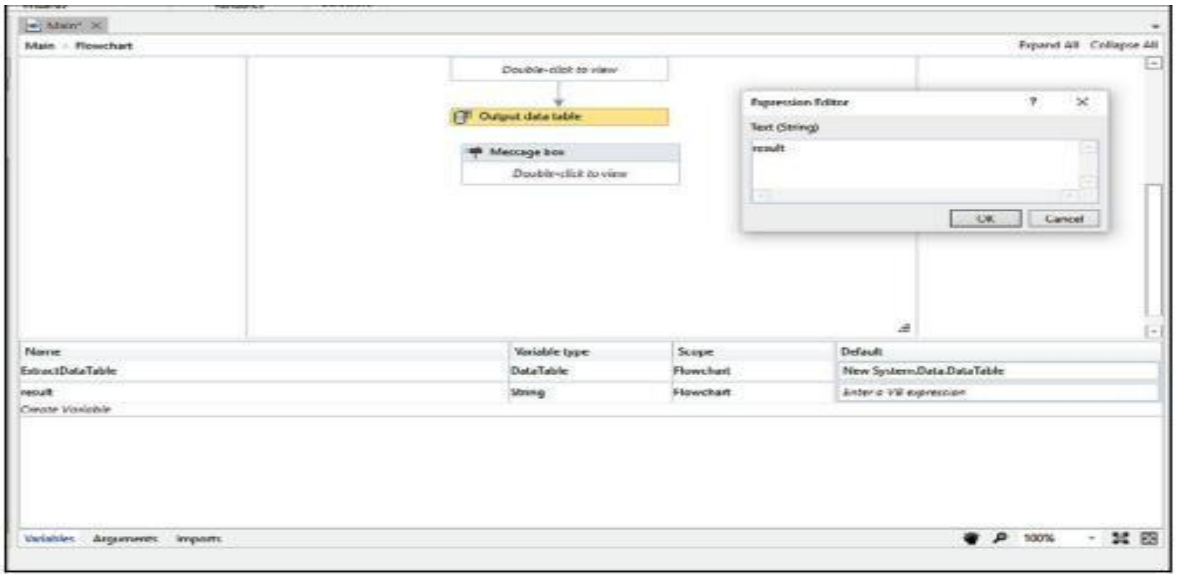
9. Data scraping generates a data table. (In this case, Extractiondatatable is generated.) Change the scope of Extractiondatatable to the Flowchart so that it is accessible within the Flowchart activity:



10. Drag and drop the Output data table activity on the Flowchart. Set the Output property of the Output data table activity as: Extractiondatatable:



11. Connect the Output data table activity to the Data Scraping activity. Drag and drop the Message box activity on the Designer window. Also create a string variable to receive the text from the Output data table activity (in our case, we have created a result variable). Specify the text property of the Output data table activity as the result variable to receive the text from the Output data table:



12. Connect the Message box activity to the Output data table activity. Double-click on the Message box and specify the text property as result variable (the variable that you created to receive the text from the Output data table activity).

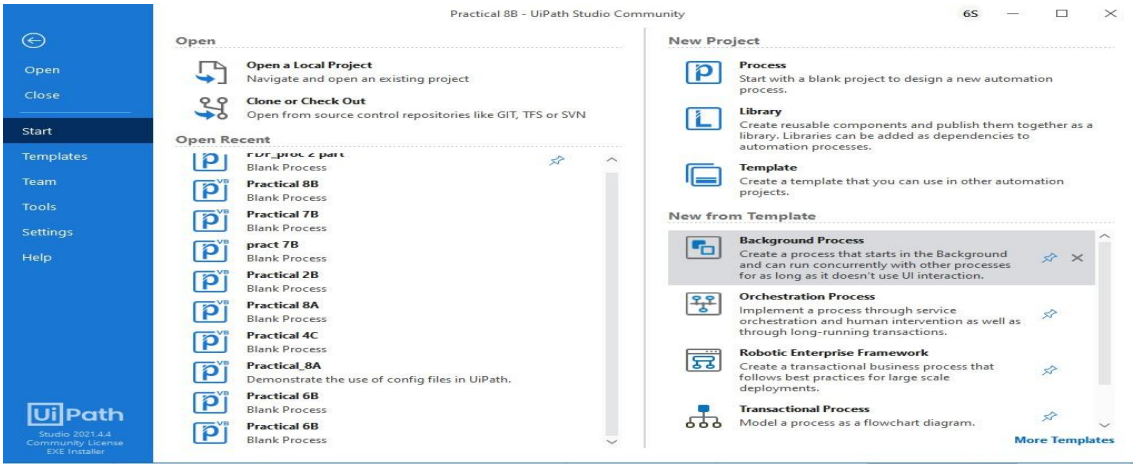
13. Hit the Run button and see the result.

