Submitted in partial fulfillment of the
Requirements for the award of the Degree of

MASTER OF SCIENCE (INFORMATION TECHNOLOGY)

By

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Seat Number: (3254636**)**

SUBJECT NAME:
DATA SCIENCE AND RESERCH IN COMPUTING

DEPARTMENT OF INFORMATION TECHNOLOGY

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(Affiliated to University of Mumbai)
MUMBAI , 400071
MAHARASHTRA
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DEPARTMENT OF INFORMATION TECHNOLOGY

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CERTIFICATE

This is to certify that **Siddiqui Imran Ahmed** bearing Seat No: 3254636 submitted journal of DATA SCIENCE AND RESEARCH IN COMPUTING in partial fulfillment of the requirements for the award of Degree of **MASTER OF SCIENCE in INFORMATION TECHNOLOGY** from University of Mumbai.

Internal Guide **Coordinator**

External Examiner

Date: **College Seal**

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Practical No. 1

A.Text delimited CSV to HORUS format

Write Python / R Program to convert from the following formats to HORUS format:

Code :

```
# Utility Start CSV to HORUS ================================
# Standard Tools
#============================================================
import pandas as pd
# Input Agreement ===========================================
sInputFileName='C:/VKHCG/05-DS/9999-Data/Country_Code.csv'
InputData=pd.read_csv(sInputFileName,encoding="latin-1") print('Input Data
Values ==================================')
print(InputData)
print('====================================================')
# Processing Rules ==========================================
ProcessData=InputData
# Remove columns ISO-2-Code and ISO-3-CODE
ProcessData.drop('ISO-2-CODE', axis=1,inplace=True)
ProcessData.drop('ISO-3-Code', axis=1,inplace=True)
# Rename Country and ISO-M49
ProcessData.rename(columns={'Country': 'CountryName'}, inplace=True)
ProcessData.rename(columns={'ISO-M49': 'CountryNumber'}, inplace=True)
# Set new Index
ProcessData.set_index('CountryNumber', inplace=True)
# Sort data by CurrencyNumber
ProcessData.sort_values('CountryName', axis=0, ascending=False, inplace=True) print('Process
Data Values ================================') print(ProcessData)
print('====================================================')
# Output Agreement ==========================================
```

OutputData=ProcessData sOutputFileName='C:/VKHCG/05-

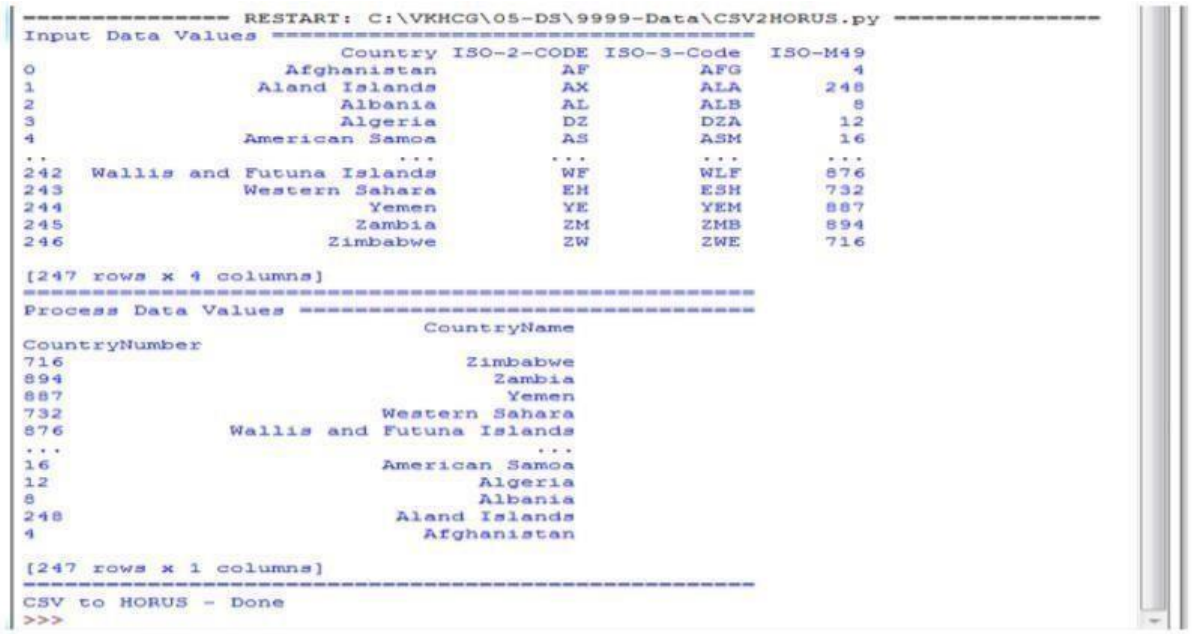
DS/9999Data/HORUS-CSV-Country.csv' OutputData.to_csv(sOutputFileName,

index =

False) print('CSV to HORUS - Done')

Utility done ==========

Output :



```
---------- RESTART: C:\VKHCG\05-DS\9999-Data\CSV2HORUS.py ----------
Input Data Values =================================
                      Country ISO-2-CODE ISO-3-Code  ISO-M49
0                 Afghanistan          AF         AFG        4
1               Aland Islands          AX         ALA      248
2                     Albania          AL         ALB        8
3                     Algeria          DZ         DZA       12
4              American Samoa          AS         ASM       16
..                        ...         ...         ...      ...
242  Wallis and Futuna Islands          WF         WLF      876
243             Western Sahara          EH         ESH      732
244                      Yemen          YE         YEM      887
245                     Zambia          ZM         ZMB      894
246                   Zimbabwe          ZW         ZWE      716

[247 rows x 4 columns]
====================================================
Process Data Values ===============================
                            CountryName
CountryNumber
716                            Zimbabwe
894                              Zambia
887                               Yemen
732                      Western Sahara
876          Wallis and Futuna Islands
...                                ...
16                      American Samoa
12                             Algeria
8                              Albania
248                      Aland Islands
4                          Afghanistan

[247 rows x 1 columns]
====================================================
CSV to HORUS - Done
>>>
```

B : XML to HORUS format

Code :

Utility Start XML to HORUS ==========

Standard Tools import pandas as

pd import xml.etree.ElementTree as

ET def df2xml(data):

header = data.columns root = ET.Element('root')

for row in range(data.shape[0]):

entry = ET.SubElement(root,'entry')

for index in range(data.shape[1]):

schild=str(header[index]) child =

ET.SubElement(entry, schild) if

```
str(data[schild][row]) != 'nan':        child.text
= str(data[schild][row])     else:
       child.text = 'n/a'
entry.append(child)     result =
ET.tostring(root)     return result def
xml2df(xml_data):        root =
ET.XML(xml_data)        all_records
= []        for i, child in
enumerate(root):
          record = {}
for subchild in child:
          record[subchild.tag] = subchild.text
all_records.append(record)        return pd.DataFrame(all_records)
sInputFileName='C:/VKHCG/05-DS/9999-Data/Country_Code.xml' InputData
= open(sInputFileName).read()
print('=====================================================')
print('Input Data Values ===================================')
print('=====================================================')
print(InputData)
print('=====================================================')
#============================================================
# Processing Rules ==========================================
#============================================================
ProcessDataXML=InputData
# XML to Data Frame
ProcessData=xml2df(ProcessDataXML)
# Remove columns ISO-2-Code and ISO-3-CODE
ProcessData.drop('ISO-2-CODE', axis=1,inplace=True)
ProcessData.drop('ISO-3-Code', axis=1,inplace=True)
# Rename Country and ISO-M49
ProcessData.rename(columns={'Country': 'CountryName'}, inplace=True)
ProcessData.rename(columns={'ISO-M49': 'CountryNumber'}, inplace=True)
```

```
# Set new Index
ProcessData.set_index('CountryNumber', inplace=True)
# Sort data by CurrencyNumber
ProcessData.sort_values('CountryName', axis=0, ascending=False, inplace=True)
print('====================================================') print('Process Data Values
==================================')
print('====================================================')
print(ProcessData)
print('====================================================')
OutputData=ProcessData sOutputFileName='C:/VKHCG/05-
DS/9999Data/HORUS-XML-Country.csv' OutputData.to_csv(sOutputFileName,
index = False)
print('====================================================')
print('XML to HORUS - Done')
print('====================================================')
# Utility done ============================================
```

Output :

```
========== RESTART: C:\VKHCG\05-DS\9999-Data\XML2HORUS.py ==========
====================================================
Input Data Values ==================================
====================================================
Squeezed text (385 lines).
====================================================
====================================================
Process Data Values ================================
====================================================
                          CountryName
CountryNumber
716                          Zimbabwe
894                            Zambia
887                             Yemen
732                    Western Sahara
876            Wallis and Futuna Islands
...                                ...
16                      American Samoa
12                             Algeria
8                              Albania
248                      Aland Islands
4                          Afghanistan

[247 rows x 1 columns]
====================================================
====================================================
XML to HORUS - Done
====================================================
>>>
```

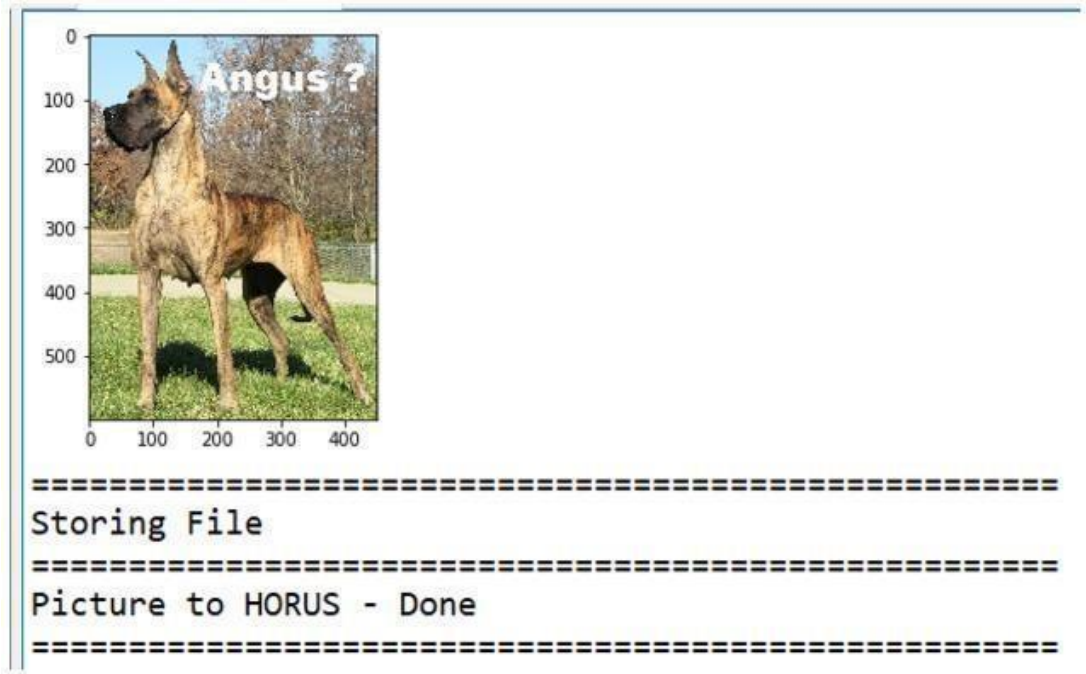
C. Picture (JPEG) to HORUS format

Code :

```
# Utility Start Picture to HORUS ================================
# Standard Tools
#============================================================
from scipy.misc import imread import
pandas as pd import
matplotlib.pyplot as plt import
numpy as np
# Input Agreement ============================================
sInputFileName='C:/VKHCG/05-DS/9999-Data/Angus.jpg' InputData =
imread(sInputFileName, flatten=False, mode='RGBA') print('Input Data Values
==================================')
print('X: ',InputData.shape[0]) print('Y:
',InputData.shape[1]) print('RGBA:
', InputData.shape[2])
print('====================================================')
# Processing Rules ===========================================
ProcessRawData=InputData.flatten() y=InputData.shape[2] + 2
x=int(ProcessRawData.shape[0]/y)
ProcessData=pd.DataFrame(np.reshape(ProcessRawData, (x, y)))
sColumns= ['XAxis','YAxis','Red', 'Green', 'Blue','Alpha']
ProcessData.columns=sColumns
ProcessData.index.names =['ID'] print('Rows:
',ProcessData.shape[0]) print('Columns
:',ProcessData.shape[1])
```

```
print('=====================================================')
print('Process Data Values ================================')
print('=====================================================')
plt.imshow(InputData) plt.show()
print('=====================================================')
# Output Agreement ==========================================
OutputData=ProcessData
print('Storing File') sOutputFileName='C:/VKHCG/05-DS/9999-Data/HORUS-
Picture.csv' OutputData.to_csv(sOutputFileName, index = False)
print('=====================================================')
print('Picture to HORUS - Done')
print('=====================================================')
```

Output :



Practical No 2

Basic Utility

1. Load data as per input agreement.
2. Apply processing rules of utility.
3. Save data as per output agreement. **There are three types of utilities**

- Data processing utilities
- Maintenance utilities
- Processing utilities

A. Fixer Utilities Code

:

```
import string import
datetime as dt
# 1 Removing leading or lagging spaces from a data entry print('#1
Removing leading or lagging spaces from a data entry'); baddata =
" Data Science with too many spaces is bad!!! "
print('>',baddata,'<') cleandata=baddata.strip()
print('>',cleandata,'<')
# 2 Removing nonprintable characters from a data entry print('#2
Removing nonprintable characters from a data entry') printable =
set(string.printable)
baddata = "Data\x00Science with\x02 funny characters is \x10bad!!!"
cleandata=''.join(filter(lambda x: x in string.printable,baddata)) print('Bad
Data : ',baddata);
print('Clean Data : ',cleandata)
# 3 Reformatting data entry to match specific formatting criteria.
```

Convert YYYY/MM/DD to DD Month YYYY

print('# 3 Reformatting data entry to match specific formatting criteria.')

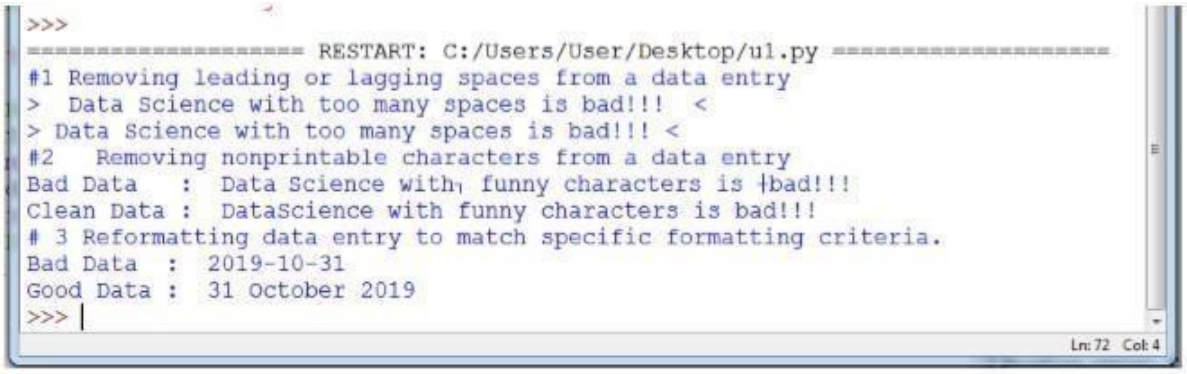
baddate = dt.date(2019, 10, 31) baddata=format(baddate,'%Y-%m-%d')

gooddate = dt.datetime.strptime(baddata,'%Y-%m-%d')

gooddata=format(gooddate,'%d %B %Y') print('Bad

Data : ',baddata) print('Good Data : ',gooddata)

Output:



B. Data binning or Bucketing Code

:

import numpy as np import

matplotlib.mlab as mlab import

matplotlib.pyplot as plt import

scipy.stats as stats

np.random.seed(0) # example data

mu = 90 # mean of distribution

sigma = 25 # standard deviation of distribution x =

mu + sigma * np.random.randn(5000) num_bins

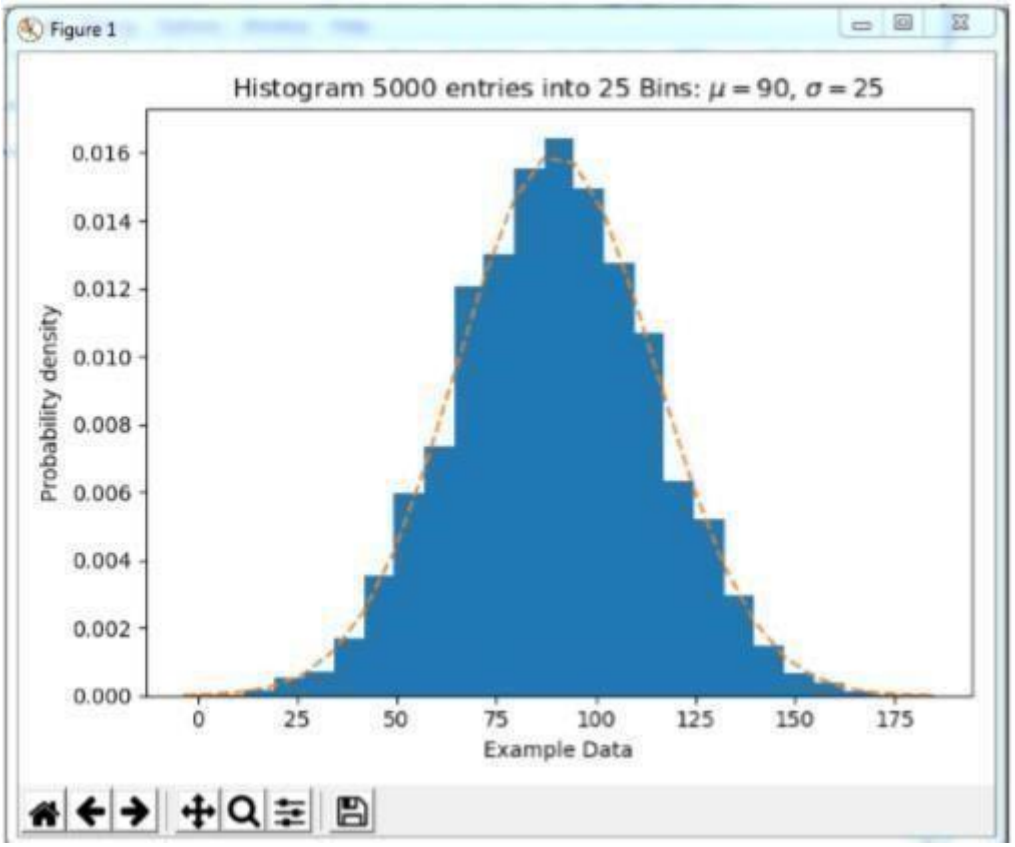
= 25

fig, ax = plt.subplots() # the

histogram of the data

```
n, bins, patches = ax.hist(x, num_bins, density=1)
# add a 'best fit' line y = stats.norm.pdf(bins,
mu, sigma) # mlab.normpdf(bins, mu,
sigma)
ax.plot(bins, y, '--') ax.set_xlabel('Example Data')
ax.set_ylabel('Probability density') sTitle=r'Histogram ' + str(len(x)) + '
entries into ' + str(num_bins) + ' Bins:
$\mu=' + str(mu) + '$, $\sigma=' +str(sigma) + '$' ax.set_title(sTitle)
fig.tight_layout()
sPathFig='C:/VKHCG/05-DS/4000-UL/0200-DU/DU-Histogram.png'
fig.savefig(sPathFig) plt.show()
```

Output :

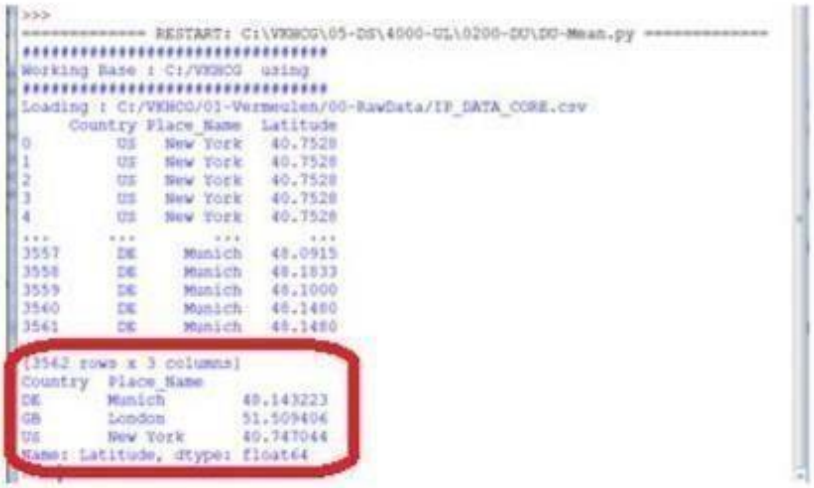


C. Averaging of Data

The use of averaging of features value enables the reduction of data volumes in a control fashion to improve effective data processing. C:\VKHCG\05-DS\4000-UL\0200-DU\DU-Mean.py **Code** import pandas as pd

```
##########################################################################
InputFileName='IP_DATA_CORE.csv'
OutputFileName='Retrieve_Router_Location.csv'
Base='C:/VKHCG' print('#################################')
print('Working Base :',Base, ' using ')
print('#################################') sFileName=Base +
'/01-Vermeulen/00-RawData/' + InputFileName print('Loading
:',sFileName)
IP_DATA_ALL=pd.read_csv(sFileName,header=0,low_memory=False,
usecols=['Country','Place Name','Latitude','Longitude'], encoding="latin-1")
IP_DATA_ALL.rename(columns={'Place Name': 'Place_Name'}, inplace=True)
AllData=IP_DATA_ALL[['Country', 'Place_Name','Latitude']] print(AllData)
MeanData=AllData.groupby(['Country', 'Place_Name'])['Latitude'].mean()
print(MeanData)
##########################################################################
```

Output :



D. Outlier Detection

Outliers are data that is so different from the rest of the data in the data set that it may be caused by an error in the data source. There is a technique called outlier detection that, with good data science, will identify these outliers. C:\VKHCG\05-DS\4000-UL\0200-DU\DU-Outliers.py **code :**

```
################################################################
# -*- coding: utf-8 -*-
################################################################
import pandas as pd
################################################################
InputFileName='IP_DATA_CORE.csv'
OutputFileName='Retrieve_Router_Location.csv'
Base='C:/VKHCG' print('##################################')
print('Working Base :',Base) print('##################################')
################################################################
sFileName=Base + '/01-Vermeulen/00-RawData/' + InputFileName
print('Loading :',sFileName)
IP_DATA_ALL=pd.read_csv(sFileName,header=0,low_memory=False,
usecols=['Country','Place Name','Latitude','Longitude'], encoding="latin-1")
IP_DATA_ALL.rename(columns={'Place Name': 'Place_Name'}, inplace=True)
LondonData=IP_DATA_ALL.loc[IP_DATA_ALL['Place_Name']=='London']
AllData=LondonData[['Country', 'Place_Name','Latitude']]
print('All Data') print(AllData)
MeanData=AllData.groupby(['Country', 'Place_Name'])['Latitude'].mean()
StdData=AllData.groupby(['Country', 'Place_Name'])['Latitude'].std()
print('Outliers')
UpperBound=float(MeanData+StdData) print('Higher than
', UpperBound)
OutliersHigher=AllData[AllData.Latitude>UpperBound] print(OutliersHigher)
LowerBound=float(MeanData-StdData) print('Lower than ', LowerBound)
OutliersLower=AllData[AllData.Latitude<LowerBound] print(OutliersLower)
print('Not Outliers')
OutliersNot=AllData[(AllData.Latitude>=LowerBound)
```

```
& (AllData.Latitude<=UpperBound)]

print(OutliersNot)

#########################################################################
```

Output :

```
========== RESTART: C:\VKHCG\05-DS\4000-UL\0200-DU\DU-Outliers.py ==========
###################################
Working Base : C:/VKHCG
###################################
Loading : C:/VKHCG/01-Vermeulen/00-RawData/IP_DATA_CORE.csv
All Data
     Country Place_Name  Latitude
1910      GB     London   51.5130
1911      GB     London   51.5508
1912      GB     London   51.5649
1913      GB     London   51.5895
1914      GB     London   51.5232
...      ...        ...       ...
3434      GB     London   51.5092
3435      GB     London   51.5092
3436      GB     London   51.5163
3437      GB     London   51.5085
3438      GB     London   51.5136

[1502 rows x 3 columns]
Outliers
Higher than  51.51263550786781
     Country Place_Name  Latitude
1910      GB     London   51.5130
1911      GB     London   51.5508
1912      GB     London   51.5649
1913      GB     London   51.5895
1914      GB     London   51.5232
1916      GB     London   51.5491
1919      GB     London   51.5161
```

```
1920    GB    London   51.5198
1921    GB    London   51.5198
1923    GB    London   51.5237
1924    GB    London   51.5237
1925    GB    London   51.5237
1926    GB    London   51.5237
1927    GB    London   51.5232
3436    GB    London   51.5163
3438    GB    London   51.5136
Lower than  51.506176875621 66
    Country Place_Name  Latitude
1915    GB    London   51.4739
Not Outliers
    Country Place_Name  Latitude
1917    GB    London   51.5085
1918    GB    London   51.5085
1922    GB    London   51.5085
1928    GB    London   51.5085
1929    GB    London   51.5085
...     ...      ...      ...
3432    GB    London   51.5092
3433    GB    London   51.5092
3434    GB    London   51.5092
3435    GB    London   51.5092
3437    GB    London   51.5085
[1485 rows x 3 columns]
```

E. Logging

Write a Python / R program for basic logging in data science.