Practical 8 : PDF Automation and Exception Handling

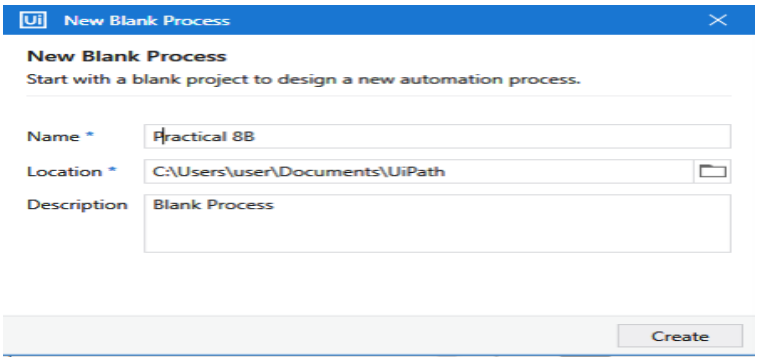
f. Demonstrate Exception Handling using UiPath

Steps:

1. Create new project: Open UiPath and create new project by clicking on “Process” option at the right side of the window.



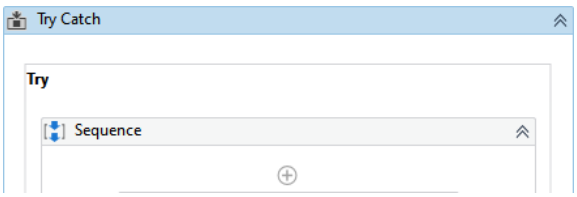
2. In “New Blank Process” window insert the project name you want in the “Name” textbox. In “Location” textbox insert the path in which folder you want to save the project (In normal case you will see the default location of project). In “Description” textbox insert the project description. Then click on “Create” button.



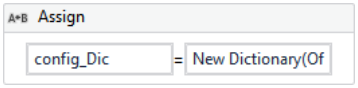
3. Create a Variable config_Dic of Variable types and Dictionary<String,Object>.

Name	Variable type	Scope	Default
config_DT	DataTable	Saurabh Yadav 8B Sequence	Enter a VB expression
config_Dic	Dictionary<String,Object>	Saurabh Yadav 8B Sequence	Enter a VB expression

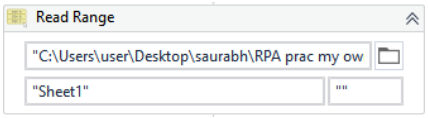
4. Select Activity Try Catch from Activities and Insert sequence in it.



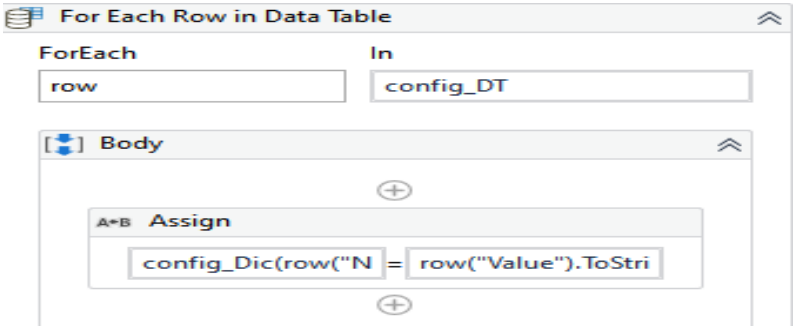
5. Select Activity Assign from Activities and initialize the dictionary.



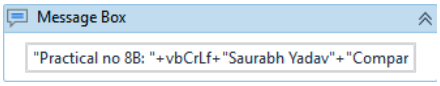
6. Select activity Read Range from activities to read Excel sheet.



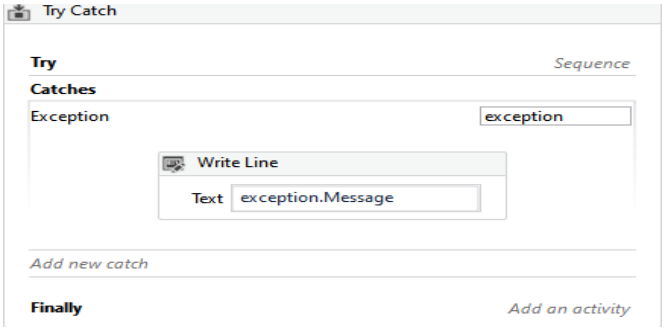
7. Select For Each Row from activities.