C:\VKHCG\77-Yoke\Yoke_Logging.py

Code : import sys import os import

logging import uuid import shutil

import time

```
################################################################
Base='C:/VKHCG'
################################################################
```

sCompanies=['01-

Vermeulen','02-Krennwallner','03-Hillman','04-Clark'] sLayers=['01-Retrieve','02-

Assess','03Process','04-Transform','05-Organise','06-Report']

sLevels=['debug','info','warning','error'] for sCompany in sCompanies: sFileDir=Base + '/'

+ sCompany if not os.path.exists(sFileDir): os.makedirs(sFileDir) for sLayer in sLayers:

```
   log = logging.getLogger() # root logger for hdlr in log.handlers[:]:
# remove all old handlers     log.removeHandler(hdlr)
#-------------------------------------------------------------------------------
sFileDir=Base + '/' + sCompany + '/' + sLayer + '/Logging' if
os.path.exists(sFileDir):     shutil.rmtree(sFileDir) time.sleep(2) if
not os.path.exists(sFileDir):
   os.makedirs(sFileDir)
30 skey=str(uuid.uuid4()) sLogFile=Base + '/' + sCompany + '/' + sLayer +
'/Logging/Logging_'+skey+'.log' print('Set up:',sLogFile)  # set up
logging to file - see previous section for  more details
logging.basicConfig(level=logging.DEBUG,  format='%(asctime)s
%(name)-12s %(levelname)-8s %(message)s', datefmt='%m-%d
%H:%M', filename=sLogFile, filemode='w')
# define a Handler which writes INFO messages or higher to the sys.stderr
console = logging.StreamHandler() console.setLevel(logging.INFO) # set a
format which is simpler for console use formatter =
logging.Formatter('%(name)-12s: %(levelname)-8s %(message)s')
# tell the handler to use this format
console.setFormatter(formatter) # add the
handler to the root logger
logging.getLogger('').addHandler(console)
# Now, we can log to the root logger, or any other logger. First the root...
logging.info('Practical Data Science is fun!.') for sLevel in sLevels:
sApp='Apllication-'+ sCompany + '-' + sLayer + '-' + sLevel logger =
logging.getLogger(sApp) if sLevel == 'debug':
   logger.debug('Practical Data Science logged a debugging message.') if
sLevel == 'info':
   logger.info('Practical Data Science logged information message.') if sLevel
== 'warning':
   logger.warning('Practical Data Science logged a warning message.') if
sLevel == 'error':
   logger.error('Practical Data Science logged an error message.')
```

Output :

```
>>>
================= RESTART: C:\VKHCG\77-Yoke\Yoke_Logging.py =================
Set up: C:/VKHCG/01-Vermeulen/01-Retrieve/Logging/Logging_61705603-bb6e-47f0-b5a
9-23d42e267311.log
root        : INFO     Practical Data Science is fun!.
Apllication-01-Vermeulen-01-Retrieve-info: INFO     Practical Data Science logge
d information message.
Apllication-01-Vermeulen-01-Retrieve-warning: WARNING  Practical Data Science lo
gged a warning message.
Apllication-01-Vermeulen-01-Retrieve-error: ERROR    Practical Data Science logg
ed an error message.
Set up: C:/VKHCG/01-Vermeulen/02-Assess/Logging/Logging_a7fecb9b-4d40-474e-bc2d-
994958d85194.log
```

Practical No. 3

A. Vermeulen PLC :

The company has two main jobs on which to focus your attention:

• Designing a routing diagram for company

• Planning a schedule of jobs to be performed for the router network

Start your Python editor and create a text file named Retrieve-IP_Routing.py in directory. C:\VKHCG\01-Vermeulen\01-Retrieve

Code :

```
import sys import os import pandas as pd from
math import radians, cos, sin, asin, sqrt
##################################################################
def haversine(lon1, lat1, lon2, lat2,stype):
   """Calculate the great circle distance between two points     on
the earth (specified in decimal degrees)
   """
   # convert decimal degrees to radians     lon1, lat1, lon2, lat2
= map(radians, [lon1, lat1, lon2, lat2])
   # haversine formula     dlon = lon2 - lon1     dlat = lat2 - lat1
a = sin(dlat/2)**2 + cos(lat1) * cos(lat2) * sin(dlon/2)**2     c
= 2 * asin(sqrt(a))     if stype == 'km':
      r = 6371 # Radius of earth in kilometers
   else:
      r = 3956 # Radius of earth in miles         d=round(c
* r,3)     return d
################################
################################
##

Base='C:/VKHCG'
##################################################################
sFileName=Base + '/01-Vermeulen/00-RawData/IP_DATA_CORE.csv'
print('Loading :',sFileName)
IP_DATA_ALL=pd.read_csv(sFileName,header=0,low_memory=False,
```

```
usecols=['Country','Place Name','Latitude','Longitude'], encoding="latin-1")
#####################################################################
sFileDir=Base + '/01-Vermeulen/01-Retrieve/01-EDS/02-Python' if
not os.path.exists(sFileDir):
   os.makedirs(sFileDir)
#####################################################################
IP_DATA = IP_DATA_ALL.drop_duplicates(subset=None, keep='first', inplace=False)
IP_DATA.rename(columns={'Place Name': 'Place_Name'}, inplace=True)
IP_DATA1 = IP_DATA
IP_DATA1.insert(0, 'K', 1)
IP_DATA2 = IP_DATA1
#####################################################################
print(IP_DATA1.shape)
#####################################################################
IP_CROSS=pd.merge(right=IP_DATA1,left=IP_DATA2,on='K')
IP_CROSS.drop('K', axis=1, inplace=True)
IP_CROSS.rename(columns={'Longitude_x': 'Longitude_from', 'Longitude_y': 'Longitude_to'},
inplace=True)
IP_CROSS.rename(columns={'Latitude_x': 'Latitude_from', 'Latitude_y': 'Latitude_to'}, inplace=True)
IP_CROSS.rename(columns={'Place_Name_x': 'Place_Name_from', 'Place_Name_y':
'Place_Name_to'}, inplace=True)
IP_CROSS.rename(columns={'Country_x': 'Country_from', 'Country_y': 'Country_to'}, inplace=True)
#####################################################################
IP_CROSS['DistanceBetweenKilometers'] = IP_CROSS.apply(lambda row:
haversine( row['Longitude_from'], row['Latitude_from'], row['Longitude_to'],
row['Latitude_to'],
'km')
,axis=1)
#####################################################################
IP_CROSS['DistanceBetweenMiles'] = IP_CROSS.apply(lambda row:
haversine( row['Longitude_from'], row['Latitude_from'], row['Longitude_to'],
row['Latitude_to'],
```

'miles') ,axis=1)

print(IP_CROSS.shape) sFileName2=sFileDir +

'/Retrieve_IP_Routing.csv'

IP_CROSS.to_csv(sFileName2, index = False, encoding="latin-1")

##

print('### Done!! ##')

##

Output :

See the file named Retrieve_IP_Routing.csv in C:\VKHCG\01-Vermeulen\01-Retrieve\01-EDS\02-Python.

	Country_from	Place_Name_from	Latitude_from	Longitude_from	Country_to	Place_Name_to	Latitude_to	Longitude_to	DistanceBetweenKilometers	DistanceBetweenMile
2	US	New York	40.7528	-73.9725	US	New York	40.7528	-73.9725	0	0
3	US	New York	40.7528	-73.9725	US	New York	40.7214	-74.0052	4.448	2.762
4	US	New York	40.7528	-73.9725	US	New York	40.7662	-73.9862	1.885	1.17
5	US	New York	40.7528	-73.9725	US	New York	40.7449	-73.9782	1.001	0.622
6	US	New York	40.7528	-73.9725	US	New York	40.7605	-73.9933	1.95	1.211
7	US	New York	40.7528	-73.9725	US	New York	40.7588	-73.968	0.767	0.476
8	US	New York	40.7528	-73.9725	US	New York	40.7637	-73.9727	1.212	0.753
9	US	New York	40.7528	-73.9725	US	New York	40.7553	-73.9924	1.699	1.055
10	US	New York	40.7528	-73.9725	US	New York	40.7308	-73.9975	3.228	2.004
11	US	New York	40.7528	-73.9725	US	New York	40.7694	-73.9609	2.088	1.297

Total Records: 22501

So, the distance between a router in New York (40.7528, -73.9725) to anoher router in New York (40.7214, -74.0052) is 4.448 kilometers, or 2.762 miles.

B .Building a Diagram for the Scheduling of Jobs

Start your Python editor and create a text file named Retrieve-Router-Location.py in directory. C:\VKHCG\01-Vermeulen\01-Retrieve.

Code :

##

import sys import os import pandas as pd

##

InputFileName='IP_DATA_CORE.csv'

OutputFileName='Retrieve_Router_Location.csv'

##

Base='C:/VKHCG'

##

sFileName=Base + '/01-Vermeulen/00-RawData/' + InputFileName

print('Loading :',sFileName)

IP_DATA_ALL=pd.read_csv(sFileName,header=0,low_memory=False,

usecols=['Country','Place Name','Latitude','Longitude'], encoding="latin-1")

```
#####################################################################
IP_DATA_ALL.rename(columns={'Place Name': 'Place_Name'}, inplace=True)
#####################################################################
sFileDir=Base + '/01-Vermeulen/01-Retrieve/01-EDS/02-Python' if
not os.path.exists(sFileDir):

   os.makedirs(sFileDir)
ROUTERLOC = IP_DATA_ALL.drop_duplicates(subset=None, keep='first', inplace=False)
print('Rows :',ROUTERLOC.shape[0]) print('Columns :',ROUTERLOC.shape[1]) sFileName2=sFileDir
+ '/' + OutputFileName
ROUTERLOC.to_csv(sFileName2, index = False, encoding="latin-1")
#####################################################################
print('### Done!! ################################################')
#####################################################################
```

Output :

```
>>>
=== RESTART: C:\VKHCG\01-Vermeulen\01-Retrieve\Retrieve-Router-Location.py ===
Loading : C:/VKHCG/01-Vermeulen/00-RawData/IP_DATA_CORE.csv
Rows : 150
Columns : 4
### Done!! ############################################
```

1	Country	Place_Name	Latitude	Longitude
2	US	New York	40.7528	-73.9725
3	US	New York	40.7214	-74.0052
4	US	New York	40.7662	-73.9862
5	US	New York	40.7449	-73.9782
6	US	New York	40.7605	-73.9933
7	US	New York	40.7588	-73.968
8	US	New York	40.7637	-73.9727
9	US	New York	40.7553	-73.9924
10	US	New York	40.7308	-73.9975

C. Krennwallner AG

The company has two main jobs in need of your attention:

- Picking content for billboards: I will guide you through the data science required to pick advertisements for each billboard in the company.

- Understanding your online visitor data: I will guide you through the evaluation of the web traffic to the billboard's online web servers. **code :**

```
######################################################################
import sys import os import pandas as pd
######################################################################
InputFileName='DE_Billboard_Locations.csv'
OutputFileName='Retrieve_DE_Billboard_Locations.csv'
Company='02-Krennwallner'
######################################################################
Base='C:/VKHCG' print('##################################')
print('Working Base :',Base, ' using ', sys.platform)
print('##################################')
######################################################################
Base='C:/VKHCG' sFileName=Base + '/' + Company + '/00-RawData/' +
InputFileName print('Loading :',sFileName)
IP_DATA_ALL=pd.read_csv(sFileName,header=0,low_memory=False,
usecols=['Country','PlaceName','Latitude','Longitude'])
IP_DATA_ALL.rename(columns={'PlaceName': 'Place_Name'}, inplace=True)
#########  sFileDir=Base + '/' + Company + '/01-Retrieve/01-
EDS/02-Python' if not os.path.exists(sFileDir):
   os.makedirs(sFileDir)
ROUTERLOC = IP_DATA_ALL.drop_duplicates(subset=None, keep='first', inplace=False)
print('Rows :',ROUTERLOC.shape[0]) print('Columns :',ROUTERLOC.shape[1]) sFileName2=sFileDir
+ '/' + OutputFileName

ROUTERLOC.to_csv(sFileName2, index = False)
######################################################################
print('### Done!! ############################################')
######################################################################
```

Output :

```
>>>
 RESTART: C:\VKHCG\02-Krennwallner\01-Retrieve\Retrieve-DE-Billboard-Locations.py
################################
Working Base : C:/VKHCG  using  win32
################################
Loading : C:/VKHCG/02-Krennwallner/00-RawData/DE_Billboard_Locations.csv
Rows : 8873
Columns : 4
### Done!! ############################################
```

See the file named Retrieve_Router_Location.csv in
C:\VKHCG\02-Krennwallner\01-Retrieve\01-EDS\02-Python.

1	Country	Place_Name	Latitude	Longitude
2	US	New York	40.7528	-73.9725
3	US	New York	40.7214	-74.0052
4	US	New York	40.7662	-73.9862
5	US	New York	40.7449	-73.9782
6	US	New York	40.7605	-73.9933
7	US	New York	40.7588	-73.968
8	US	New York	40.7637	-73.9727
9	US	New York	40.7553	-73.9924
10	US	New York	40.7308	-73.9975

D . XML processing.

Code :

```
#################################################################
import sys import os import pandas as pd import xml.etree.ElementTree as ET
#################################################################
def df2xml(data):
   header = data.columns
root = ET.Element('root')    for
row in range(data.shape[0]):
      entry = ET.SubElement(root,'entry')    for
index in range(data.shape[1]):
      schild=str(header[index])       child =
ET.SubElement(entry, schild)    if
str(data[schild][row]) != 'nan':
child.text = str(data[schild][row])
   else:
      child.text = 'n/a'
entry.append(child)       result =
ET.tostring(root)    return result
#################################################################
```

```
def xml2df(xml_data):     root = ET.XML(xml_data)     all_records = []     for i,
child in enumerate(root):
       record = {}     for
subchild in child:
       record[subchild.tag] = subchild.text
all_records.append(record)     return pd.DataFrame(all_records)
#####################################################################
InputFileName='IP_DATA_ALL.csv'
OutputFileName='Retrieve_Online_Visitor.xml'
CompanyIn= '01-Vermeulen'
CompanyOut= '02-Krennwallner'
#####################################################################
if sys.platform == 'linux':
   Base=os.path.expanduser('~') + '/VKHCG'  else:
   Base='C:/VKHCG'
#####################################################################
print('################################') print('Working Base :',Base, '
using ', sys.platform)
print('################################')
#####################################################################
sFileName=Base + '/' + CompanyIn + '/00-RawData/' + InputFileName
print('Loading :',sFileName)
IP_DATA_ALL=pd.read_csv(sFileName,header=0,low_memory=False)
IP_DATA_ALL.rename(columns={'Place Name': 'Place_Name'}, inplace=True)
IP_DATA_ALL.rename(columns={'First IP Number': 'First_IP_Number'}, inplace=True)
IP_DATA_ALL.rename(columns={'Last IP Number': 'Last_IP_Number'}, inplace=True)
IP_DATA_ALL.rename(columns={'Post Code': 'Post_Code'}, inplace=True)
#####################################################################    sFileDir=Base + '/' +
CompanyOut + '/01-Retrieve/01-EDS/02-Python' if not os.path.exists(sFileDir):
   os.makedirs(sFileDir) visitordata =
IP_DATA_ALL.head(10000) print('Original
Subset Data Frame') print('Rows
```

```
:',visitordata.shape[0]) print('Columns
:',visitordata.shape[1]) print(visitordata)
print('Export XML')
sXML=df2xml(visitordata)
sFileName=sFileDir + '/' + OutputFileName
file_out = open(sFileName, 'wb')
file_out.write(sXML) file_out.close()
print('Store XML:',sFileName) xml_data =
open(sFileName).read()
unxmlrawdata=xml2df(xml_data) print('Raw
XML Data Frame') print('Rows
:',unxmlrawdata.shape[0]) print('Columns
:',unxmlrawdata.shape[1]) print(unxmlrawdata)
unxmldata =
unxmlrawdata.drop_duplicates(subset=N
one, keep='first', inplace=False)
print('Deduplicated XML Data Frame') print('Rows
:',unxmldata.shape[0]) print('Columns
:',unxmldata.shape[1]) print(unxmldata)
#####################################################################
#print('### Done!! ############################################')
#####################################################################
```

OUTPUT :

```
Working Base : C:/VKHCG using win32
####################################
Loading : C:/VKHCG/01-Vermeulen/00-RawData/IP_DATA_ALL.csv
Original Subset Data Frame
Rows : 3562
Columns : 8
      ID Country Place_Name  ... Longitude  First_IP_Number  Last_IP_Number
0      1      US   New York  ...  -73.9725        204276480        204276735
1      2      US   New York  ...  -73.9725        301984864        301985791
2      3      US   New York  ...  -73.9725        404678736        404679039
3      4      US   New York  ...  -73.9725        411592704        411592959
4      5      US   New York  ...  -73.9725        416784384        416784639
...  ...     ...        ...  ...       ...              ...              ...
3557 3558      DE     Munich  ...   11.5392       1591269504       1591269631
3558 3559      DE     Munich  ...   11.7500       1558374784       1558374911
3559 3560      DE     Munich  ...   11.4667       1480845312       1480845439
3560 3561      DE     Munich  ...   11.7434       1480596992       1480597503
3561 3562      DE     Munich  ...   11.7434       1558418432       1558418943

[3562 rows x 8 columns]
Export XML
Store XML: C:/VKHCG/02-Krennwallner/01-Retrieve/01-EDS/02-Python/Retrieve_Online_Visitor.xml
Raw XML Data Frame
Rows : 3562
Columns : 8
      ID Country Place_Name  ... Longitude First_IP_Number Last_IP_Number
0      1      US   New York  ...  -73.9725       204276480       204276735
1      2      US   New York  ...  -73.9725       301984864       301985791
2      3      US   New York  ...  -73.9725       404678736       404679039
3      4      US   New York  ...  -73.9725       411592704       411592959
4      5      US   New York  ...  -73.9725       416784384       416784639
...  ...     ...        ...  ...       ...             ...             ...
3557 3558      DE     Munich  ...   11.5392      1591269504      1591269631
3558 3559      DE     Munich  ...     11.75      1558374784      1558374911
3559 3560      DE     Munich  ...   11.4667      1480845312      1480845439
3560 3561      DE     Munich  ...   11.7434      1480596992      1480597503
3561 3562      DE     Munich  ...   11.7434      1558418432      1558418943

[3562 rows x 8 columns]
Deduplicated XML Data Frame
Rows : 3562
Columns : 8
      ID Country Place_Name  ... Longitude First_IP_Number Last_IP_Number
0      1      US   New York  ...  -73.9725       204276480       204276735
1      2      US   New York  ...  -73.9725       301984864       301985791
2      3      US   New York  ...  -73.9725       404678736       404679039
3      4      US   New York  ...  -73.9725       411592704       411592959
4      5      US   New York  ...  -73.9725       416784384       416784639
...  ...     ...        ...  ...       ...             ...             ...
3557 3558      DE     Munich  ...   11.5392      1591269504      1591269631
3558 3559      DE     Munich  ...     11.75      1558374784      1558374911
3559 3560      DE     Munich  ...   11.4667      1480845312      1480845439
3560 3561      DE     Munich  ...   11.7434      1480596992      1480597503
3561 3562      DE     Munich  ...   11.7434      1558418432      1558418943

[3562 rows x 8 columns]
>>>
```

See a file named Retrieve_Online_Visitor.xml in C:\VKHCG\02-Krennwallner\01-Retrieve\01EDS\02Python. This enables you to deliver XML format data as part of the retrieve step.

Practical No. 4

Assessing Data

Assess Superstep

Data quality refers to the condition of a set of qualitative or quantitative variables. Data quality is a multidimensional measurement of the acceptability of specific data sets. In business, data quality is measured to determine whether data can be used as a basis for reliable intelligence extraction for supporting organizational decisions. Data profiling involves observing in your data sources all the viewpoints that the information offers. The main goal is to determine if individual viewpoints are accurate and complete. The Assess superstep determines what additional processing to apply to the entries that are noncompliant. **Errors**

Typically, one of four things can be done with an error to the data.

1. Accept the Error

2. Reject the Error

3. Correct the Error

4. Create a Default Value

A : Write Python program to create the network routing diagram from the given data on routers.

Code :

```
######################################################################
import sys import os import pandas as pd
######################################################################
pd.options.mode.chained_assignment = None
######################################################################
Base='C:/VKHCG'
######################################################################
print('##################################')
print('Working Base :',Base, ' using ', sys.platform)
print('##################################')
######################################################################
sInputFileName='01-Retrieve/01-EDS/02-Python/Retrieve_IP_DATA.csv'
######################################################################
sOutputFileName='Assess-Network-Routing-Node.csv'
Company='01-Vermeulen'
######################################################################
```

```
### Import IP Data
######################################################################
sFileName=Base + '/' + Company + '/' + sInputFileName
print('###################################') print('Loading
:',sFileName)
print('###################################')
IPData=pd.read_csv(sFileName,header=0,low_memory=False, encoding="latin-1")
print('Loaded IP :', IPData.columns.values)
print('###################################')
######################################################################
print('###################################') print('Changed
:',IPData.columns.values)
IPData.drop('RowID', axis=1, inplace=True)
IPData.drop('ID', axis=1, inplace=True)
IPData.rename(columns={'Country': 'Country_Code'}, inplace=True)
IPData.rename(columns={'Place.Name': 'Place_Name'}, inplace=True)
IPData.rename(columns={'Post.Code': 'Post_Code'}, inplace=True)
IPData.rename(columns={'First.IP.Number': 'First_IP_Number'}, inplace=True)
IPData.rename(columns={'Last.IP.Number': 'Last_IP_Number'}, inplace=True)
print('To :',IPData.columns.values)
print('###################################')
######################################################################
print('###################################') print('Change
',IPData.columns.values) for i in IPData.columns.values:
j='Node_'+i
IPData.rename(columns={i: j}, inplace=True) print('To
', IPData.columns.values) print('###################################')
######################################################################
sFileDir=Base + '/' + Company + '/02-Assess/01-EDS/02-Python'
if not os.path.exists(sFileDir):
   os.makedirs(sFileDir)
######################################################################
```

```
sFileName=sFileDir + '/' + sOutputFileName

print('#################################') print('Storing :', sFileName)

print('#################################')

IPData.to_csv(sFileName, index = False, encoding="latin-1")

######################################################################

print('#################################') print('### Done!!

######################') print('#################################')
```

Output :

Go to C:\VKHCG\01-Vermeulen\02-Assess\01-EDS\02-Python folder and open AssessNetworkRouting-Company.csv

	A	B	C	D	E
1	ny_Countr	Company_Pl		ny_Longitude	Company_Country_Name
2	US	New York		-73.9725	United States of America
3	US	New York	40.7214	-74.0052	United States of America
4	US	New York	40.7662	-73.9862	United States of America
5	US	New York	40.7449	-73.9782	United States of America
6	US	New York	40.7605	-73.9933	United States of America
7	US	New York	40.7588	-73.968	United States of America
8	US	New York	40.7637	-73.9727	United States of America
9	US	New York	40.7553	-73.9924	United States of America

B : Keep Only the Rows That Contain a Maximum of Two Missing Values.

Code :

```
# -*- coding: utf-8 -*-

######################################################################

import sys import os import pandas as pd

######################################################################

sInputFileName='Good-or-Bad.csv' sOutputFileName='Good-or-Bad-03.csv'

Company='01-Vermeulen'

Base='C:/VKHCG'

######################################################################

print('#################################') print('Working Base :',Base, '

using Windows ~~~~') print('#################################')

######################################################################
```

```
sFileDir=Base + '/' + Company + '/02-Assess/01-EDS/02-Python' if
not os.path.exists(sFileDir):
   os.makedirs(sFileDir)
########################################################################
### Import Warehouse
########################################################################
sFileName=Base + '/' + Company + '/00-RawData/' + sInputFileName
print('Loading :',sFileName)
RawData=pd.read_csv(sFileName,header=0)
print('#################################')
print('## Raw Data Values')
print('#################################') print(RawData)
print('#################################')
print('## Data Profile') print('#################################')
print('Rows :',RawData.shape[0]) print('Columns :',RawData.shape[1])
print('#################################')
########################################################################
sFileName=sFileDir + '/' + sInputFileName
RawData.to_csv(sFileName, index = False)
########################################################################
TestData=RawData.dropna(thresh=2)
print('#################################') print('## Test Data Values')
print('#################################') print(TestData)
print('#################################')
print('## Data Profile') print('#################################')
print('Rows :',TestData.shape[0]) print('Columns
:',TestData.shape[1])
print('#################################') sFileName=sFileDir
+ '/' + sOutputFileName  TestData.to_csv(sFileName, index =
False)
########################################################
##########
```

print('###################################') print('### Done!!

####################') print('###################################')

Output :

Before

	A	B	C	D	E	F	G	H
1	ID	FieldA	FieldB	FieldC	FieldD	FieldE	FieldF	FieldG
2	1	Good	Better	Best	1024		10241	1
3	2	Good		Best	512		5121	2
4	3	Good	Better		256		256	3
5	4	Good	Better	Best			211	4
6	5	Good	Better		64		6411	5
7	6	Good		Best	32		32	6
8	7		Better	Best	16		1611	7
9	8			Best	8		8111	8
10	9				4		41	9
11	10	A	B	C	2		21111	10
12								11
13	10	Good	Better	Best	1024		102411	12
14	10	Good		Best	512		512	13
15	10	Good	Better		256		1256	14
16	10	Good	Better	Best				15
17	10	Good	Better		64		164	16
18	10	Good		Best	32		322	17
19	10		Better	Best	16		163	18
20	10			Best	8		844	19
21	10				4		4555	20
22	10	A	B	C	2		111	21

After

	A	B	C	D	E	F	G	H
1	ID	FieldA	FieldB	FieldC	FieldD	FieldE	FieldF	FieldG
2	1	Good	Better	Best	1024		10241	1
3	2	Good		Best	512		5121	2
4	3	Good	Better		256		256	3
5	4	Good	Better	Best			211	4
6	5	Good	Better		64		6411	5
7	6	Good		Best	32		32	6
8	7		Better	Best	16		1611	7
9	8			Best	8		8111	8
10	9				4		41	9
11	10	A	B	C	2		21111	10
12	10	Good	Better	Best	1024		102411	12
13	10	Good		Best	512		512	13
14	10	Good	Better		256		1256	14
15	10	Good	Better	Best				15
16	10	Good	Better		64		164	16
17	10	Good		Best	32		322	17
18	10		Better	Best	16		163	18
19	10			Best	8		844	19
20	10				4		4555	20
21	10	A	B	C	2		111	21

Row with more than two missing values got deleted.

C : Write a Python program to build directed acyclic graph.

Code :

##

import networkx as nx import matplotlib.pyplot as plt import sys import os

import pandas

as pd

##

Base='C:/VKHCG'

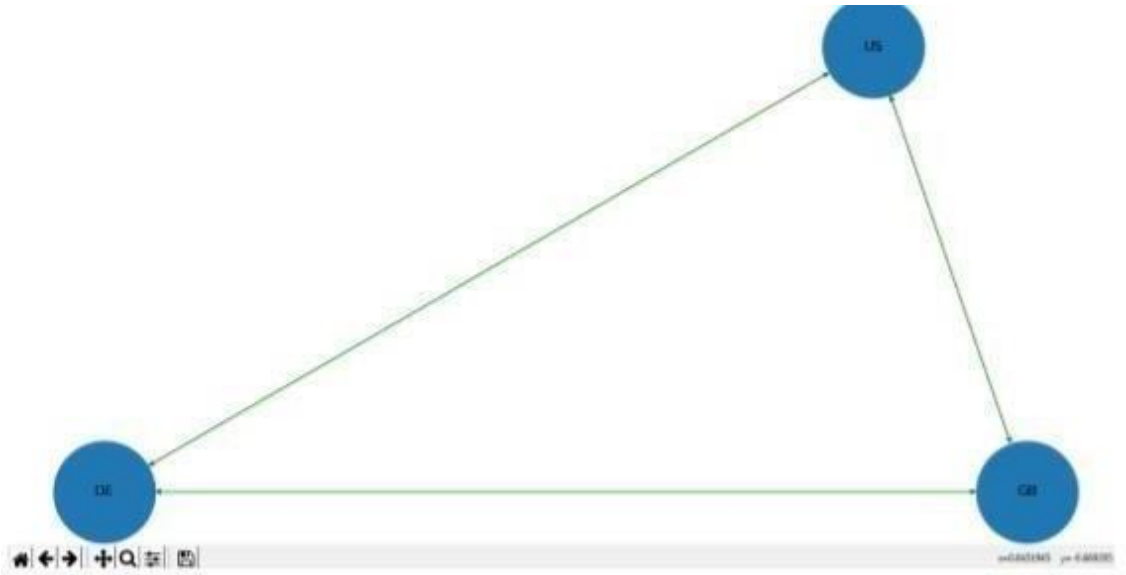
```
#####################################################################
print('#################################') print('Working Base :',Base, '
using ', sys.platform)
print('#################################')
##################################################################### sInputFileName='01-
Retrieve/01-EDS/02-Python/Retrieve_Router_Location.csv' sOutputFileName1='Assess-DAG-
Company-Country.png' sOutputFileName2='Assess-DAG-Company-Country-Place.png'
Company='01-Vermeulen'
#####################################################################
### Import Company Data
#####################################################################
sFileName=Base + '/' + Company + '/' + sInputFileName
print('#################################') print('Loading
:',sFileName) print('#################################')
CompanyData=pd.read_csv(sFileName,header=0,low_memory=False, encoding="latin-1")
print('Loaded Company :',CompanyData.columns.values)
print('#################################')
#####################################################################
print(CompanyData) print('#################################')
print('Rows : ',CompanyData.shape[0])
print('#################################')
#####################################################################
G1=nx.DiGraph()
G2=nx.DiGraph()
#####################################################################
for i in range(CompanyData.shape[0]):
G1.add_node(CompanyData['Country'][i])    sPlaceName=
CompanyData['Place_Name'][i] + '-' + CompanyData['Country'][i]
G2.add_node(sPlaceName) print('#################################')

for n1 in G1.nodes():    for
n2 in G1.nodes():       if
n1 != n2:
```

```
        print('Link :',n1,' to ', n2)
G1.add_edge(n1,n2) print('#################################')
print('#################################')
print("Nodes of graph: ")
print(G1.nodes()) print("Edges of
graph: ") print(G1.edges())
print('#################################')
#####################################################################
sFileDir=Base + '/' + Company + '/02-Assess/01-EDS/02-Python'
if not os.path.exists(sFileDir):
   os.makedirs(sFileDir)
#####################################################################
sFileName=sFileDir + '/' + sOutputFileName1
print('#################################') print('Storing :',
sFileName) print('#################################')
#nx.draw(G1,pos=nx.spectral_layout(G1),nodecolor='r',edge_color='g',with_labels=True,node_size=
8000,font_size=12) plt.savefig(sFileName)
# save as png plt.show() # display
#####################################################################
print('#################################')
for n1 in G2.nodes():    for
n2 in G2.nodes():
if n1 != n2:
print('Link :',n1,' to ', n2)

G2.add_edge(n1,n2) print('#################################')
print('#################################')
print("Nodes of graph: ") print(G2.nodes()) print("Edges
of graph: ") print(G2.edges())
print('#################################')

#####################################################################
sFileDir=Base + '/' + Company + '/02-Assess/01-EDS/02-Python' if not
os.path.exists(sFileDir):
```

```
   os.makedirs(sFileDir)
#####################################################################
sFileName=sFileDir + '/' + sOutputFileName2
print('################################')
print('Storing :', sFileName)
print('################################')
nx.draw(G2,pos=nx.spectral_layout(G2),
nodecolor='r',edge_color='b',
with_labels=True,node_size=8000, font_size=12)
plt.savefig(sFileName) # save as png plt.show() #
```

Output :

```
Rows : 150
################################
################################
Link  :  US  to  DE
Link  :  US  to  GB
Link : DE  to  US
Link : DE  to GB   Link
: GB  to US
Link : GB to DE
################################
################################
Nodes of graph:  ['US', 'DE', 'GB']
Edges of graph: [('US', 'DE'), ('US', 'GB'), ('DE', 'US'), ('DE', 'GB'), ('GB', 'US'), ('GB', 'DE')]
 ################################
```



D : Write a Python program to create a delivery route using the given data.

Creating a Delivery Route Hillman requires the complete grid plan of the delivery routes for the company, to ensure the suppliers, warehouses, shops, and customers can be reached by its new strategy. This new plan will enable the optimum routes between suppliers, warehouses, shops, and customers.

Open Python editor and create a file named Assess-Shipping-Routes.py in directory C:\VKHCG\03Hillman\02-Assess.

Code :

```
######################################################################

# -*- coding: utf-8 -*-

######################################################################

import sys import os import pandas

as pd import sqlite3 as sq from

pandas.io import sql import

networkx as nx from geopy.distance

import vincenty

######################################################################

nMax=3 nMaxPath=10 nSet=False nVSet=False

######################################################################

Base='C:/VKHCG'

######################################################################

print('##################################')

print('Working Base :',Base, ' using ', sys.platform)
```

```
print('#################################')
#####################################################################
Company='03-Hillman'
InputDir1='01-Retrieve/01-EDS/01-R'
InputDir2='01-Retrieve/01-EDS/02-Python'
InputFileName1='Retrieve_GB_Postcode_Warehouse.csv'
InputFileName2='Retrieve_GB_Postcodes_Shops.csv'
EDSDir='02-Assess/01-EDS'
OutputDir=EDSDir + '/02-Python'
OutputFileName1='Assess_Shipping_Routes.gml'
OutputFileName2='Assess_Shipping_Routes.txt'
#####################################################################
sFileDir=Base + '/' + Company + '/' + EDSDir if not
os.path.exists(sFileDir):
   os.makedirs(sFileDir)
#####################################################################
sFileDir=Base + '/' + Company + '/' + OutputDir if
not os.path.exists(sFileDir):
os.makedirs(sFileDir)
#####################################################################
sDataBaseDir=Base + '/' + Company + '/02-Assess/SQLite' if not
os.path.exists(sDataBaseDir):     os.makedirs(sDataBaseDir)
#####################################################################
sDatabaseName=sDataBaseDir + '/hillman.db' conn =
sq.connect(sDatabaseName)
#####################################################################
#####################################################################
### Import Warehouse Data
#####################################################################
sFileName=Base + '/' + Company + '/' + InputDir1 + '/' + InputFileName1
print('############') print('Loading :',sFileName)
WarehouseRawData=pd.read_csv(sFileName, header=0, low_memory=False,
encoding="latin-1"
```

```
)
WarehouseRawData.drop_duplicates(subset=None, keep='first', inplace=True)
WarehouseRawData.index.name = 'IDNumber'
WarehouseData=WarehouseRawData.head(nMax)
WarehouseData=WarehouseData.append(WarehouseRawData.tail(nMax))
WarehouseData=WarehouseData.append(WarehouseRawData[WarehouseRawData.postcode=='KA
13']) if
nSet==True:

WarehouseData=WarehouseData.append(WarehouseRawData[WarehouseRawData.postcode=='SW
1W'])
WarehouseData.drop_duplicates(subset=None, keep='first', inplace=True)
print('Loaded Warehouses :',WarehouseData.columns.values)
print('##################################')
#####################################################################
print('#################') sTable='Assess_Warehouse_UK'  print('Storing
:',sDatabaseName,' Table:',sTable) WarehouseData.to_sql(sTable, conn,
if_exists="replace") print('#################')
#####################################################################
print(WarehouseData.head()) print('##################################')
print('Rows
: ',WarehouseData.shape[0]) print('##################################')
#####################################################################
### Import Shop Data
#####################################################################
sFileName=Base + '/' + Company + '/' + InputDir1 + '/' + InputFileName2
print('############') print('Loading :',sFileName)
ShopRawData=pd.read_csv(sFileName, header=0, low_memory=False,
encoding="latin-1"
)
ShopRawData.drop_duplicates(subset=None, keep='first', inplace=True)
ShopRawData.index.name = 'IDNumber'
ShopData=ShopRawData print('Loaded Shops
```

```
:',ShopData.columns.values) print('###################################')

#####################################################################
print('#################') sTable='Assess_Shop_UK' print('Storing
:',sDatabaseName,' Table:',sTable) ShopData.to_sql(sTable, conn,
if_exists="replace") print('#################')
#####################################################################
print(ShopData.head()) print('###################################')
print('Rows : ',ShopData.shape[0])
print('###################################')
#####################################################################
### Connect HQ
#####################################################################
print('#################') sView='Assess_HQ' print('Creating
:',sDatabaseName,' View:',sView) sSQL="DROP VIEW IF EXISTS " + sView + ";"
sql.execute(sSQL,conn) sSQL="CREATE VIEW " + sView + " AS" sSQL=sSQL+ "
SELECT" sSQL=sSQL+ "
W.postcode AS HQ_PostCode," sSQL=sSQL+ " 'HQ-' ||
W.postcode AS HQ_Name," sSQL=sSQL+ "
round(W.latitude,6) AS HQ_Latitude," sSQL=sSQL+ "
round(W.longitude,6) AS HQ_Longitude" sSQL=sSQL+ "
FROM" sSQL=sSQL+ " Assess_Warehouse_UK as W"
sSQL=sSQL+ " WHERE" sSQL=sSQL+ " TRIM(W.postcode)
in ('KA13','SW1W');" sql.execute(sSQL,conn)
#############################################

####################

### Connect Warehouses
#####################################################################
print('#################') sView='Assess_Warehouse'  print('Creating
:',sDatabaseName,' View:',sView) sSQL="DROP VIEW IF EXISTS " + sView + ";"
sql.execute(sSQL,conn) sSQL="CREATE VIEW " + sView + " AS" sSQL=sSQL+ "
SELECT" sSQL=sSQL+ " W.postcode AS Warehouse_PostCode," sSQL=sSQL+ "
```

```
'WH-' || W.postcode AS Warehouse_Name," sSQL=sSQL+ "
round(W.latitude,6) AS Warehouse_Latitude," sSQL=sSQL+ "
round(W.longitude,6) AS Warehouse_Longitude" sSQL=sSQL+ " FROM"
sSQL=sSQL+ " Assess_Warehouse_UK as
W;" sql.execute(sSQL,conn)
######################################################################
### Connect Warehouse to Shops by PostCode
######################################################################
print('#################') sView='Assess_Shop' print('Creating :',sDatabaseName,'
View:',sView) sSQL="DROP VIEW IF EXISTS " + sView + ";" sql.execute(sSQL,conn) sSQL="CREATE
VIEW " + sView + " AS" sSQL=sSQL+ " SELECT" sSQL=sSQL+ "
TRIM(S.postcode) AS Shop_PostCode," sSQL=sSQL+ " 'SP-' || TRIM(S.FirstCode) || '-'
|| TRIM(S.SecondCode) AS Shop_Name," sSQL=sSQL+ " TRIM(S.FirstCode) AS
Warehouse_PostCode," sSQL=sSQL+ " round(S.latitude,6) AS Shop_Latitude,"
sSQL=sSQL+ " round(S.longitude,6) AS Shop_Longitude" sSQL=sSQL+ "
FROM" sSQL=sSQL+ "
Assess_Warehouse_UK as W" sSQL=sSQL+ " JOIN" sSQL=sSQL+
" Assess_Shop_UK as S" sSQL=sSQL+ " ON" sSQL=sSQL+ "
TRIM(W.postcode) = TRIM(S.FirstCode);"
sql.execute(sSQL,conn)
######################################################################
######################################################################
G=nx.Graph()
######################################################################
print('#################') sTable = 'Assess_HQ' print('Loading
:',sDatabaseName,' Table:',sTable) sSQL=" SELECT DISTINCT" sSQL=sSQL+ " *"
sSQL=sSQL+ " FROM" sSQL=sSQL+ " " + sTable +
";"
RouteData=pd.read_sql_query(sSQL, conn) print('#################')
######################################################################
print(RouteData.head()) print('#################################')
```

```
print('HQ Rows : ',RouteData.shape[0])
print('##################################')
#####################################################################
for i in range(RouteData.shape[0]):    sNode0=RouteData['HQ_Name'][i]
G.add_node(sNode0,
Nodetype='HQ',
PostCode=RouteData['HQ_PostCode'][i],
Latitude=round(RouteData['HQ_Latitude'][i],6),
Longitude=round(RouteData['HQ_Longitude'][i],6))
#####################################################################
print('#################') sTable = 'Assess_Warehouse' print('Loading
:',sDatabaseName,' Table:',sTable) sSQL=" SELECT DISTINCT" sSQL=sSQL+ " *"
sSQL=sSQL+ " FROM"
sSQL=sSQL+ " " + sTable + ";"
RouteData=pd.read_sql_query(sSQL, conn) print('#################')
#####################################################################
print(RouteData.head()) print('##################################')
print('Warehouse Rows : ',RouteData.shape[0])
print('##################################') for i in
range(RouteData.shape[0]):
   sNode0=RouteData['Warehouse_Name'][i]
G.add_node(sNode0,
Nodetype='Warehouse',
PostCode=RouteData['Warehouse_PostCode'][i],
Latitude=round(RouteData['Warehouse_Latitude'][i],6),
Longitude=round(RouteData['Warehouse_Longitude'][i],6))
print('#################') sTable = 'Assess_Shop'
print('Loading :',sDatabaseName,' Table:',sTable) sSQL=" SELECT
DISTINCT" sSQL=sSQL+ " *" sSQL=sSQL+ " FROM"  sSQL=sSQL+ "
" + sTable + ";"
RouteData=pd.read_sql_query(sSQL, conn)
print('#################') print(RouteData.head())
```

```
print('#################################') print('Shop
Rows : ',RouteData.shape[0])
print('#################################')
for i in range(RouteData.shape[0]):    sNode0=RouteData['Shop_Name'][i]
G.add_node(sNode0,
Nodetype='Shop',
PostCode=RouteData['Shop_PostCode'][i],
WarehousePostCode=RouteData['Warehouse_PostCode'][i],
Latitude=round(RouteData['Shop_Latitude'][i],6),
Longitude=round(RouteData['Shop_Longitude'][i],6))
#####################################################################
## Create Edges
#####################################################################
print('#################################') print('Loading Edges')
print('#################################')
for sNode0 in nx.nodes_iter(G):    for sNode1 in
nx.nodes_iter(G):
      if G.node[sNode0]['Nodetype']=='HQ' and \
G.node[sNode1]['Nodetype']=='HQ' and \           sNode0
!= sNode1:
          distancemeters=round(\ vincenty(\
(\
G.node[sNode0]['Latitude'],\
G.node[sNode0]['Longitude']\
),\
(\
G.node[sNode1]['Latitude']\
,\
G.node[sNode1]['Longitude']\
)\
).meters\
,0)
```

```
distancemiles=round(\ vincenty(\
(\
G.node[sNode0]['Latitude'],\
G.node[sNode0]['Longitude']\
),\
(\
G.node[sNode1]['Latitude']\
,\
G.node[sNode1]['Longitude']\
)\  ).miles\
,3) if
distancemiles >= 0.05:
   cost = round(150+(distancemiles * 2.5),6)     vehicle='V001'
else:
   cost = round(2+(distancemiles * 0.10),6) vehicle='ForkLift'
G.add_edge(sNode0,sNode1,DistanceMeters=distancemeters, \
DistanceMiles=distancemiles, \
Cost=cost,Vehicle=vehicle) if
nVSet==True:     print('Edge-HH:',sNode0,'
to ', sNode1, \ '
Distance:',distancemeters,'met
ers',\
distancemiles,'miles','Cost', cost,'Vehicle',vehicle)
if
G.node[sNode0]['Nodetype']=
='HQ' and \
G.node[sNode1]['Nodetype']=
='Warehouse' and \ sNode0 !=
sNode1:
distancemeters=round(\
vincenty(\
(\
```

```
G.node[sNode0]['Latitude'],\
G.node[sNode0]['Longitude']\
),\
(\
G.node[sNode1]['Latitude']\
,\
G.node[sNode1]['Longitude']\
)\
).meters\
,0)
distancemiles=round(\ vincenty(\
(\
G.node[sNode0]['Latitude'],\
G.node[sNode0]['Longitude']\
),\
(\
G.node[sNode1]['Latitude']\
,\
G.node[sNode1]['Longitude']\
)\
).miles\
,3)
if distancemiles >= 10:     cost =
round(50+(distancemiles * 2),6)     vehicle='V002'
else:
   cost = round(5+(distancemiles * 1.5),6) vehicle='V003'
if distancemiles <= 50:
   G.add_edge(sNode0,sNode1,DistanceMeters=distancemeters, \
DistanceMiles=distancemiles, \
Cost=cost,Vehicle=vehicle) if nVSet==True:
   print('Edge-H-W:',sNode0,' to ', sNode1, \ '
Distance:',distancemeters,'meters',\
```

```
distancemiles,'miles','Cost', cost,'Vehicle',vehicle) if
nSet==True and \
G.node[sNode0]['Nodetype']=='Warehouse' and \
G.node[sNode1]['Nodetype']=='Warehouse' and \ sNode0
!= sNode1:
distancemeters=round(\ vincenty(\
(\
G.node[sNode0]['Latitude'],\
G.node[sNode0]['Longitude']\
),\
(\
G.node[sNode1]['Latitude']\
,\
G.node[sNode1]['Longitude']\
)\
).meters\
,0)
distancemiles=round(\ vincenty(\
(\
G.node[sNode0]['Latitude'],\
G.node[sNode0]['Longitude']\
),\
(\
G.node[sNode1]['Latitude']\
,\
G.node[sNode1]['Longitude']\
)\
).miles\ ,3) if
distancemiles >= 10:
   cost = round(50+(distancemiles * 1.10),6)     vehicle='V004'
else:
```

```
    cost = round(5+(distancemiles * 1.05),6) vehicle='V005'
if distancemiles <= 20:
    G.add_edge(sNode0,sNode1,DistanceMeters=distancemeters, \
DistanceMiles=distancemiles, \
Cost=cost,Vehicle=vehicle) if nVSet==True:
    print('Edge-W-W:',sNode0,' to ', sNode1, \ '
Distance:',distancemeters,'meters',\ distancemiles,'miles','Cost',
cost,'Vehicle',vehicle) if
G.node[sNode0]['Nodetype']=='Warehouse' and \
G.node[sNode1]['Nodetype']=='Shop' and \
G.node[sNode0]['PostCode']==G.node[sNode1]['WarehousePostCode'] and \ sNode0 != sNode1:
distancemeters=round(\ vincenty(\
(\
G.node[sNode0]['Latitude'],\
G.node[sNode0]['Longitude']\
),\
(\
G.node[sNode1]['Latitude']\
,\
G.node[sNode1]['Longitude']\
)\
).meters\
,0)
distancemiles=round(\ vincenty(\
(\
G.node[sNode0]['Latitude'],\
G.node[sNode0]['Longitude']\
),\
(\
G.node[sNode1]['Latitude']\
,\
G.node[sNode1]['Longitude']\
```

```
)\
).miles\ ,3)  if distancemiles >= 10:
cost = round(50+(distancemiles *
1.50),6)     vehicle='V006' else:
   cost = round(5+(distancemiles * 0.75),6) vehicle='V007'
if distancemiles <= 10:
   G.add_edge(sNode0,sNode1,DistanceMeters=distancemeters, \
DistanceMiles=distancemiles, \
Cost=cost,Vehicle=vehicle) if nVSet==True:
   print('Edge-W-S:',sNode0,' to ', sNode1, \ '
Distance:',distancemeters,'meters',\
distancemiles,'miles','Cost', cost,'Vehicle',vehicle) if
nSet==True and \
G.node[sNode0]['Nodetype']=='Shop' and \
G.node[sNode1]['Nodetype']=='Shop' and \
G.node[sNode0]['WarehousePostCode']==G.node[sNode1]['WarehousePostCode'] and \ sNode0
!= sNode1:
   distancemeters=round(\ vincenty(\
(\
G.node[sNode0]['Latitude'],\
G.node[sNode0]['Longitude']\
),\
(\
G.node[sNode1]['Latitude']\
,\
G.node[sNode1]['Longitude']\
)\
).meters\
,0)
distancemiles=round(\ vincenty(\
(\
G.node[sNode0]['Latitude'],\
```