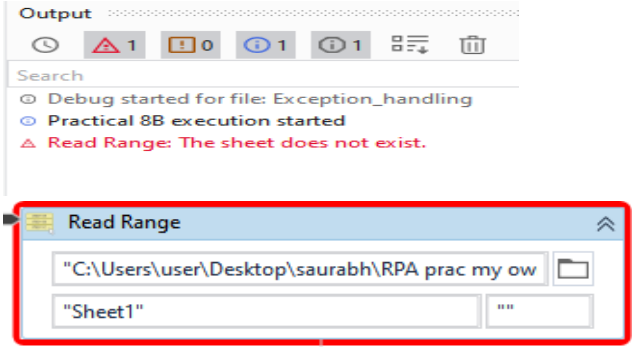
8. Select Message Box activity to print Output



9. Add a WriteLine Activity in the Catch Block.



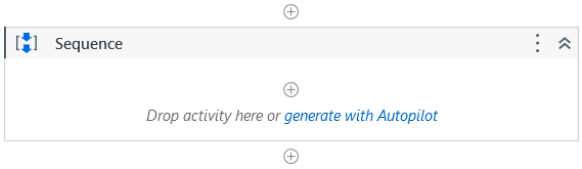
Output:



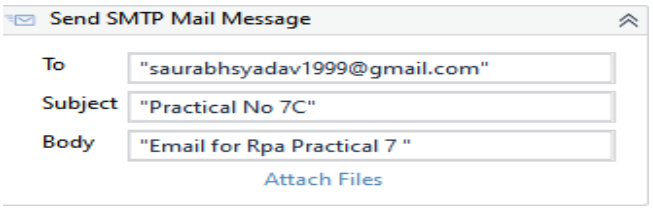
Practical 9 : Email Automation

c. Send Email with Attachment

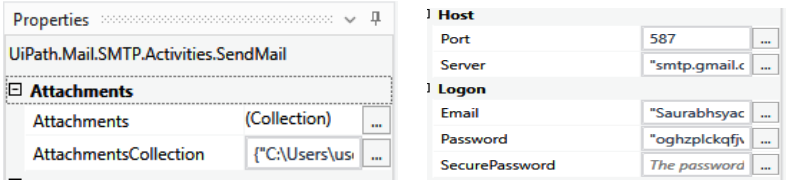
SMTP server address: smtp.gmail.com.
Gmail SMTP port (TLS): 587.
Add 3 different attachments as input.
Step:
1. Create a new Blank Project and give it an appropriate name. Drag a Sequence activity from Activity tab.



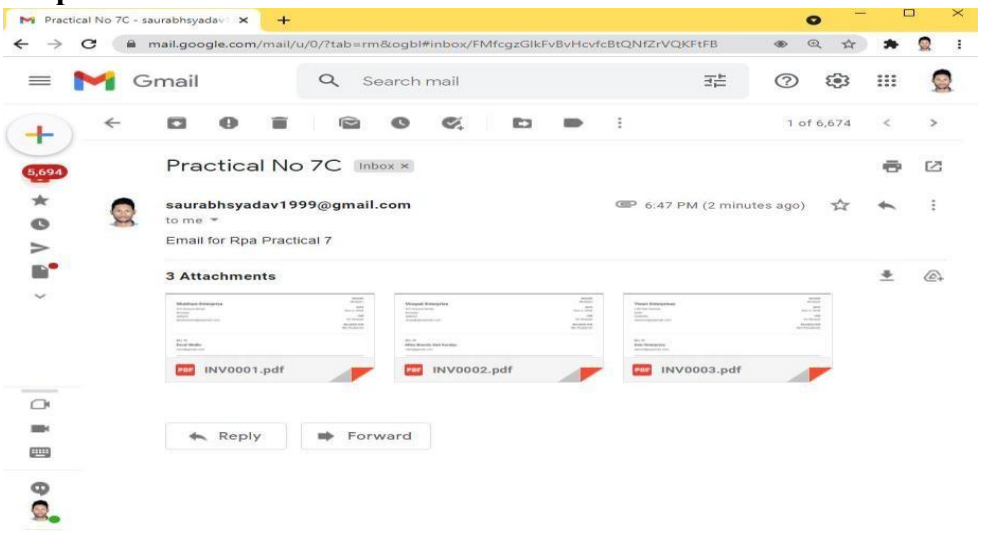
2. Add Send SMTP Mail Message Activity enter the recipient email, subject and body of the email to be sent.



3. Enter the files variable in AttachmentsCollection Attribute. Enter smtp port number in port
attribute of Host and the hostname in server field. Enter the email and password of the sender in the Logon email and password.