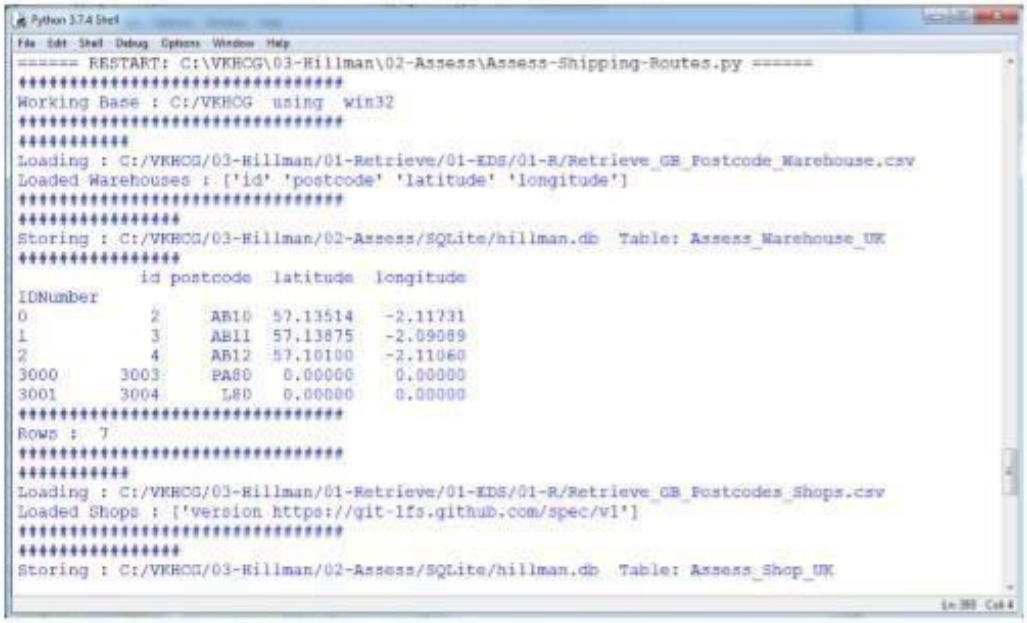
```
G.node[sNode0]['Longitude']\
),\
(\
G.node[sNode1]['Latitude']\
,\
G.node[sNode1]['Longitude']\
)\
).miles\ ,3)  if
distancemiles >= 0.05:
   cost = round(5+(distancemiles * 0.5),6)     vehicle='V008'
else:
   cost = round(1+(distancemiles * 0.1),6) vehicle='V009'
if distancemiles <= 0.075:
   G.add_edge(sNode0,sNode1,DistanceMeters=distancemeters, \
DistanceMiles=distancemiles, \
Cost=cost,Vehicle=vehicle) if nVSet==True:
   print('Edge-S-S:',sNode0,' to ', sNode1, \ '
Distance:',distancemeters,'meters',\
distancemiles,'miles','Cost', cost,'Vehicle',vehicle) if
nSet==True and \
   G.node[sNode0]['Nodetype']=='Shop' and \
G.node[sNode1]['Nodetype']=='Shop' and \
G.node[sNode0]['WarehousePostCode']!=G.node[sNode1]['WarehousePostCode'] and \ sNode0
!= sNode1:
distancemeters=round(\ vincenty(\
(\
G.node[sNode0]['Latitude'],\
G.node[sNode0]['Longitude']\
),\
(\
G.node[sNode1]['Latitude']\
,\
```

```
G.node[sNode1]['Longitude']\
)\
).meters\
,0)
distancemiles=round(\ vincenty(\
(\
G.node[sNode0]['Latitude'],\
G.node[sNode0]['Longitude']\
),\
(\
G.node[sNode1]['Latitude']\
,\
G.node[sNode1]['Longitude']\
)\
).miles\
,3)
cost = round(1+(distancemiles * 0.1),6) vehicle='V010'
if distancemiles <=
0.025:
   G.add_edge(sNode0,sNode1,DistanceMeters=distancemeters, \
DistanceMiles=distancemiles, \
Cost=cost,Vehicle=vehicle) if
nVSet==True:     print('Edge-SS:',sNode0,'
to ', sNode1, \ '
Distance:',distancemeters,'met
ers',\
distancemiles,'miles','Cost',
cost,'Vehicle',vehicle)  sFileName=sFileDir + '/'
+ OutputFileName1
print('################################')
print('Storing :', sFileName)
```

```
print('##################################')
nx.write_gml(G,sFileName) sFileName=sFileName +'.gz'
nx.write_gml(G,sFileName)
print('Nodes:',nx.number_of_nodes(G))
print('Edges:',nx.number_of_edges(G))
sFileName=sFileDir + '/' + OutputFileName2
print('##################################')
print('Storing :', sFileName) print('##################################')
##                    Create                    Paths
print('##################################')
print('Loading Paths')
print('##################################')
f = open(sFileName,'w') l=0 sline =
'ID|Cost|StartAt|EndAt|Path|Measure' if
nVSet==True: print ('0', sline)
f.write(sline+ '\n') for sNode0 in nx.nodes_iter(G):     for
sNode1 in nx.nodes_iter(G):        if sNode0 != sNode1
and \           nx.has_path(G, sNode0, sNode1)==True
and \           nx.shortest_path_length(G, \
source=sNode0,
\
target=sNode1, \
weight='DistanceMiles') < nMaxPath:
        l+=1
sID='{:.0f}'.format(l) spath = ','.join(nx.shortest_path(G,
\
source=sNode0, \ target=sNode1, \
weight='DistanceMiles')) slength= '{:.6f}'.format(\
nx.shortest_path_length(G, \ source=sNode0, \
target=sNode1, \ weight='DistanceMiles')) sline = sID
+ '|"DistanceMiles"|"' + sNode0 + '"|"' \ + sNode1 +
```

```
'"|"' + spath + '"|' + slength if nVSet==True: print
(sline)
f.write(sline + '\n') l+=1 sID='{:.0f}'.format(l)
spath = ','.join(nx.shortest_path(G, \
source=sNode0, \ target=sNode1, \
weight='DistanceMeters')) slength= '{:.6f}'.format(\
nx.shortest_path_length(G, \ source=sNode0, \
target=sNode1, \ weight='DistanceMeters')) sline =
sID + '|"DistanceMeters"|"' + sNode0 + '"|"' \ +
sNode1 + '"|"' + spath + '"|' + slength if nVSet==True:
print (sline)

f.write(sline + '\n') l+=1 sID='{:.0f}'.format(l)
spath = ','.join(nx.shortest_path(G, \
source=sNode0, \ target=sNode1, \
weight='Cost')) slength= '{:.6f}'.format(\
nx.shortest_path_length(G, \ source=sNode0,
\ target=sNode1, \
weight='Cost')) sline = sID + '|"Cost"|"' + sNode0
+ '"|"' \ + sNode1 + '"|"' + spath
+ '"|' + slength if nVSet==True: print
(sline)
f.write(sline + '\n')
f.close()
print('Nodes:',nx.number_of_nodes(G))
print('Edges:',nx.number_of_edges(G)) print('Paths:',sID)
print('#################') print('Vacuum Database') sSQL="VACUUM;"
sql.execute(sSQL,conn) print('#################') print('### Done!!
##############################################')
```

Output :


Python 3.7.4 Shell
File Edit Shell Debug Options Window Help
====== RESTART: C:\VKHCG\03-Hillman\02-Assess\Assess-Shipping-Routes.py ======
##################################
Working Base : C:/VKHCG using win32
##################################
############
Loading : C:/VKHCG/03-Hillman/01-Retrieve/01-EDS/01-R/Retrieve_GB_Postcode_Warehouse.csv
Loaded Warehouses : ['id' 'postcode' 'latitude' 'longitude']
##################################
#################
Storing : C:/VKHCG/03-Hillman/02-Assess/SQLite/hillman.db Table: Assess_Warehouse_UK
#################
id postcode latitude longitude
IDNumber
0 2 AB10 57.13514 -2.11731
1 3 AB11 57.13875 -2.09089
2 4 AB12 57.10100 -2.11060
3000 3003 PA80 0.00000 0.00000
3001 3004 L80 0.00000 0.00000
##################################
Rows : 7
##################################
############
Loading : C:/VKHCG/03-Hillman/01-Retrieve/01-EDS/01-R/Retrieve_GB_Postcodes_Shops.csv
Loaded Shops : ['version https://git-lfs.github.com/spec/v1']
##################################
#################
Storing : C:/VKHCG/03-Hillman/02-Assess/SQLite/hillman.db Table: Assess_Shop_UK

Practical No. 5

A : Build the Time, Hub and Satellites.

Code :

Open your Python editor and create a file named Process_Time.py. Save it into directory C:\VKHCG\01-Vermeulen\03-Process import sys import os from datetime import datetime from datetime import timedelta from pytz import timezone, all_timezones import pandas as pd import sqlite3 as sq from pandas.io import sql import uuid

```
pd.options.mode.chained_assignment = None
################################################################
if sys.platform == 'linux':
    Base=os.path.expanduser('~') + '/VKHCG' else:
    Base='C:/VKHCG' print('################################')
print('Working Base :',Base, ' using ', sys.platform)
print('################################')
################################################################
Company='01-Vermeulen'
InputDir='00-RawData'
InputFileName='VehicleData.csv'
################################################################
sDataBaseDir=Base + '/' + Company + '/03-Process/SQLite' if not
os.path.exists(sDataBaseDir):
    os.makedirs(sDataBaseDir)
################################################################
sDatabaseName=sDataBaseDir + '/Hillman.db' conn1
= sq.connect(sDatabaseName)
################################################################
sDataVaultDir=Base + '/88-DV' if not os.path.exists(sDataBaseDir):
    os.makedirs(sDataBaseDir)
################################################################
sDatabaseName=sDataVaultDir + '/datavault.db' conn2
= sq.connect(sDatabaseName)
################################################################
base = datetime(2018,1,1,0,0,0)  numUnits=10*365*24
```

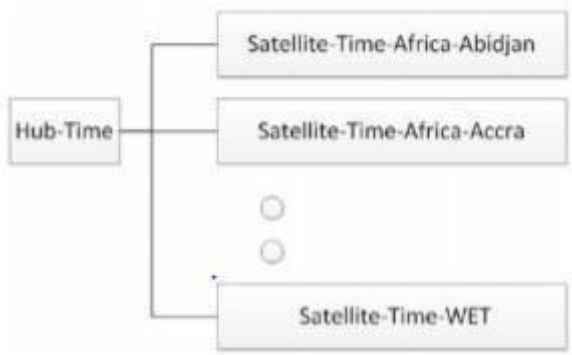
```
#####################################################################
date_list = [base - timedelta(hours=x) for x in range(0, numUnits)]
t=0 for i in date_list:
   now_utc=i.replace(tzinfo=timezone('UTC'))
sDateTime=now_utc.strftime("%Y-%m-%d %H:%M:%S") print(sDateTime)
sDateTimeKey=sDateTime.replace('
','-').replace(':','-') t+=1
IDNumber=str(uuid.uuid4())
TimeLine=[('ZoneBaseKey', ['UTC']),
('IDNumber', [IDNumber]),
('nDateTimeValue', [now_utc]),
('DateTimeValue', [sDateTime]), ('DateTimeKey',
[sDateTimeKey])]
if t==1:
   TimeFrame = pd.DataFrame.from_items(TimeLine)
else:
   TimeRow = pd.DataFrame.from_items(TimeLine)
TimeFrame = TimeFrame.append(TimeRow)
#####################################################################
TimeHub=TimeFrame[['IDNumber','ZoneBaseKey','DateTimeKey','DateTimeValue']]
TimeHubIndex=TimeHub.set_index(['IDNumber'],inplace=False)
#####################################################################
TimeFrame.set_index(['IDNumber'],inplace=True)
#####################################################################
sTable = 'Process-Time' print('Storing
:',sDatabaseName,' Table:',sTable)
TimeHubIndex.to_sql(sTable, conn1, if_exists="replace")
#####################################################################
sTable = 'Hub-Time' print('Storing
:',sDatabaseName,' Table:',sTable)
TimeHubIndex.to_sql(sTable, conn2, if_exists="replace")
#####################################################################
active_timezones=all_timezones z=0 for zone in active_timezones:
```

```
   t=0
   for j in range(TimeFrame.shape[0]):
      now_date=TimeFrame['nDateTimeValue'][j]
DateTimeKey=TimeFrame['DateTimeKey'][j]
now_utc=now_date.replace(tzinfo=timezone('UTC'))
sDateTime=now_utc.strftime("%Y-%m-%d %H:%M:%S")     now_zone
= now_utc.astimezone(timezone(zone))
sZoneDateTime=now_zone.strftime("%Y-%m-%d %H:%M:%S")
   print(sZoneDateTime) t+=1
z+=1
IDZoneNumber=str(uuid.uuid4())
TimeZoneLine=[('ZoneBaseKey', ['UTC']),
('IDZoneNumber', [IDZoneNumber]),
('DateTimeKey', [DateTimeKey]),
('UTCDateTimeValue', [sDateTime]),
('Zone', [zone]),
('DateTimeValue', [sZoneDateTime])]
if t==1:
   TimeZoneFrame = pd.DataFrame.from_items(TimeZoneLine)
else:
   TimeZoneRow = pd.DataFrame.from_items(TimeZoneLine)
TimeZoneFrame = TimeZoneFrame.append(TimeZoneRow)
TimeZoneFrameIndex=TimeZoneFrame.set_index(['IDZoneNumber'],inplace=False)
sZone=zone.replace('/','-').replace(' ','')
#################################################################
sTable = 'Process-Time-'+sZone print('Storing :',sDatabaseName,'
Table:',sTable)
TimeZoneFrameIndex.to_sql(sTable, conn1, if_exists="replace")
#################################################################
# ###############################################################
sTable = 'Satellite-Time-'+sZone print('Storing
:',sDatabaseName,' Table:',sTable)
```

```
TimeZoneFrameIndex.to_sql(sTable, conn2, if_exists="replace")

#####################################################################

# print('#################') print('Vacuum Databases') sSQL="VACUUM;"

sql.execute(sSQL,conn1) sql.execute(sSQL,conn2) print('#################')

##################################################################### print('###

Done!! ##############################################')
```

You have built your first hub and satellites for time in the data vault. The data vault has been built in directory ..\ VKHCG\88-DV\datavault.db. You can access it with your SQLite tools

Output :



B : Golden Nominal.

A golden nominal record is a single person's record, with distinctive references for use by all systems. This gives the system a single view of the person. I use first name, other names, last name, and birth date as my golden nominal.

The data we have in the assess directory requires a birth date to become a golden nominal. The proram will generate a golden nominal using our sample data set. Open your Python editor and create a file called Process-People.py in the .. C:\VKHCG\04-Clark\03-Process directory.

Code :

```
#####################################################################

import sys import os import sqlite3 as sq

import pandas as pd from pandas.io import

sql from datetime import datetime,

timedelta from pytz import timezone,

all_timezones from random import randint

import uuid

#####################################################################

if sys.platform == 'linux':
```

```
   Base=os.path.expanduser('~') + '/VKHCG'  else:
   Base='C:/VKHCG' print('##################################')
print('Working Base :',Base, ' using ', sys.platform)
print('##################################')
#########################################################################
Company='04-Clark' sInputFileName='02-Assess/01-EDS/02-
Python/Assess_People.csv'
#########################################################################
sDataBaseDir=Base + '/' + Company + '/03-Process/SQLite' if not
os.path.exists(sDataBaseDir):      os.makedirs(sDataBaseDir)
#########################################################################
sDatabaseName=sDataBaseDir + '/clark.db' conn1
= sq.connect(sDatabaseName)
#########################################################################
sDataVaultDir=Base + '/88-DV' if not os.path.exists(sDataBaseDir):
   os.makedirs(sDataBaseDir)
#########################################################################
sDatabaseName=sDataVaultDir + '/datavault.db' conn2
= sq.connect(sDatabaseName)
#########################################################################
### Import Female Data
#########################################################################
sFileName=Base + '/' + Company + '/' + sInputFileName
print('##################################')
print('Loading :',sFileName)
print('##################################') print(sFileName)
RawData=pd.read_csv(sFileName,header=0,low_memory=False,
encoding="latin-1") RawData.drop_duplicates(subset=None, keep='first',
inplace=True) start_date =
datetime(1900,1,1,0,0,0) start_date_utc=start_date.replace(tzinfo=timezone('UTC'))
HoursBirth=100*365*24
RawData['BirthDateUTC']=RawData.apply(lambda row:
```

```
(start_date_utc + timedelta(hours=randint(0, HoursBirth)))
,axis=1) zonemax=len(all_timezones)-1
RawData['TimeZone']=RawData.apply(lambda row:
(all_timezones[randint(0, zonemax)])
,axis=1)
RawData['BirthDateISO']=RawData.apply(lambda row:
row["BirthDateUTC"].astimezone(timezone(row['TimeZone'])) ,axis=1)
RawData['BirthDateKey']=RawData.apply(lambda row:
row["BirthDateUTC"].strftime("%Y-%m-%d %H:%M:%S")
,axis=1)
RawData['BirthDate']=RawData.apply(lambda row:
row["BirthDateISO"].strftime("%Y-%m-%d %H:%M:%S")
,axis=1)
RawData['PersonID']=RawData.apply(lambda row:
str(uuid.uuid4())
,axis=1)
#####################################################################
Data=RawData.copy()
Data.drop('BirthDateUTC', axis=1,inplace=True)
Data.drop('BirthDateISO', axis=1,inplace=True) indexed_data
= Data.set_index(['PersonID']) print('################################')
#####################################################################
print('#################') sTable='Process_Person'

print('Storing

:',sDatabaseName,' Table:',sTable)
indexed_data.to_sql(sTable, conn1, if_exists="replace")
print('#################')
#####################################################################
PersonHubRaw=Data[['PersonID','FirstName','SecondName','LastName','BirthDateKey']]
PersonHubRaw['PersonHubID']=RawData.apply(lambda row:
str(uuid.uuid4())
,axis=1)
```

```
PersonHub=PersonHubRaw.drop_duplicates(subset=None, \ keep='first',\
inplace=False) indexed_PersonHub =
PersonHub.set_index(['PersonHubID']) sTable = 'Hub-Person'
print('Storing :',sDatabaseName,' Table:',sTable)
indexed_PersonHub.to_sql(sTable, conn2, if_exists="replace")
#####################################################################
PersonSatelliteGenderRaw=Data[['PersonID','FirstName','SecondName','LastName'\
,'BirthDateKey','Gender']]
PersonSatelliteGenderRaw['PersonSatelliteID']=RawData.apply(lambda row:
str(uuid.uuid4())
,axis=1)
PersonSatelliteGender=PersonSatelliteGenderRaw.drop_duplicates(subset=None, \
keep='first', \  inplace=False)
indexed_PersonSatelliteGender  =
PersonSatelliteGender.set_index(['PersonSatelliteID']) sTable = 'Satellite-PersonGender'
print('Storing :',sDatabaseName,' Table:',sTable)
indexed_PersonSatelliteGender.to_sql(sTable, conn2, if_exists="replace")
#####################################################################
PersonSatelliteBirthdayRaw=Data[['PersonID','FirstName','SecondName','LastName',\
'BirthDateKey','TimeZone','BirthDate']]
PersonSatelliteBirthdayRaw['PersonSatelliteID']=RawData.apply(lambda row:
str(uuid.uuid4())
,axis=1)
PersonSatelliteBirthday=PersonSatelliteBirthdayRaw.drop_duplicates(subset=None, \ keep='first',\
inplace=False) indexed_PersonSatelliteBirthday =
PersonSatelliteBirthday.set_index(['PersonSatelliteID']) sTable = 'Satellite-Person-Names' print('Storing
:',sDatabaseName,' Table:',sTable) indexed_PersonSatelliteBirthday.to_sql(sTable, conn2,
if_exists="replace")
#####################################################################
sFileDir=Base + '/' + Company + '/03-Process/01-EDS/02-Python' if not
os.path.exists(sFileDir):
   os.makedirs(sFileDir)
```

```
#################################################################
sOutputFileName = sTable + '.csv' sFileName=sFileDir
+ '/' + sOutputFileName print('################################')
print('Storing :', sFileName) print('################################')
RawData.to_csv(sFileName, index = False)
print('################################')
#################################################################
print('################') print('Vacuum Databases')
sSQL="VACUUM;" sql.execute(sSQL,conn1)
sql.execute(sSQL,conn2)
print('################')
################################################################# print('###
Done!! ############################################')
```

Output:

```
========== RESTART: C:\VKHCG\04-Clark\03-Process\Process-People.py ==========
################################
Working Base : C:/VKHCG  using  win32
################################
################################
Loading : C:/VKHCG/04-Clark/02-Assess/01-EDS/02-Python/Assess_People.csv
################################
C:/VKHCG/04-Clark/02-Assess/01-EDS/02-Python/Assess_People.csv
################################
################
Storing : C:/VKHCG/88-DV/datavault.db  Table: Process_Person
################
Storing : C:/VKHCG/88-DV/datavault.db  Table: Satellite-Person-Gender
Storing : C:/VKHCG/88-DV/datavault.db  Table: Satellite-Person-Names
################################
Storing : C:/VKHCG/04-Clark/03-Process/01-EDS/02-Python/Satellite-Person-Names.csv
################################
################################
################
Vacuum Databases
################
### Done!! ############################################
```

Practical No 6

Transform Superstep

The Transform superstep allows you, as a data scientist, to take data from the data vault and formulate answers to questions raised by your investigations. The transformation step is the data science process that converts results into insights. It takes standard data science techniques and methods to attain insight and knowledge about the data that then can be transformed into actionable decisions, which, through storytelling, you can explain to non-data scientists what you have discovered in the data lake.

To illustrate the consolidation process, the example show a person being borne. Open a new file in the Python editor and save it as Transform-Gunnarsson_is_Born.py in directory C:\VKHCG\01-Vermeulen\04-Transform.

Code:

```
################################################################

# import sys import os from datetime import datetime from pytz import

timezone import pandas as pd import sqlite3 as sq import uuid

pd.options.mode.chained_assignment =

None

################################################################

# Base='C:/VKHCG' print('##################################')

print('Working Base :',Base, ' using ', sys.platform)

print('##################################')

################################################################

Company='01-Vermeulen'

InputDir='00-RawData'

InputFileName='VehicleData.csv'

################################################################

# sDataBaseDir=Base + '/' + Company + '/04-Transform/SQLite' if not

os.path.exists(sDataBaseDir):    os.makedirs(sDataBaseDir)

################################################################

# sDatabaseName=sDataBaseDir + '/Vermeulen.db' conn1 =

sq.connect(sDatabaseName)

################################################################
```

```
    sDataVaultDir=Base + '/88-DV' if not
    os.path.exists(sDataVaultDir):
    os.makedirs(sDataVaultDir)
    ########################################################################
    # sDatabaseName=sDataVaultDir + '/datavault.db' conn2 =
    sq.connect(sDatabaseName)
    ########################################################################

    sDataWarehouseDir=Base + '/99-DW' if not
    os.path.exists(sDataWarehouseDir):
    os.makedirs(sDataWarehouseDir)
    ########################################################################
    # sDatabaseName=sDataWarehouseDir + '/datawarehouse.db' conn3 =
    sq.connect(sDatabaseName)
    ########################################################################
    # print('\n###################################') print('Time Category')
    print('UTC Time')
    BirthDateUTC = datetime(1960,12,20,10,15,0)
    BirthDateZoneUTC=BirthDateUTC.replace(tzinfo=timezone('UTC'))
    BirthDateZoneStr=BirthDateZoneUTC.strftime("%Y-%m-%d %H:%M:%S")
    BirthDateZoneUTCStr=BirthDateZoneUTC.strftime("%Y-%m-%d %H:%M:%S (%Z) (%z)")
    print(BirthDateZoneUTCStr) print('###################################')
    print('Birth Date in Reykjavik :')
    BirthZone = 'Atlantic/Reykjavik'
    BirthDate = BirthDateZoneUTC.astimezone(timezone(BirthZone))
    BirthDateStr=BirthDate.strftime("%Y-%m-%d %H:%M:%S (%Z) (%z)")
    BirthDateLocal=BirthDate.strftime("%Y-%m-%d %H:%M:%S")
    print(BirthDateStr)
print('###################################')
```

Output:

Guðmundur Gunnarsson was born on December 20, 1960, at 9:15 in Landspítali, Hringbraut 101, 101 Reykjavík, Iceland

You must build three items: dimension Person, dimension Time, and factPersonBornAtTime. Open your Python editor and create a file named Transform-Gunnarsson-Sun-Model.py in directory C:\VKHCG\01-Vermeulen\04-Transform

```
>>>
 RESTART: C:\VKHCG\01-Vermeulen\04-Transform\Transform-Gunnarsson_Is_Born.py
Working Base : C:/VKHCG using win32
Time Category
UTC Time
1960-12-20 10:15:00 (UTC) (+0000)
####################################
Birth Date in Reykjavik :
1960-12-20 09:15:00 (-01) (-0100)
####################################
####################################
Storing : C:/VKHCG/99-DW/datawarehouse.db
 Table: Hub-Time-Gunnarsson
####################################
####################################
Storing : C:/VKHCG/99-DW/datawarehouse.db
 Table: Satellite-Time-Atlantic-Reykjavik-Gunnarsson
####################################
Person Category
Name: Guðmundur Gunnarsson
Birth Date: 1960-12-20 09:15:00
Birth Zone: Atlantic/Reykjavik
UTC Birth Date: 1960-12-20 10:15:00
####################################
Storing : C:/VKHCG/99-DW/datawarehouse.db
 Table: Hub-Person-Gunnarsson
####################################
```

Practical No 7

Organize Superstep

The Organize superstep takes the complete data warehouse you built at the end of the Transform superstep and subsections it into business-specific data marts. A data mart is the access layer of the data warehouse environment built to expose data to the users. The data mart is a subset of the data warehouse and is generally oriented to a specific business group.

Horizontal Style

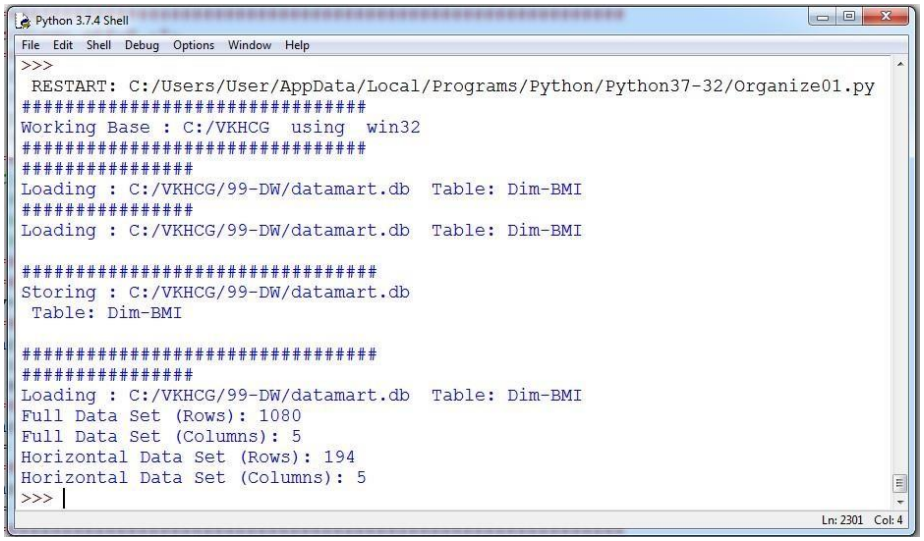
Performing horizontal-style slicing or subsetting of the data warehouse is achieved by applying a filter technique that forces the data warehouse to show only the data for a specific preselected set of filtered outcomes against the data population. The horizontal-style slicing selects the subset of rows from the population while preserving the columns. That is, the data science tool can see the complete record for the records in the subset of records.

C:\VKHCG\01-Vermeulen\05-Organise\ Organize-Horizontal.py

```
################################################################

# -*- coding: utf-8 -*-

################################################################ import sys import os
import pandas as pd import sqlite3 as sq

################################################################

Base='C:/VKHCG' print('##################################') print('Working Base :',Base, ' using ',
sys.platform) print('##################################')

################################################################

################################################################

Company='01-Vermeulen'

################################################################
sDataWarehouseDir=Base + '/99-DW' if not os.path.exists(sDataWarehouseDir):

   os.makedirs(sDataWarehouseDir)

################################################################

sDatabaseName=sDataWarehouseDir + '/datawarehouse.db' conn1 = sq.connect(sDatabaseName)

################################################################

sDatabaseName=sDataWarehouseDir + '/datamart.db' conn2 = sq.connect(sDatabaseName)

################################################################
print('################') sTable = 'Dim-BMI'

print('Loading :',sDatabaseName,' Table:',sTable) sSQL="SELECT * FROM [Dim-BMI];"
PersonFrame0=pd.read_sql_query(sSQL, conn1) print('################') sTable = 'Dim-BMI'

print('Loading :',sDatabaseName,' Table:',sTable)

sSQL="SELECT PersonID,\Height,\Weight,\bmi,\Indicator\
```

```
FROM [Dim-BMI]\ WHERE \ Height > 1.5\ and Indicator = 1\ORDER BY\ Height,\Weight;"
PersonFrame1=pd.read_sql_query(sSQL, conn1)
#################################################################
DimPerson=PersonFrame1
DimPersonIndex=DimPerson.set_index(['PersonID'],inplace=False)
#################################################################
###### sTable = 'Dim-BMI'
print('\n#################################'
) print('Storing :',sDatabaseName,'\n
Table:',sTable)
print('\n#################################'
)
#DimPersonIndex.to_sql(sTable, conn2, if_exists="replace")
#########################################################
############ print('################') sTable = 'Dim-BMI'
print('Loading :',sDatabaseName,' Table:',sTable)
sSQL="SELECT * FROM [Dim-BMI];"
PersonFrame2=pd.read_sql_query(sSQL, conn2)
print('Full Data Set (Rows):',
PersonFrame0.shape[0]) print('Full Data Set
(Columns):', PersonFrame0.shape[1])
print('Horizontal Data Set (Rows):',
PersonFrame2.shape[0]) print('Horizontal Data
Set (Columns):', PersonFrame2.shape[1])
```

Output:



The horizontal-style slicing selects the 194 subset of rows from the 1080 rows while preserving the columns.

Vertical Style

Performing vertical-style slicing or subsetting of the data warehouse is achieved by applying a filter technique that forces the data warehouse to show only the data for specific preselected filtered outcomes against the data population. The vertical-style slicing selects the subset of columns from the population, while preserving the rows. That is, the data science tool can see only the preselected columns from a record for all the records in the population.

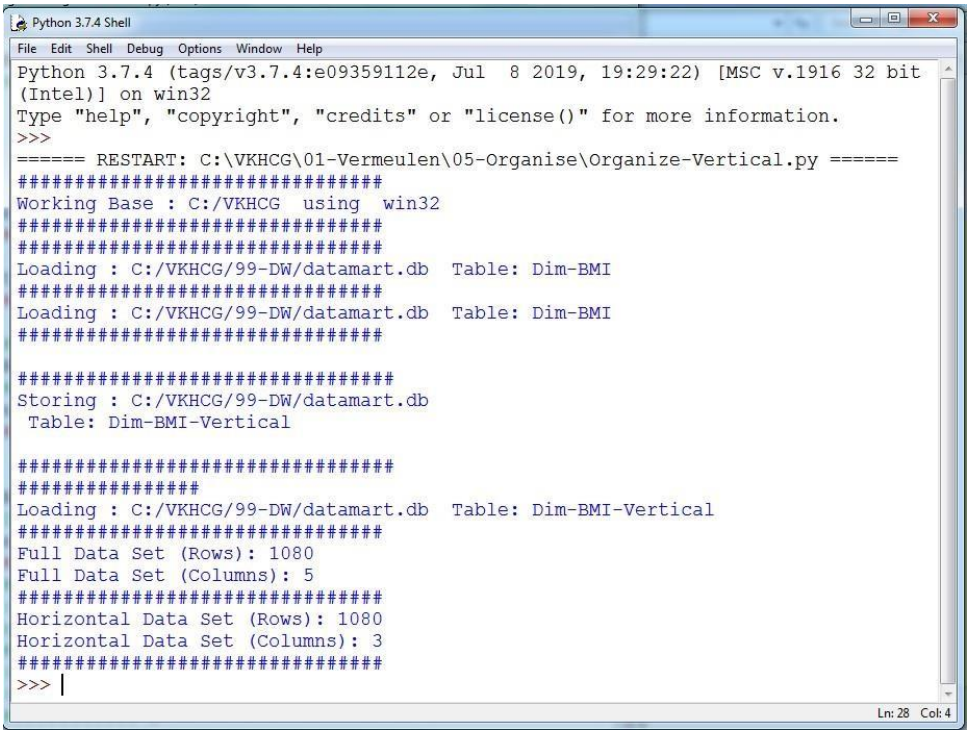
C:\VKHCG\01-Vermeulen\05-Organise\ Organize-Vertical.py

```
#################################################################
```

```
# -*- coding: utf-8 -*-
#########################################################
############ import sys import os import pandas as pd import
sqlite3 as sq
#####################################################################
Base='C:/VKHCG'
print('##################################')
print('Working Base :',Base, ' using ',
sys.platform)
print('##################################')
#####################################################################
#####################################################################
Company='01-Vermeulen'
#########################################################
############ sDataWarehouseDir=Base + '/99-DW' if not
os.path.exists(sDataWarehouseDir):
   os.makedirs(sDataWarehouseDir)
#####################################################################
sDatabaseName=sDataWarehouseDir +
'/datawarehouse.db' conn1 =
sq.connect(sDatabaseName)
#####################################################################
sDatabaseName=sDataWarehouseDir +
'/datamart.db' conn2 =
sq.connect(sDatabaseName)
#########################################################
############ print('##################################')
sTable = 'Dim-BMI'
print('Loading :',sDatabaseName,' Table:',sTable)
sSQL="SELECT * FROM [Dim-BMI];"
PersonFrame0=pd.read_sql_query(sSQL, conn1)
#########################################################
############ print('##################################')
sTable = 'Dim-BMI' print('Loading :',sDatabaseName,'
Table:',sTable) print('##################################')
sSQL="SELECT \
      Height,\
      Weight,\
      Indicator\
  FROM [Dim-BMI];"
PersonFrame1=pd.read_sql_query(sSQL, conn1)
#####################################################################
DimPerson=PersonFrame1
DimPersonIndex=DimPerson.set_index(['Indicator'],inplace=False)
##################################################################### sTable = 'Dim-
BMI-Vertical'
print('\n##################################'
) print('Storing :',sDatabaseName,'\n
Table:',sTable)
print('\n##################################'
)
DimPersonIndex.to_sql(sTable, conn2, if_exists="replace")
```

```
#########################################################
############ print('################')  sTable = 'Dim-BMI-
Vertical'
print('Loading :',sDatabaseName,' Table:',sTable)
sSQL="SELECT * FROM [Dim-BMI-Vertical];"
PersonFrame2=pd.read_sql_query(sSQL, conn2)
#########################################################
############ print('##################################')
print('Full Data Set (Rows):', PersonFrame0.shape[0]) print('Full
Data Set (Columns):', PersonFrame0.shape[1])
print('##################################')
print('Horizontal Data Set (Rows):', PersonFrame2.shape[0])
print('Horizontal Data Set (Columns):',
PersonFrame2.shape[1])
print('##################################')
#################################################################
```

Output:



The vertical-style slicing selects 3 of 5 from the population, while preserving the rows [1080].

Island Style

Performing island-style slicing or subsetting of the data warehouse is achieved by applying a combination of horizontal- and vertical-style slicing. This generates a subset of specific rows and specific columns reduced at the same time.

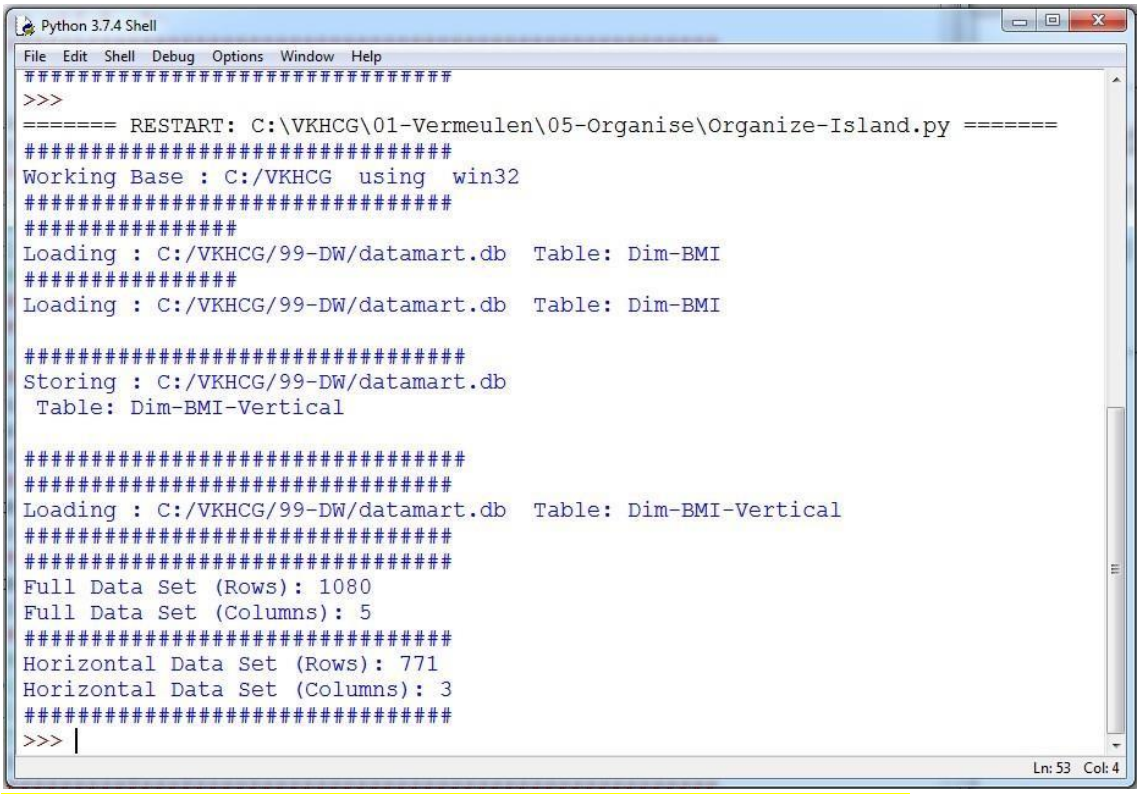
C:\VKHCG\01-Vermeulen\05-Organise\ Organize-Island.py

```
#################################################################
# -*- coding: utf-8 -*-
#########################################################
############ import sys import os import pandas as pd import
sqlite3 as sq
#################################################################
Base='C:/VKHCG'
```

```
print('################################')
print('Working Base :',Base, ' using ',
sys.platform)
print('################################')
#####################################################################
#####################################################################
Company='01-Vermeulen'
#####################################################################
sDataWarehouseDir=Base
+ '/99-DW' if not
os.path.exists(sDataWareho
useDir):
   os.makedirs(sDataWarehouseDir)
#####################################################################
sDatabaseName=sDataWarehouseDir +
'/datawarehouse.db' conn1 =
sq.connect(sDatabaseName)
#####################################################################
sDatabaseName=sDataWarehouseDir +
'/datamart.db' conn2 =
sq.connect(sDatabaseName)
#####################################################
############ print('################')  sTable = 'Dim-BMI'
print('Loading :',sDatabaseName,' Table:',sTable)
sSQL="SELECT * FROM [Dim-BMI];"
PersonFrame0=pd.read_sql_query(sSQL, conn1)
#####################################################
############ print('################')  sTable = 'Dim-BMI'
print('Loading :',sDatabaseName,' Table:',sTable)

sSQL="SELECT \
      Height,\
      Weight,\
      Indicator\
  FROM [Dim-BMI]\
  WHERE Indicator > 2\
  ORDER BY  \
      Height,\
      Weight;"
PersonFrame1=pd.read_sql_query(sSQL, conn1)
#####################################################################
DimPerson=PersonFrame1
DimPersonIndex=DimPerson.set_index(['Indicator'],inplace=False)
#############################################################
###### sTable = 'Dim-BMI-Vertical'
print('\n#################################'
) print('Storing :',sDatabaseName,'\n
Table:',sTable)
print('\n#################################'
)
DimPersonIndex.to_sql(sTable, conn2, if_exists="replace")
#####################################################
############ print('################################')
sTable = 'Dim-BMI-Vertical' print('Loading :',sDatabaseName,'
```

Table:',sTable) print('################################')
sSQL="SELECT * FROM [Dim-BMI-Vertical];"
PersonFrame2=pd.read_sql_query(sSQL, conn2)
###
############ print('################################')
print('Full Data Set (Rows):', PersonFrame0.shape[0]) print('Full
Data Set (Columns):', PersonFrame0.shape[1])
print('################################')
print('Horizontal Data Set (Rows):', PersonFrame2.shape[0])
print('Horizontal Data Set (Columns):',
PersonFrame2.shape[1])
print('################################')
###

Output:



This generates a subset of 771 rows out of 1080 rows and 3 columns out of 5.

Secure Vault Style

The secure vault is a version of one of the horizontal, vertical, or island slicing techniques, but the outcome is also attached to the person who performs the query. This is common in multi-security environments, where different users are allowed to see different data sets.

This process works well, if you use a role-based access control (RBAC) approach to restricting system access to authorized users. The security is applied against the "role," and a person can then, by the security system, simply be added or removed from the role, to enable or disable access.

C:\VKHCG\01-Vermeulen\05-Organise\ Organize-Secure-Vault.py

###
-*- coding: utf-8 -*-
###
############ import sys import os import pandas as pd import
sqlite3 as sq
###

```
Base='C:/VKHCG'
print('################################')
print('Working Base :',Base, ' using ',
sys.platform)
print('################################')
################################################################
################################################################
Company='01-Vermeulen'
################################################################
sDataWarehouseDir=Base
+ '/99-DW' if not
os.path.exists(sDataWareho
useDir):
   os.makedirs(sDataWarehouseDir)
################################################################
sDatabaseName=sDataWarehouseDir +
'/datawarehouse.db' conn1 =
sq.connect(sDatabaseName)
################################################################
sDatabaseName=sDataWarehouseDir +
'/datamart.db' conn2 =
sq.connect(sDatabaseName)
#####################################################
############ print('################')  sTable = 'Dim-BMI'
print('Loading :',sDatabaseName,' Table:',sTable)
sSQL="SELECT * FROM [Dim-BMI];"
PersonFrame0=pd.read_sql_query(sSQL, conn1)
#####################################################
############ print('################')  sTable = 'Dim-BMI'
print('Loading :',sDatabaseName,' Table:',sTable)

sSQL="SELECT \
      Height,\
      Weight,\
      Indicator,\
      CASE Indicator\
      WHEN 1 THEN 'Pip'\
      WHEN 2 THEN 'Norman'\
      WHEN 3 THEN 'Grant'\
      ELSE 'Sam'\
      END AS Name\
  FROM [Dim-BMI]\
  WHERE Indicator > 2\
  ORDER BY  \
      Height,\
      Weight;"
PersonFrame1=pd.read_sql_query(sSQL, conn1)
################################################################
DimPerson=PersonFrame1
DimPersonIndex=DimPerson.set_index(['Indicator'],inplace=Fals
e)
#####################################################
############ sTable = 'Dim-BMI-Secure'
print('\n################################') print('Storing
```

```
:',sDatabaseName,'\n Table:',sTable)
print('\n#################################')
DimPersonIndex.to_sql(sTable, conn2, if_exists="replace")
#########################################################################
print('########################
#########') sTable = 'Dim-BMI-
Secure' print('Loading
:',sDatabaseName,' Table:',sTable)
print('########################
#########')
sSQL="SELECT * FROM [Dim-BMI-Secure] WHERE Name = 'Sam';"
PersonFrame2=pd.read_sql_query(sSQL, conn2)
#########################################################################
print('#################################')
print('Full Data Set (Rows):',
PersonFrame0.shape[0]) print('Full Data Set
(Columns):', PersonFrame0.shape[1])
print('#################################')
print('Horizontal Data Set (Rows):',
PersonFrame2.shape[0]) print('Horizontal Data
Set (Columns):', PersonFrame2.shape[1])
print('Only Sam Data')
print(PersonFrame2.head())
print('#################################')
#########################################################################
```

Output:

```
Python 3.7.4 Shell
File  Edit  Shell  Debug  Options  Window  Help
>>>
==== RESTART: C:\VKHCG\01-Vermeulen\05-Organise\Organize-Secure-Vault.py ====
################################
Working Base : C:/VKHCG  using  win32
################################
################
Loading : C:/VKHCG/99-DW/datamart.db  Table: Dim-BMI
################
Loading : C:/VKHCG/99-DW/datamart.db  Table: Dim-BMI

################################
Storing : C:/VKHCG/99-DW/datamart.db
 Table: Dim-BMI-Secure

################################
################################
Loading : C:/VKHCG/99-DW/datamart.db  Table: Dim-BMI-Secure
################################
################################
Full Data Set (Rows): 1080
Full Data Set (Columns): 5
################################
Horizontal Data Set (Rows): 692
Horizontal Data Set (Columns): 4
Only Sam Data
   Indicator  Height  Weight Name
0          4     1.0      35  Sam
1          4     1.0      40  Sam
2          4     1.0      45  Sam
3          4     1.0      50  Sam
4          4     1.0      55  Sam
################################
```

Association Rule Mining

Association rule learning is a rule-based machine-learning method for discovering interesting relations between variables in large databases, similar to the data you will find in a data lake. The technique enables you to investigate the interaction between data within the same population. Lift

is simply estimated by the ratio of the joint probability of two items x and y, divided by the product of their individual probabilities:

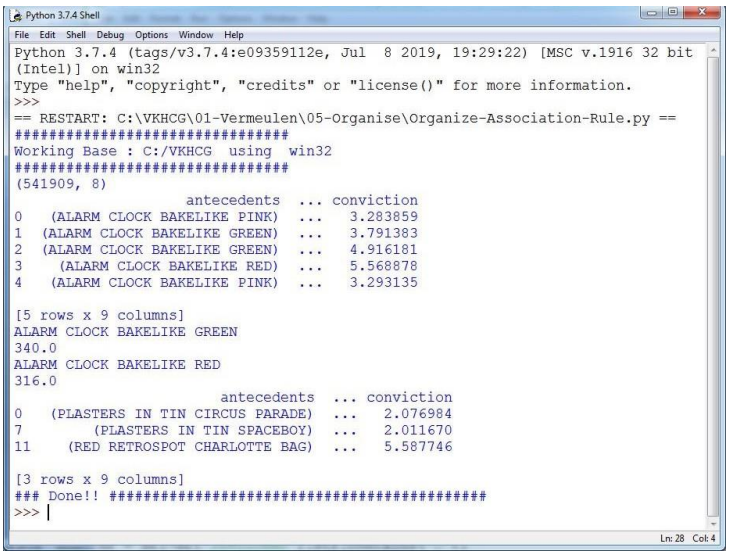
$$Lift = \frac{P(x,y)}{P(x)P(y)}$$

C:\VKHCG\01-Vermeulen\05-Organise\ Organize-Association-Rule.py

```
########################################################################
# -*- coding: utf-8 -*-
########################################################
############ import sys import os import pandas as pd
from mlxtend.frequent_patterns import apriori
from mlxtend.frequent_patterns import association_rules
########################################################################
Base='C:/VKHCG'
print('##################################')
print('Working Base :',Base, ' using ',
sys.platform)
print('##################################')
########################################################################
Company='01-Vermeulen'
InputFileName='Online-Retail-Billboard.xlsx'
EDSAssessDir='02-Assess/01-EDS'
InputAssessDir=EDSAssessDir + '/02-Python'
########################################################################
sFileAssessDir=Base + '/' + Company + '/' +
InputAssessDir if not
os.path.exists(sFileAssessDir):
   os.makedirs(sFileAssessDir)
########################################################################
sFileName=Base+'/'+ Company + '/00-RawData/' + InputFileName
########################################################
########## df = pd.read_excel(sFileName)
print(df.shape)
########################################################
############ df['Description'] = df['Description'].str.strip()
df.dropna(axis=0, subset=['InvoiceNo'], inplace=True)
df['InvoiceNo'] =
df['InvoiceNo'].astype('str') df =
df[~df['InvoiceNo'].str.contains('
C')]

basket = (df[df['Country'] =="France"]
        .groupby(['InvoiceNo', 'Description'])['Quantity']
        .sum().unstack().reset_index().fillna(0)
        .set_index('InvoiceNo'))
########################################################
############ def encode_units(x):     if x <= 0:         return 0
   if
x
>=
1:
```

```
retu
rn 1
#####################################################################
basket_sets = basket.applymap(encode_units)
basket_sets.drop('POSTAGE', inplace=True, axis=1)
frequent_itemsets = apriori(basket_sets, min_support=0.07,
use_colnames=True) rules = association_rules(frequent_itemsets,
metric="lift", min_threshold=1) print(rules.head()) rules[
(rules['lift'] >= 6) &        (rules['confidence'] >= 0.8) ]
#####################################################################
sProduct1='ALARM CLOCK BAKELIKE GREEN'
print(sProduct1)
print(basket[sProduct1].sum())
sProduct2='ALARM CLOCK BAKELIKE RED'
print(sProduct2)
print(basket[sProduct2].sum())
#####################################################################
basket2 = (df[df['Country'] =="Germany"]
        .groupby(['InvoiceNo', 'Description'])['Quantity']
        .sum().unstack().reset_index().fillna(0)
        .set_index('InvoiceNo'))

basket_sets2 = basket2.applymap(encode_units)
basket_sets2.drop('POSTAGE', inplace=True, axis=1)
frequent_itemsets2 = apriori(basket_sets2, min_support=0.05,
use_colnames=True) rules2 = association_rules(frequent_itemsets2,
metric="lift", min_threshold=1)

print(rules2[ (rules2['lift'] >= 4) &
(rules2['confidence'] >= 0.5)])
#####################################################################
### print('### Done!!
#############################################')
#####################################################################
```

Output:



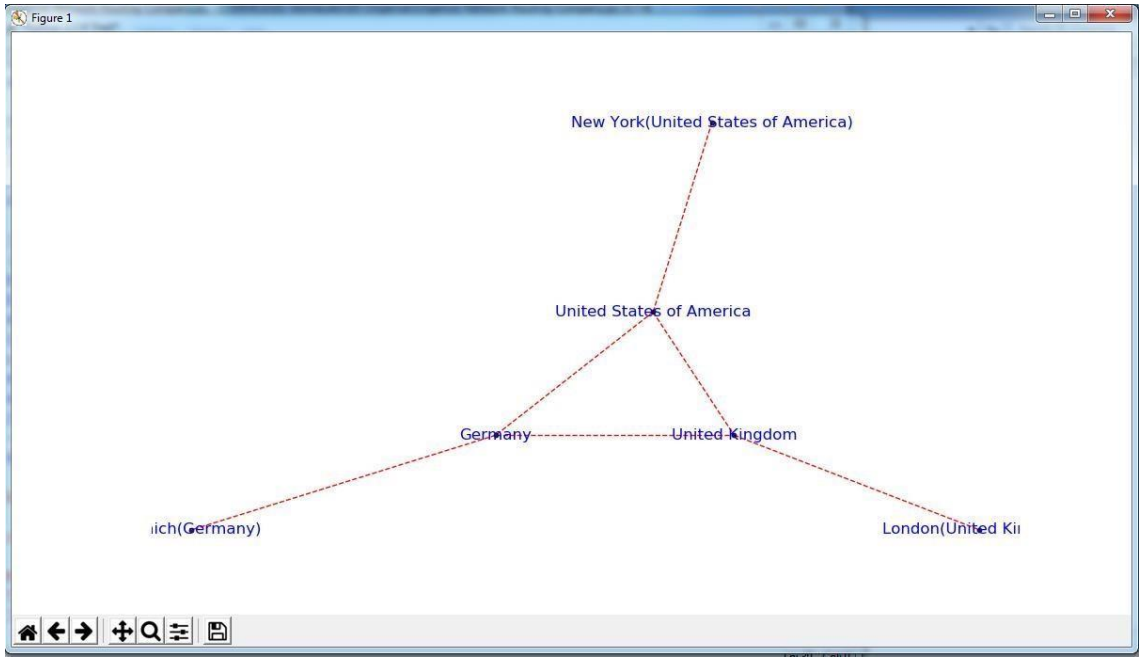
Create a Network Routing Diagram

I will guide you through a possible solution for the requirement, by constructing an island-style Organize superstep that uses a graph data model to reduce the records and the columns on the data set.