Output:



Practical 10 : Orchestrator management and mini project

a. Deploy bots to Orchestrator

Deploy the Robot to Orchestrator To deploy our Robot, first of all, it must be connected to Orchestrator. Ensure that our bot is connected to Orchestrator then follow the given steps to deploy it:

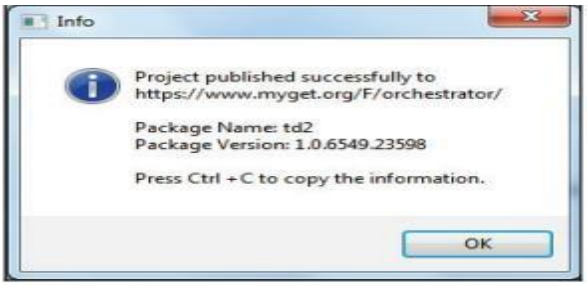
1. First of all, install UiPath on the machine.

2. Provision the Robot machine and take the Robot key from Orchestrator.

3. After receiving the key go to the Robot configuration panel and enter the key here.

4. Also, you need to enter the Robot key into the configuration URL, which can be found from the admin section of Orchestrator.

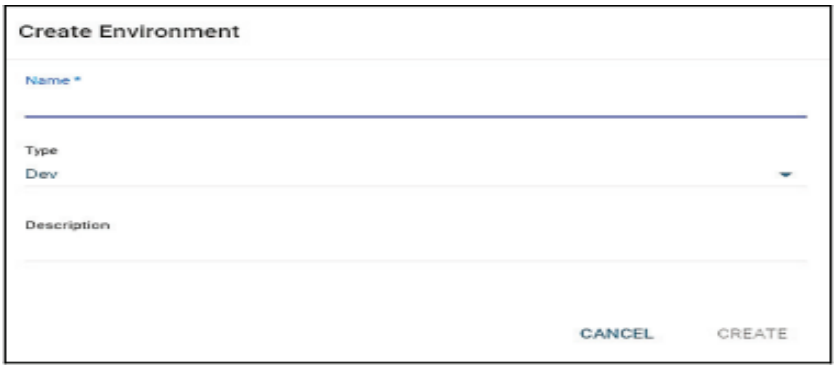
5. Publish the project with publish utility from UiPath. When it is published successfully, it will display the information shown in the following screenshot:



6. The project has been published in the Orchestrator.

7. To create the environment, go to the home page, click on the ROBOTS option, and click on the Environments Tab. Then click on the + button:

8. Once the details are filled in, click on Create:



9. After creating the environment, a small window will appear as shown in the following screenshot, where we can manage the Robot within the environment:

10. After clicking on the + button, a will window pop-up where we can choose the Published package, as shown in the following screenshot, and then click on the CREATE button:

11. After clicking the Deploy Process button, a window popup will appear where we can choose the published package, as shown in the following screenshot, and then click on the CREATE button or

12. Packages can be manually uploaded from the local directory after clicking the View Packages option and then clicking the Upload button as given in the following screenshot: PROCESS | View Packages | Upload Packages:

13. Now the package has been deployed to the Orchestrator and is ready to be executed through the web.

14. Next, click the JOBS option for execution and click on the Start icon as shown:

15. After clicking the Start Job button, the Robot will execute over Orchestrator.

c. Queue Introduction:

i. Add items to Queue.

ii. Get Queue item from Orchestrator

Queues work as a container that stores tasks that need to be implemented. Simply imagine a group of boys standing in a queue in front of a ticketing counter. The logic is that the person who goes in first gets out first. First In First Out (FIFO).

Similarly, in the case of Robots, when we have a number of operations that are to be performed and when the server is busy, then tasks are moved in a queue and they are implemented on the same logic First In First Out (FIFO).

To create a new queues, search for the Queue option in the Orchestrator Server listed on the left-hand side and then inside the Queue page, you can add one. It also allows you to access all those Queues that have already been created. It contains some information about the task such as the remaining time, progress time, average time, description, and so on, as listed in the following screenshot:

We can also add queue items from UiPath Studio and there are various activities that support this feature, which are listed as follows:

- Add Queue Item: This activity is used to add a new item to the queue in Orchestrator. The status of the item will be New.
- Add Transaction Item: This activity is used to add an item to the queue to begin transaction and set the status as In Progress. Here we can add custom reference for each respective transaction.
- Get Transaction Item: This activity is used to get an item from the queue to process it and set its status as In Progress.
- Postpone Transaction Item: This activity is used to define time parameters between which transaction should be processed. Here, basically, we will specify the time interval after which a process will start.
- Set Transaction Progress: Used to assist and create custom progress statuses for In Progress transactions. To notify its progress if the process crashes. This activity plays a significant role in tackling troubleshooting processes.
- Set Transaction Status: Used to modify the status of the transaction item; whether it fails or is successful.