C:\VKHCG\01-Vermeulen\05-Organise\ Organise-Network-Routing-Company.py

```
################################################
############ import sys import os import pandas as pd import
networkx as nx import matplotlib.pyplot as plt
#################################################################
pd.options.mode.chained_assignment = None
#################################################################
Base='C:/VKHCG'
################################################
############ print('##################################')
print('Working Base :',Base, ' using ', sys.platform)
print('##################################')
#################################################################
sInputFileName='02-Assess/01-EDS/02-Python/Assess-Network-Routing-Company.csv'
#################################################################
sOutputFileName1='05-Organise/01-EDS/02-Python/Organise-Network-Routing-Company.gml'
sOutputFileName2='05-Organise/01-EDS/02-Python/Organise-Network-Routing-Company.png'
Company='01-Vermeulen'
#################################################################
#################################################################
### Import Country Data
#################################################################
sFileName=Base + '/' + Company + '/' +
sInputFileName
print('##################################')
print('Loading :',sFileName)
print('##################################')
CompanyData=pd.read_csv(sFileName,header=0,low_memory=False, encoding="latin-1")
print('##################################')
################################################
############ print(CompanyData.head())
print(CompanyData.shape)
#################################################################
G=nx.Graph() for i in
range(CompanyData.shape
[0]):    for j in
range(CompanyData.shape
[0]):

Node0=CompanyData['Company_Country_N
ame'][i]
Node1=CompanyData['Company_Country_N
ame'][j]        if Node0 != Node1:
          G.add_edge(Node0,Node1)

for i in range(CompanyData.shape[0]):
   Node0=CompanyData['Company_Country_Name'][i]
```

```
    Node1=CompanyData['Company_Place_Name'][i] + '('+
CompanyData['Company_Country_Name'][i] + ')'     if Node0 != Node1:
        G.add_edge(Node0,Node1)

print('Nodes:', G.number_of_nodes())
print('Edges:', G.number_of_edges())
#####################################################################
sFileName=Base + '/' + Company + '/' +
sOutputFileName1
print('################################'
) print('Storing :',sFileName)
print('################################')
nx.write_gml(G, sFileName)
#####################################################################
sFileName=Base + '/' + Company + '/' +
sOutputFileName2
print('################################'
) print('Storing Graph Image:',sFileName)
print('################################')
plt.figure(figsize=(15, 15))
pos=nx.spectral_layout(G,dim=2)
nx.draw_networkx_nodes(G,pos, node_color='k', node_size=10, alpha=0.8)
nx.draw_networkx_edges(G, pos,edge_color='r', arrows=False, style='dashed')
nx.draw_networkx_labels(G,pos,font_size=12,font_family='sans-
serif',font_color='b') plt.axis('off')
plt.savefig(sFileName,dpi=600)
plt.show()
#####################################################################
print('################################
##') print('### Done!!
####################')
print('################################
##')
#####################################################################
```



Picking Content for Billboards

To enable the marketing salespeople to sell billboard content, they will require a diagram to show what billboards connect to which office content publisher. Each of Krennwallner's billboards has a proximity sensor that enables the content managers to record when a registered visitor points his/her smartphone at the billboard content or touches the near-field pad with a mobile phone.

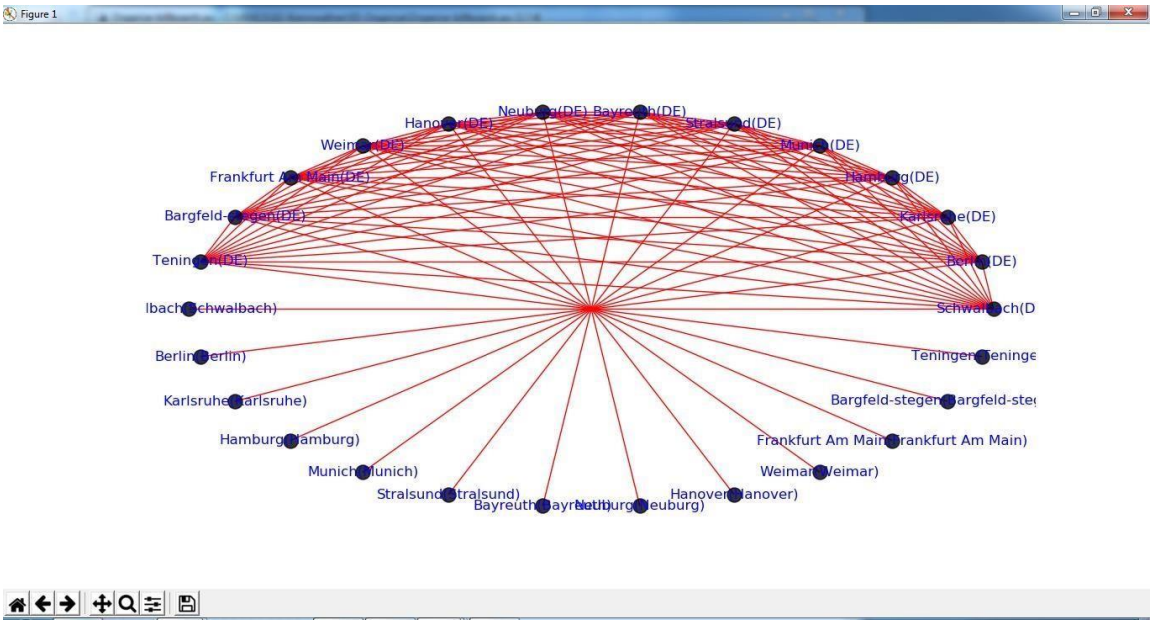
Program will assist you in building an organized graph of the billboards' locations data to help you to gain insights into the billboard locations and content picking process.

C:\VKHCG\02-Krennwallner\05-Organise\ Organise-billboards.py

```
##################################################
############ import sys import os import pandas as pd import
networkx as nx import matplotlib.pyplot as plt
import numpy as np
#################################################################
pd.options.mode.chained_assignment = None
#################################################################
Base='C:/VKHCG'
##################################################
############ print('##################################')
print('Working Base :',Base, ' using ', sys.platform)
print('##################################')
#################################################################
sInputFileName='02-Assess/01-EDS/02-Python/Assess-DE-Billboard-Visitor.csv'
#################################################################
sOutputFileName1='05-Organise/01-EDS/02-Python/Organise-Billboards.gml'
sOutputFileName2='05-Organise/01-EDS/02-Python/Organise-Billboards.png'
Company='02-Krennwallner'
#################################################################
#################################################################
### Import Company Data
#################################################################
sFileName=Base + '/' + Company + '/' +
sInputFileName
print('##################################')
print('Loading :',sFileName)
print('##################################')
BillboardDataRaw=pd.read_csv(sFileName,header=0,low_memory=False, encoding="latin-1")
print('##################################')
##################################################
############ print(BillboardDataRaw.head())
print(BillboardDataRaw.shape)
BillboardData=BillboardDataRaw
sSample=list(np.random.choice(BillboardData.shape[0],20))
#################################################################
G=n
x.Gr
aph(
) for
i in
sSa
mpl
e:
```

```
for j
in
sSa
mpl
e:
      Node0=BillboardData['BillboardPlaceName'][i] + '('+
BillboardData['BillboardCountry'][i] + ')'
Node1=BillboardData['BillboardPlaceName'][j] + '('+
BillboardData['BillboardCountry'][i] + ')'        if Node0 != Node1:
         G.add_edge(Node0,Node1)

for i in sSample:
   Node0=BillboardData['BillboardPlaceName'][i] + '('+
BillboardData['VisitorPlaceName'][i] + ')'
Node1=BillboardData['BillboardPlaceName'][i] + '('+
BillboardData['VisitorCountry'][i] + ')'     if Node0 != Node1:
      G.add_edge(Node0,Node1)

print('Nodes:', G.number_of_nodes())
print('Edges:', G.number_of_edges())
#####################################################################
sFileName=Base    +    '/02-Krennwallner/'    +
sOutputFileName1
print('################################'
) print('Storing :',sFileName)
print('################################')
nx.write_gml(G, sFileName)
#####################################################################
sFileName=Base + '/02-Krennwallner/' +
sOutputFileName2
print('################################'
) print('Storing Graph Image:',sFileName)
print('################################')
plt.figure(figsize=(15, 15)) pos=nx.circular_layout(G,dim=2)
nx.draw_networkx_nodes(G,pos, node_color='k', node_size=150,
alpha=0.8) nx.draw_networkx_edges(G, pos,edge_color='r',
arrows=False, style='solid')
nx.draw_networkx_labels(G,pos,font_size=12,font_family='sans-
serif',font_color='b')  plt.axis('off')
plt.savefig(sFileName,dpi=600)
plt.show()
#####################################################################
print('################################
##') print('### Done!!
####################')
print('################################
##')
#####################################################################
```

Output :



Create a Delivery Route

Hillman requires a new delivery route plan from HQ-KA13's delivery region. The managing director has to know the following:

- What his most expensive route is, if the cost is £1.50 per mile and two trips are planned per day
- What the average travel distance in miles is for the region per 30-day month

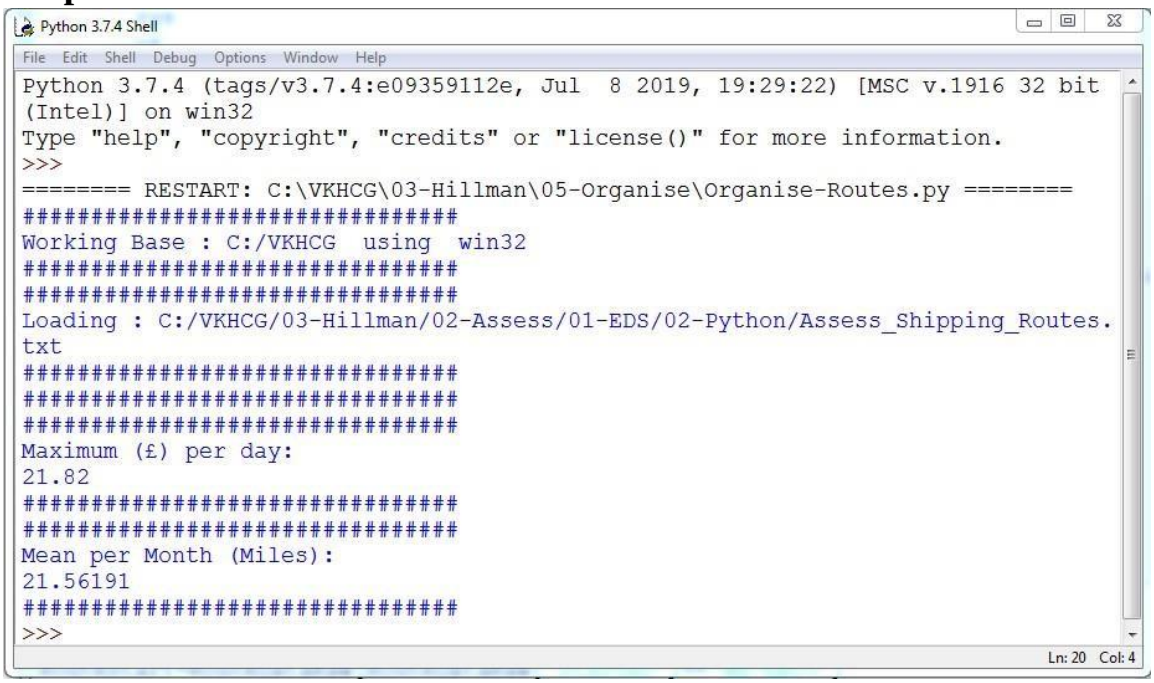
With your newfound knowledge in building the technology stack for turning data lakes into business assets, can you convert the graph stored in the Assess step called "Assess_Best_Logistics" into the shortest path between the two points?

C:\VKHCG\03-Hillman\05-Organise\Organise-Routes.py

```
# -*- coding: utf-8 -*-
##########################################################
########### import sys import os
import pandas as pd
#########################################################################
Base='C:/VKHCG'
#########################################################################
print('##################################')
print('Working Base :',Base, ' using ',
sys.platform)
print('##################################')
#########################################################################
sInputFileName='02-Assess/01-EDS/02-Python/Assess_Shipping_Routes.txt'
#########################################################################
sOutputFileName='05-Organise/01-EDS/02-Python/Organise-Routes.csv'
Company='03-Hillman'
#########################################################################
#########################################################################
### Import Routes Data
#########################################################################
```

```
sFileName=Base + '/' + Company + '/' +
sInputFileName
print('################################')
print('Loading :',sFileName)
print('################################')
RouteDataRaw=pd.read_csv(sFileName,header=0,low_memory=False, sep='|',
encoding="latin-1") print('################################')
#########################################################################
RouteStart=RouteDataRaw[RouteDataRaw['StartAt']=='WH-KA13']
#########################################################################
RouteDistance=RouteStart[RouteStart['Cost']=='DistanceMiles']
RouteDistance=RouteDistance.sort_values(by=['Measure'], ascending=False)
#########################################################################
RouteMax=RouteStart["Measure"].max()
RouteMaxCost=round((((RouteMax/1000)*1.5*2)),2)
print('################################')
print('Maximum (£) per day:')
print(RouteMaxCost)
print('################################')
#########################################################################
RouteMean=RouteStart["Measure"].mean()
RouteMeanMonth=round((((RouteMean/1000)*2*30)),6)
print('################################')
print('Mean per Month (Miles):')
print(RouteMeanMonth)
print('################################')
```

Output:



Clark Ltd

Our financial services company has been tasked to investigate the options to convert 1 million pounds sterling into extra income. Mr. Clark Junior suggests using the simple variance in the daily rate between the British pound sterling and the US dollar, to generate extra income from trading. Your chief financial officer wants to know if this is feasible?

Simple Forex Trading Planner

Your challenge is to take 1 million US dollars or just over six hunderd thou sand pounds sterling and, by simply converting it between pounds sterling and US dollars, achieve a profit. Are you up to this challenge? The Program will help you how to model this problem and achieve a positive outcome. The forex data has been collected on a daily basis by Clark's accounting department, from previous overseas transactions. **C:\VKHCG\04-Clark\05-Organise\ Organise-Forex.py**

```
# -*- coding: utf-8 -*-
##########################################################
########### import sys import os import pandas as pd import
sqlite3 as sq import re
##################################################################
Base='C:/VKHCG'
##########################################################
########### print('##################################')
print('Working Base :',Base, ' using ', sys.platform)
print('##################################')
##################################################################
sInputFileName='03-Process/01-EDS/02-Python/Process_ExchangeRates.csv'
##################################################################
sOutputFileName='05-Organise/01-EDS/02-Python/Organise-Forex.csv' Company='04-
Clark'
##########################################################
########### sDatabaseName=Base + '/' + Company + '/05-
Organise/SQLite/clark.db' conn = sq.connect(sDatabaseName)
#conn = sq.connect(':memory:')
##################################################################
##################################################################
### Import Forex Data
##################################################################
sFileName=Base + '/' + Company + '/' +
sInputFileName
print('##################################')
print('Loading :',sFileName)
print('##################################')
ForexDataRaw=pd.read_csv(sFileName,header=0,low_memory=False, encoding="latin-
1") print('##################################')
##################################################################
ForexDataRaw.index.names = ['RowID']
sTable='Forex_All'
print('Storing :',sDatabaseName,' Table:',sTable)
ForexDataRaw.to_sql(sTable, conn, if_exists="replace")
##################################################################
sSQL="SELECT 1 as Bag\
```

```
      , CAST(min(Date) AS VARCHAR(10)) as Date \
      ,CAST(1000000.0000000 as NUMERIC(12,4)) as Money \
      ,'USD' as Currency \
      FROM Forex_All \
      ;"
sSQL=re.sub("\s\s+", " ", sSQL)
nMoney=pd.read_sql_query(sSQL, conn)

#########################################################
########## nMoney.index.names = ['RowID']
sTable='MoneyData'
print('Storing :',sDatabaseName,' Table:',sTable)
nMoney.to_sql(sTable, conn, if_exists="replace")
#########################################################
########## sTable='TransactionData' print('Storing
:',sDatabaseName,' Table:',sTable)
nMoney.to_sql(sTable, conn, if_exists="replace")
#####################################################################
ForexDay=pd.read_sql_query("SELECT Date FROM Forex_All GROUP BY
Date;", conn)
#####################################################################
# t=0 for i in range(ForexDay.shape[0]):

sDay1=ForexDa
y['Date'][i]
sDay=str(sDay1
)    sSQL='\
   SELECT M.Bag as Bag, \
        F.Date as Date, \
round(M.Money * F.Rate,6) AS
Money, \
        F.CodeIn AS PCurrency, \
        F.CodeOut AS Currency \
   FROM MoneyData AS M \
   JOIN \
   ( \
      SELECT \
      CodeIn, CodeOut, Date, Rate \
      FROM \
      Forex_All \
      WHERE\
      CodeIn = "USD" AND CodeOut = "GBP" \
      UNION \
      SELECT \
      CodeOut AS CodeIn, CodeIn AS CodeOut, Date, (1/Rate) AS Rate \
      FROM \
      Forex_All \
      WHERE\
      CodeIn = "USD" AND CodeOut = "GBP" \
```

```
    ) AS F \
    ON \
    M.Currency=F.CodeIn \
    AND \
    F.Date ='" +sDay + "';'
sSQL=re.sub("\s\s+", " ", sSQL)


ForexDayRate=pd.read_sql_query(sSQL,
conn)     for j in
range(ForexDayRate.shape[0]):
sBag=str(ForexDayRate['Bag'][j])
nMoney=str(round(ForexDayRate['Mone
y'][j],2))
sCodeIn=ForexDayRate['PCurrency'][j]
       sCodeOut=ForexDayRate['Currency'][j]

    sSQL='UPDATE MoneyData SET Date= '" + sDay + "', '
sSQL= sSQL + ' Money = ' + nMoney + ', Currency='" + sCodeOut
+ ""     sSQL= sSQL + ' WHERE Bag=' + sBag + ' AND
Currency='" + sCodeIn + "';'


sSQL=re.sub("\s\s+",
" ", sSQL)     cur =
conn.cursor()
cur.execute(sSQL)
conn.commit()
t+=1
    print('Trade :', t, sDay, sCodeOut, nMoney)

    sSQL=' \
    INSERT INTO TransactionData ( \
                            RowID, \
                            Bag, \
                            Date, \
                            Money, \
                            Currency \
                        ) \
    SELECT ' + str(t) + ' AS RowID, \
      Bag, \
      Date, \
      Money, \
      Currency \
    FROM MoneyData \
    ;'
    sSQL=re.sub("\s\s+", " ", sSQL)
```

```
    cur = conn.cursor()
cur.execute(sSQL)
conn.commit()
#####################################################################
sSQL="SELECT RowID, Bag, Date, Money, Currency FROM TransactionData ORDER
BY RowID;"
sSQL=re.sub("\s\s+", " ", sSQL)
TransactionData=pd.read_sql_query(sSQL, conn)

OutputFile=Base + '/' + Company + '/' + sOutputFileName
TransactionData.to_csv(OutputFile, index = False)
#####################################################################
```

Output:

Save the Assess-Forex.py file, then compile and execute with your Python compiler.

This will produce a set of demonstrated values onscreen.

INDEX

Sr. No.	Practicals	Signature
1.	Import Data In Power BI From Microsoft Excel And CSV.	
2.	Import Data In Power BI From Microsoft Excel And CSV	
3.	Collect the primary data in excel and apply the scientific method.	
4.	Collect the secondary data in excel and apply scientific method	
5.	Design the survey from and collect the suitable data and perform analysis	
6.	Implement the different scales of measurement on data: Nominal & Ordinal	
7.	Implement the different scales of measurement on data: Ratio and Interval	
8.	Perform t-test on the data	

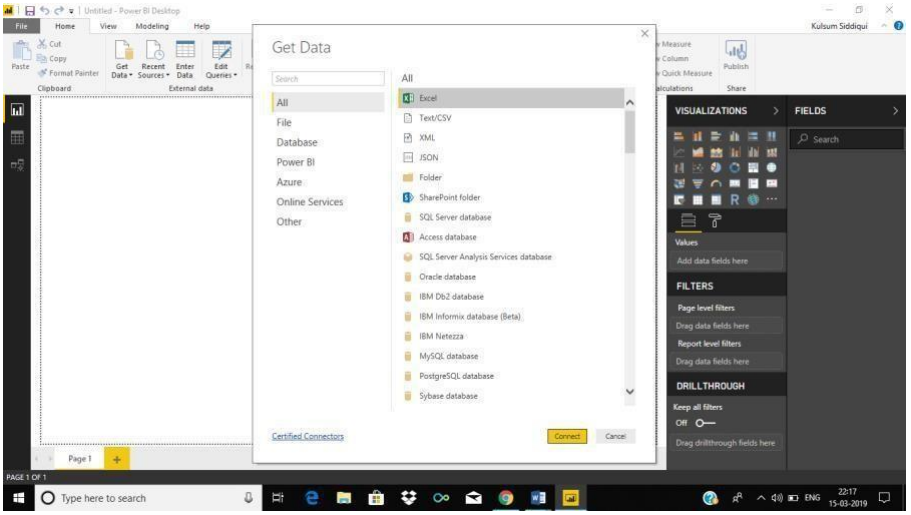
PRACTICAL 1

Aim:- Import Data In Power BI From Microsoft Excel And CSV.

- **For Excel:**

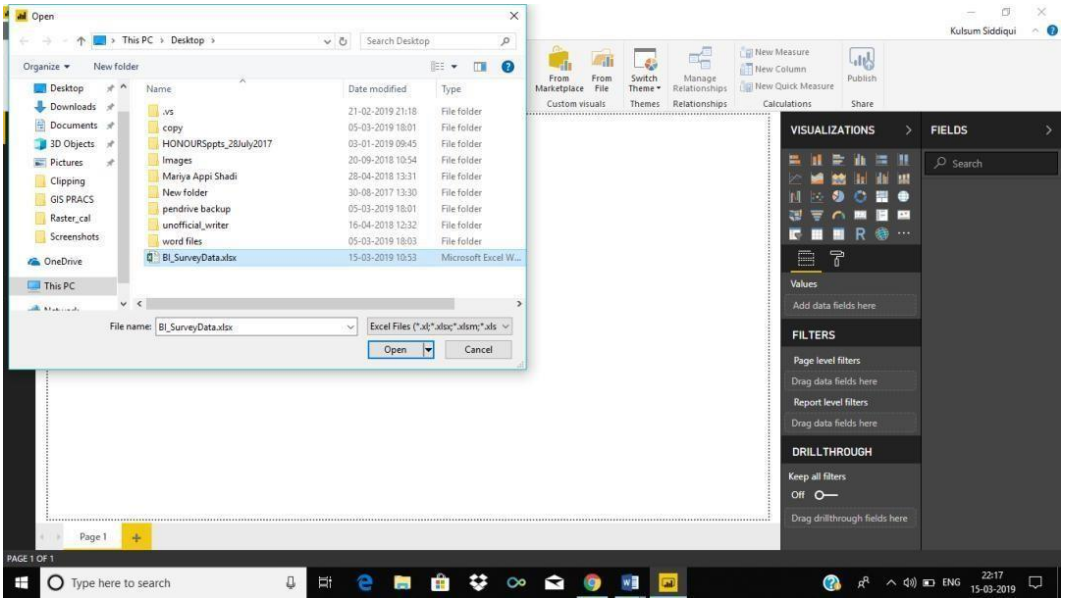
Step: 01

- **Open Power BI desktop app, Click on Get data option**
- **Select Excel from the options that appear.**
- **Click Connect.**



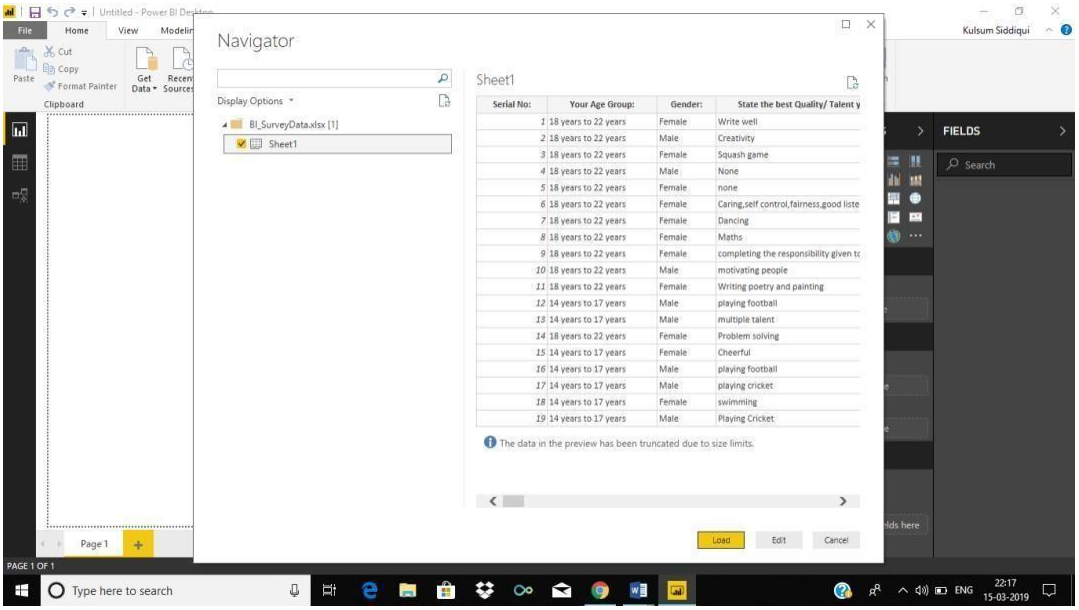
Step No: 02

- **Select the Excel file from the storage.**
- **Click on Open**



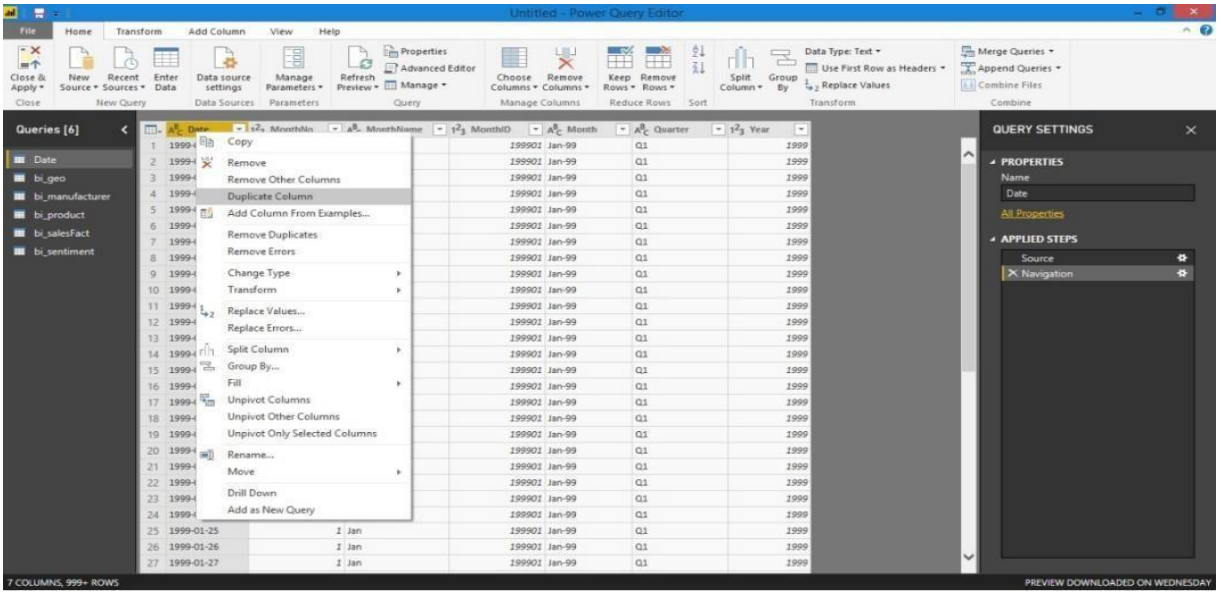
Step No: 03

- **Select(check the check box) of the sheet**
- **Click on Load to load the excel data onto the Power BI workspace to operation operations onto it.**



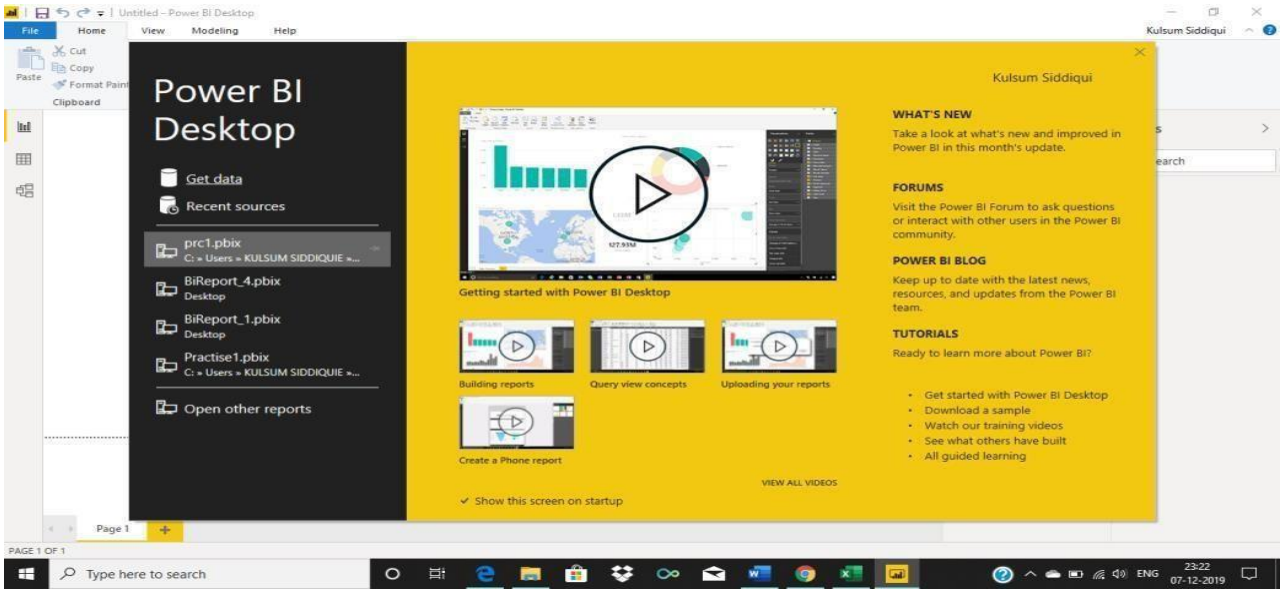
Step No:04

- **The Data fields appears onto the right side of the screen, Next to it is the Visualizations panel.**
- **Here user can drag and drop fields, Also can make graphs of all sort.**



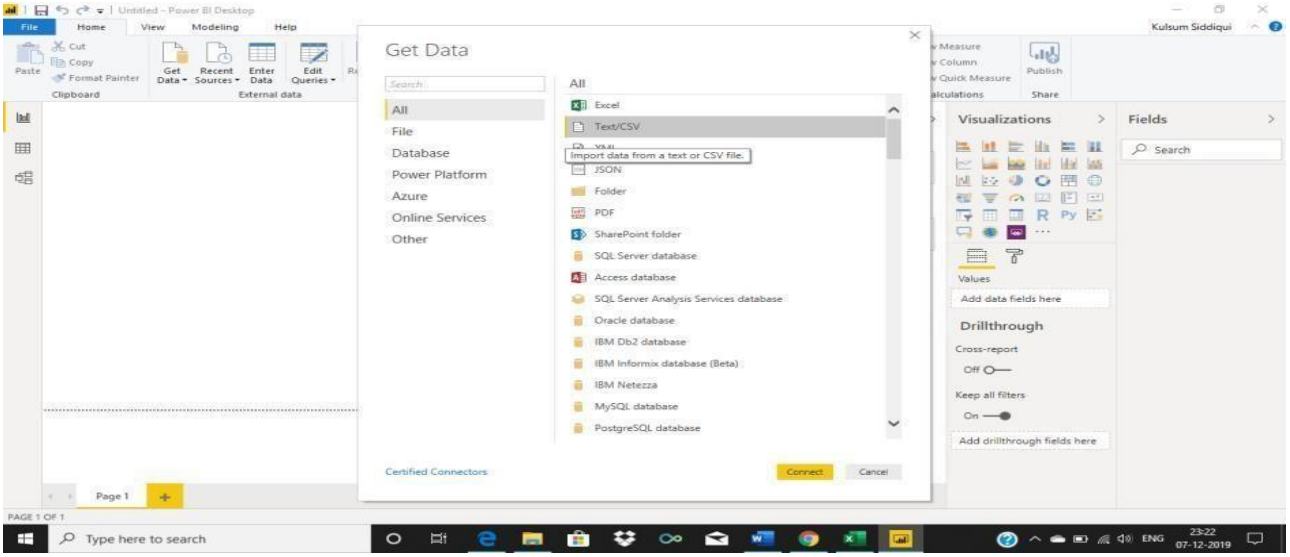
- **For CSV file:**

Step 01: Open Power BI. Click On GET DATA.



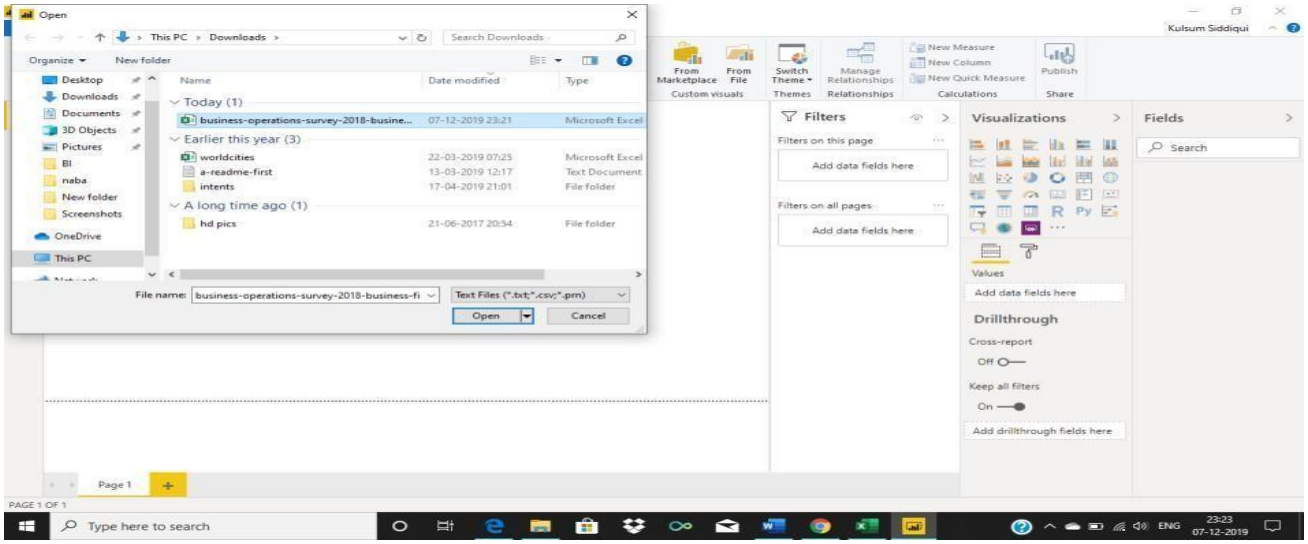
- **Step 02:**

Select Text/CSV from the set of options.



- **Step:03:**

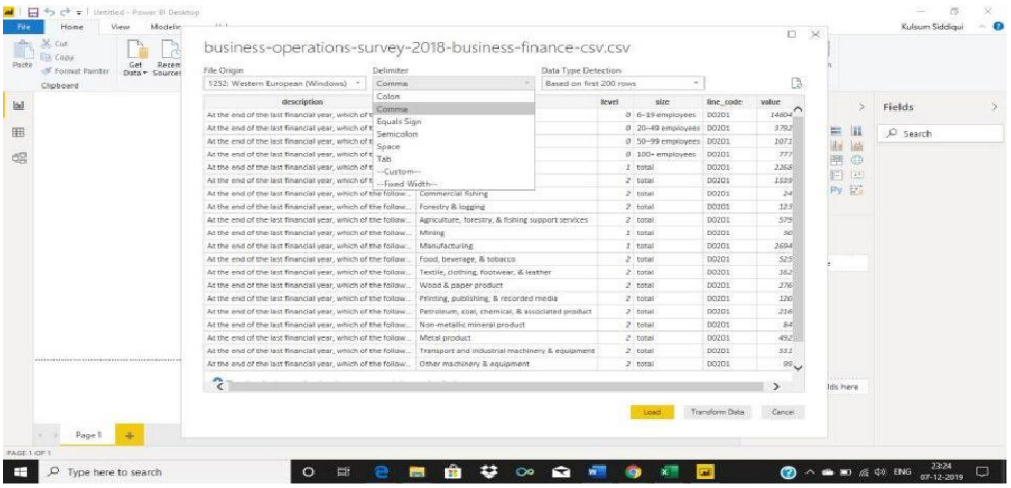
Browse to the file location from the system and select the file required to beimport.

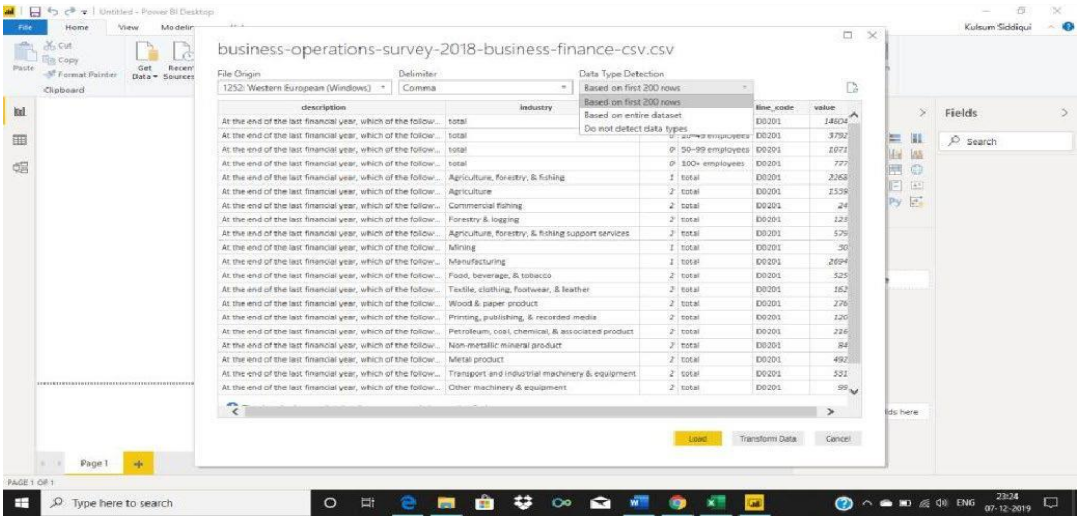


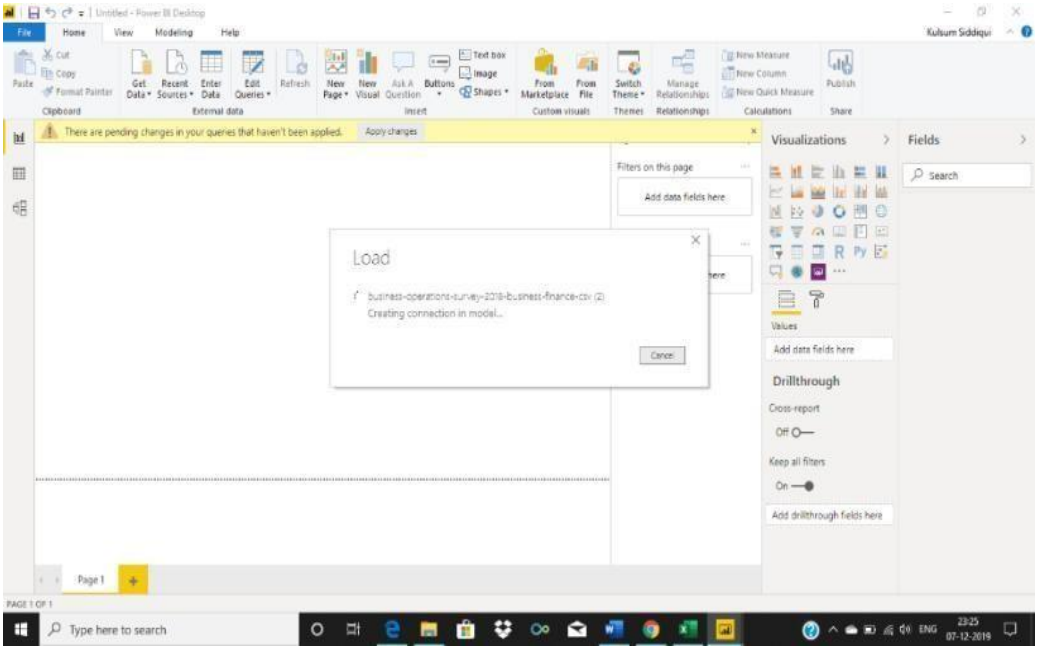
Step:04

Select the file origin, delimiter as comma, Data type detection as first 200 rows

Then click on load.

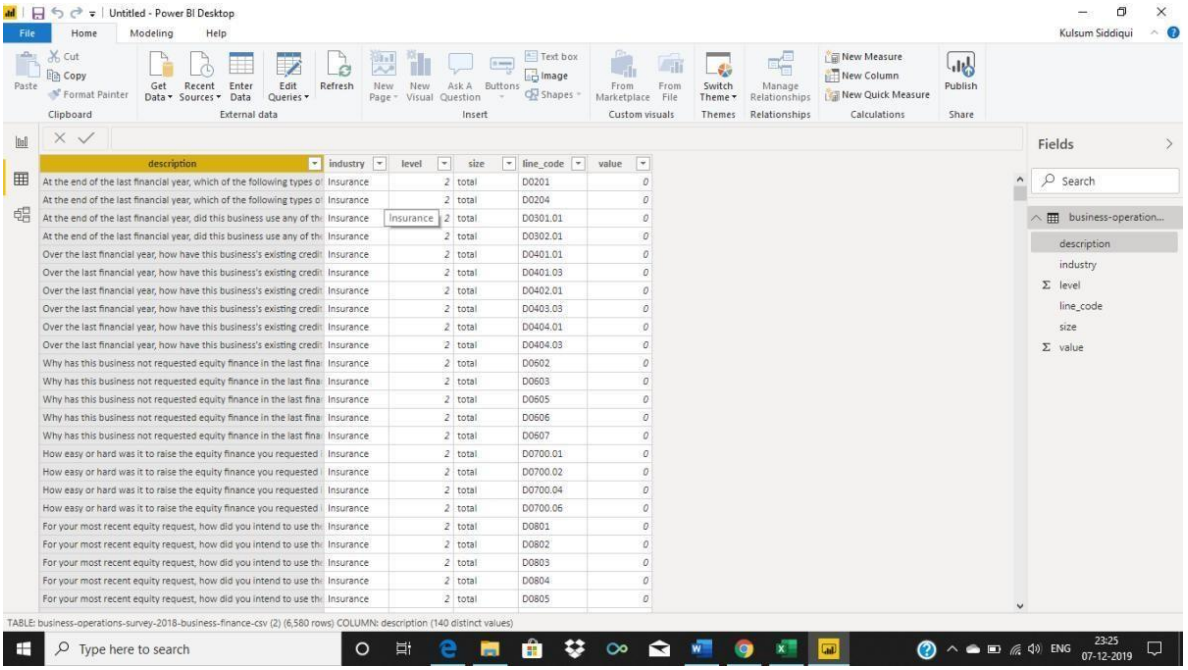

business-operations-survey-2018-business-finance-csv.csv
File Origin
Delimiter
Data Type Detection
Load
Transform Data
Cancel


business-operations-survey-2018-business-finance-csv.csv
File Origin
Delimiter
Data Type Detection
Based on first 200 rows
Based on entire dataset
Do not detect data types
Load
Transform Data
Cancel


There are pending changes in your queries that haven't been applied.
Apply changes
Load
Creating connection in model...
Cancel
Visualizations
Fields
Drillthrough

□ **Step: 05**

Click on table on the left side panel, the data appears in form of data, further analysis can be performed on this data.



Practical 2

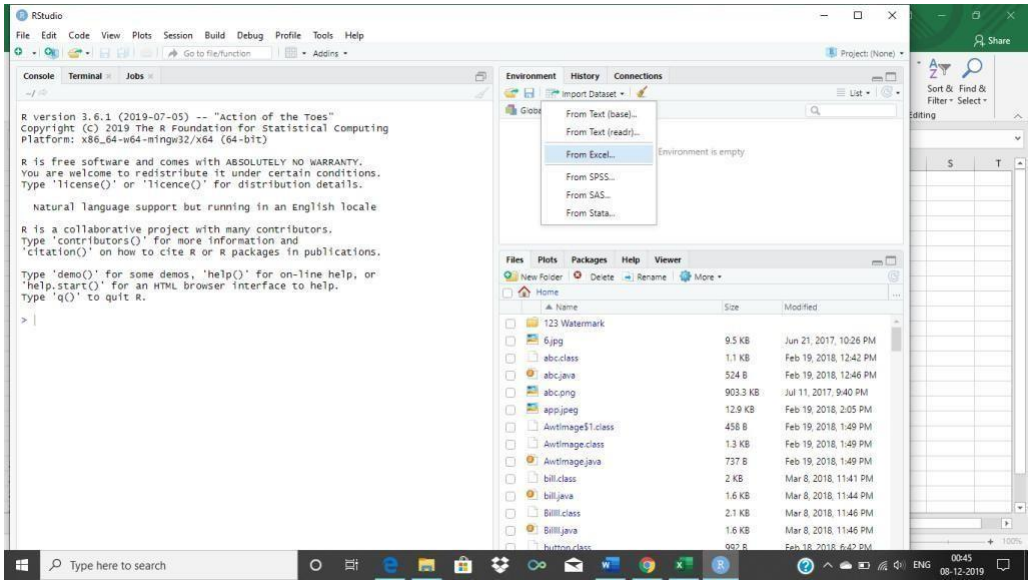
Aim: Import Data In Power BI From Microsoft Excel And CSV.

- **For Excel**

Steps:

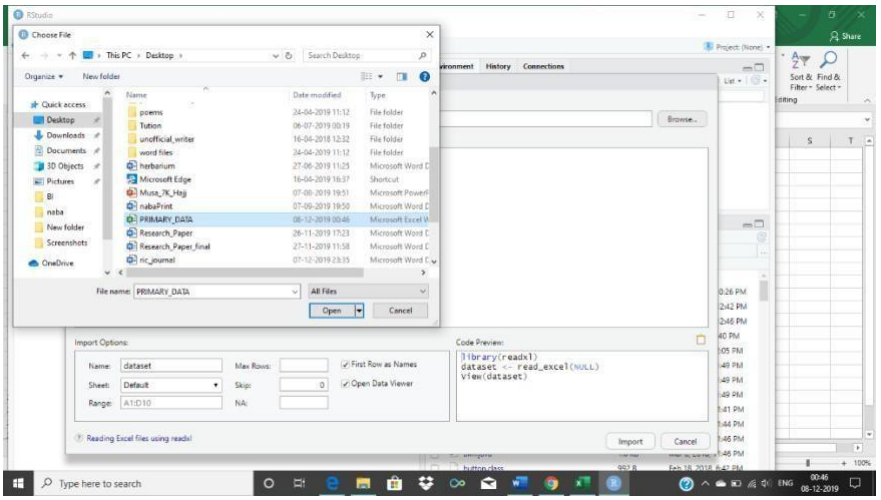
1. **Open R Studio, Click on import dataset.**

2. **Select from excel.**



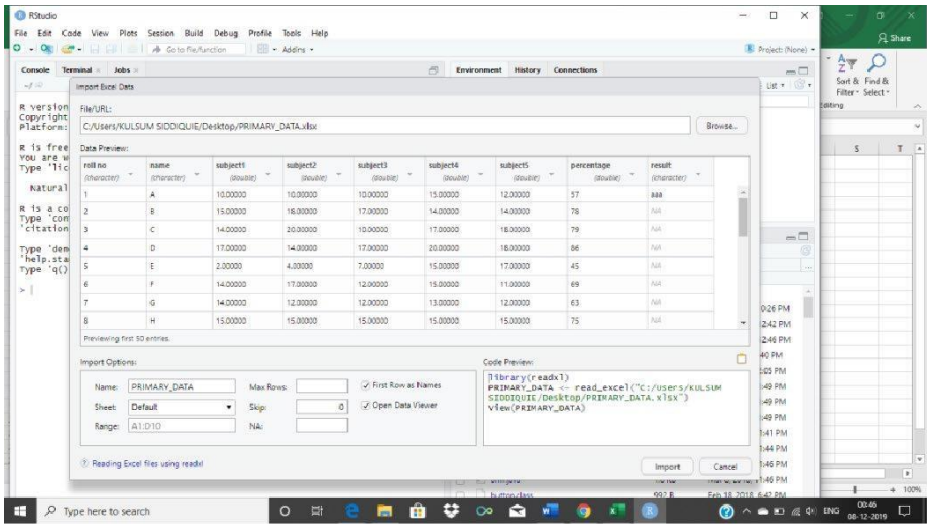
3. **Browse the file location and select the desired file.**

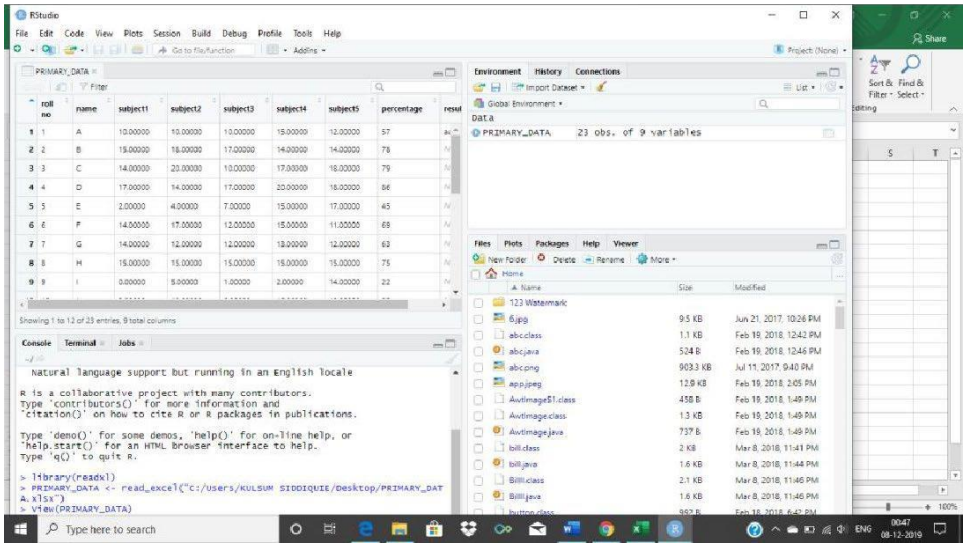
4. **Click on open.**

5. 

6. **Select the data type and make necessary settings.**

7. **Click on import.**

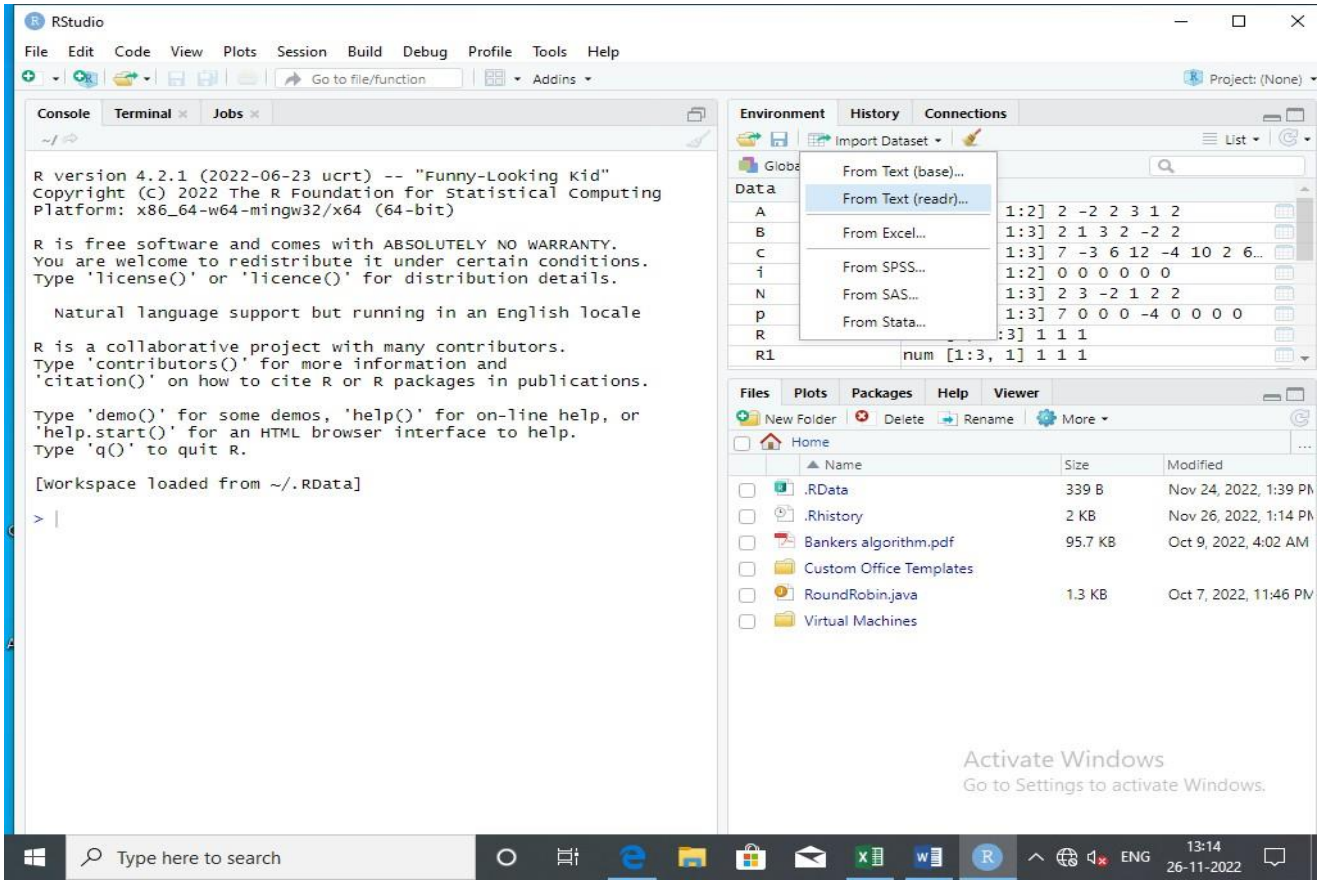




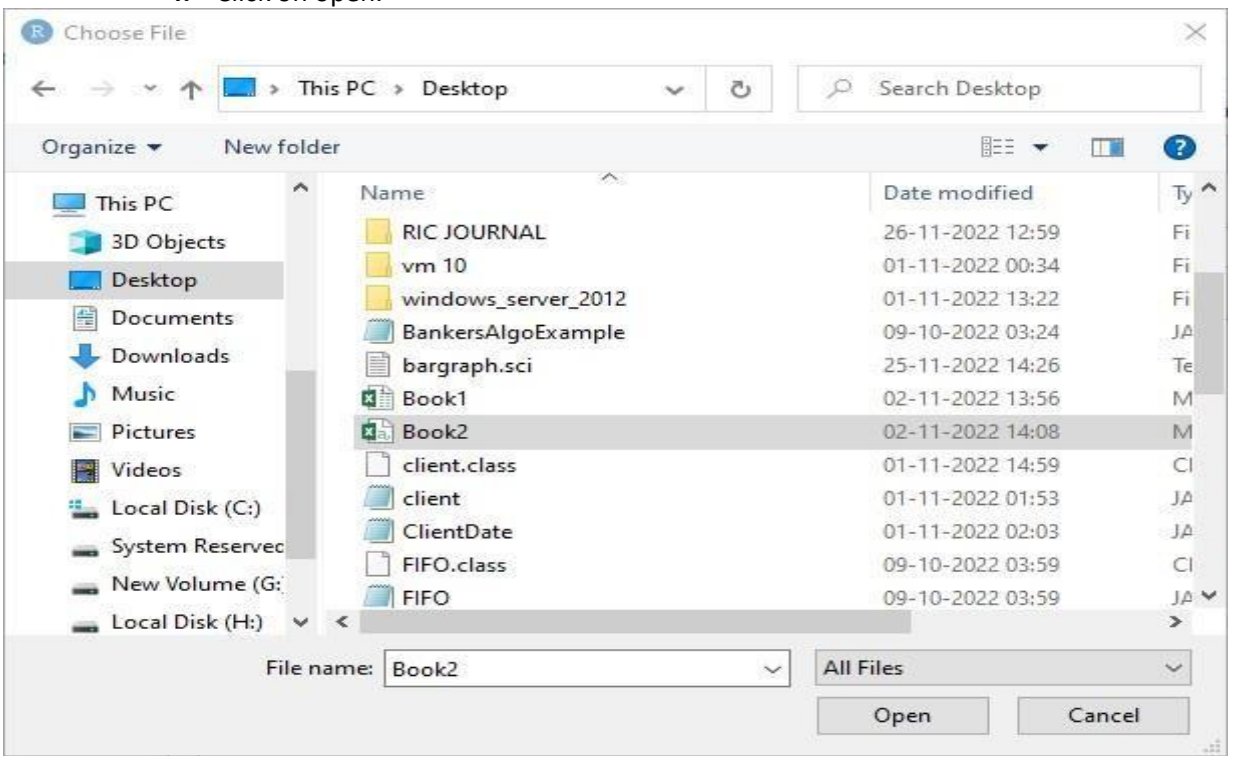
□ **For CSV**

Steps:

1. **Open R Studio, click on import data set.**
2. **Select from Text(readr)**

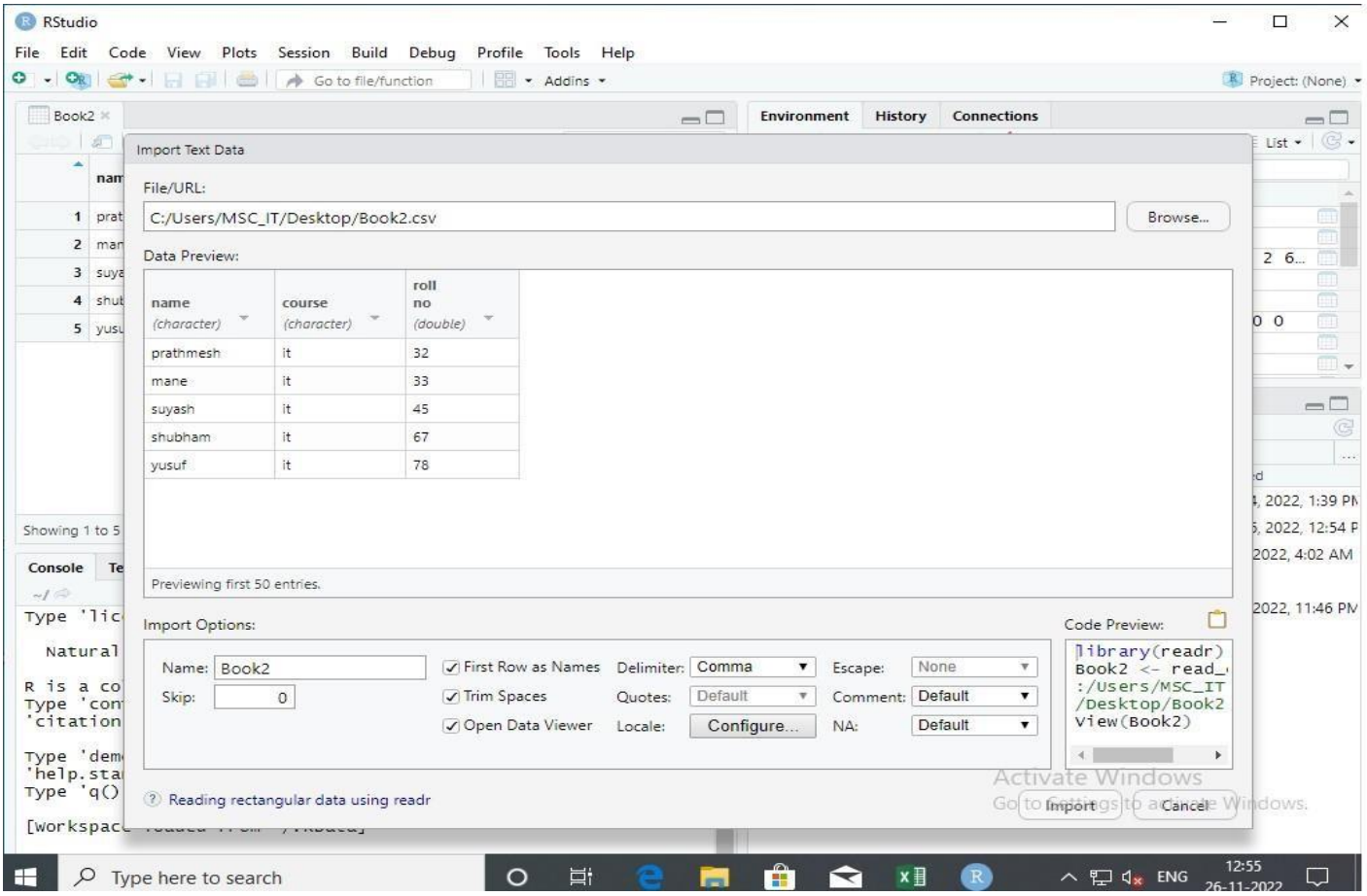


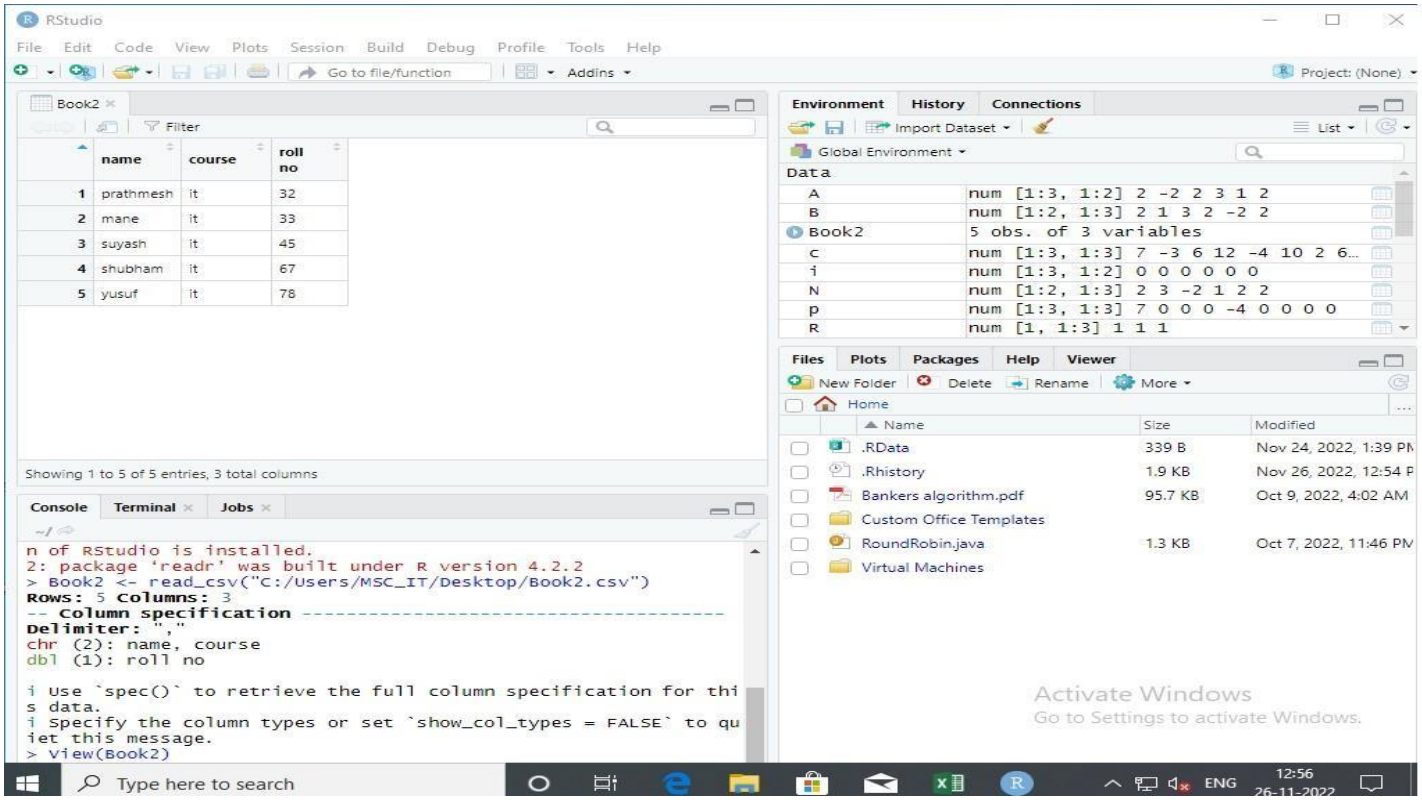
3. Browse the file location and select the desired file(.csv).
4. Click on open.



5. Select the data type and make necessary settings.

6. Click on Import.


RStudio
File Edit Code View Plots Session Build Debug Profile Tools Help
Import Text Data
File/URL:
C:/Users/MSC_IT/Desktop/Book2.csv
Browse...
Data Preview:
name (character) | course (character) | roll no (double)
prathmesh | it | 32
mane | it | 33
suyash | it | 45
shubham | it | 67
yusuf | it | 78
Previewing first 50 entries.
Import Options:
Name: Book2
Skip: 0
First Row as Names
Trim Spaces
Open Data Viewer
Delimiter: Comma
Quotes: Default
Locale: Configure...
Escape: None
Comment: Default
NA: Default
Code Preview:
library(readr)
Book2 <- read_
:/Users/MSC_IT
/Desktop/Book2
View(Book2)
Reading rectangular data using readr
Import
Cancel
Activate Windows
Type here to search
ENG
12:55
26-11-2022


RStudio
Book2
name course roll no
1 prathmesh it 32
2 mane it 33
3 suyash it 45
4 shubham it 67
5 yusuf it 78
Showing 1 to 5 of 5 entries, 3 total columns
Environment History Connections
Import Dataset
Global Environment
Data
A num [1:3, 1:2] 2 -2 2 3 1 2
B num [1:2, 1:3] 2 1 3 2 -2 2
Book2 5 obs. of 3 variables
c num [1:3, 1:3] 7 -3 6 12 -4 10 2 6...
i num [1:3, 1:2] 0 0 0 0 0 0
N num [1:2, 1:3] 2 3 -2 1 2 2
p num [1:3, 1:3] 7 0 0 0 -4 0 0 0 0
R num [1, 1:3] 1 1 1
Files Plots Packages Help Viewer
New Folder Delete Rename More
Home
Name Size Modified
.RData 339 B Nov 24, 2022, 1:39 PM
.Rhistory 1.9 KB Nov 26, 2022, 12:54 P
Bankers algorithm.pdf 95.7 KB Oct 9, 2022, 4:02 AM
Custom Office Templates
RoundRobin.java 1.3 KB Oct 7, 2022, 11:46 PM
Virtual Machines
Console Terminal Jobs
n of RStudio is installed.
2: package 'readr' was built under R version 4.2.2
> Book2 <- read_csv("C:/Users/MSC_IT/Desktop/Book2.csv")
Rows: 5 Columns: 3
-- Column specification --------------------------------------
Delimiter: ","
chr (2): name, course
dbl (1): roll no
i Use `spec()` to retrieve the full column specification for thi
s data.
i Specify the column types or set `show_col_types = FALSE` to qu
iet this message.
> View(Book2)
Activate Windows
Type here to search
ENG
12:56
26-11-2022

Practical 3

Aim: Collect the primary data in excel and apply the scientific method.

Collect data in Excel.

1. Concatenation operation performed.

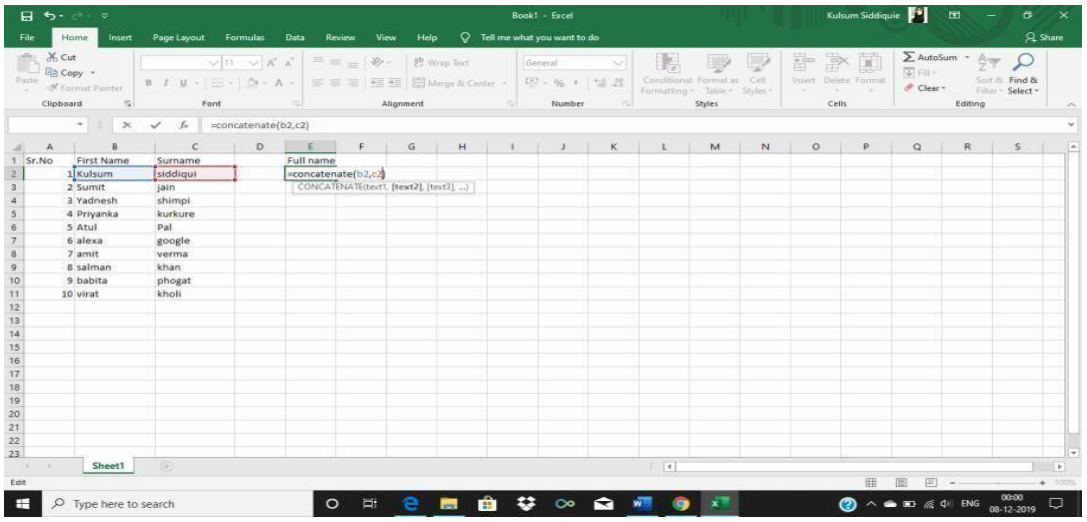
Steps:

Create a separate column for full name.

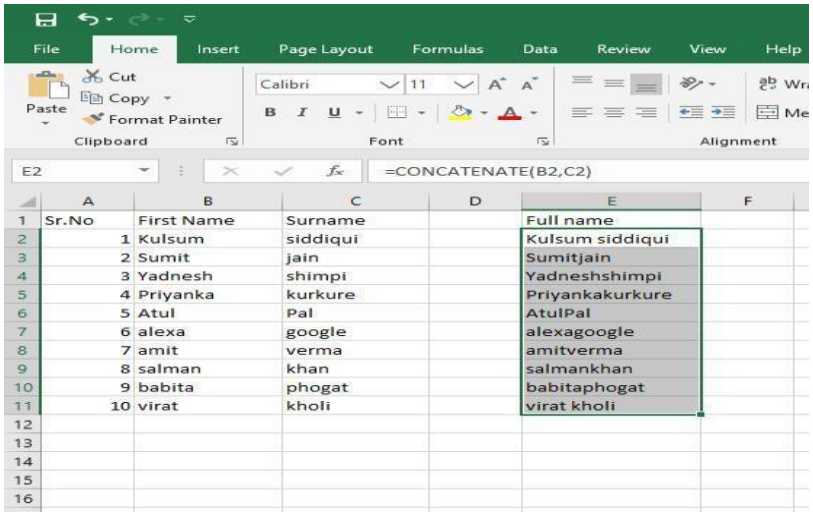
Select a cell, enter the formula: Concatenate (string1, string2)

Concatenate (B2, C2)

Enter the cell location where the strings are placed, press enter.



rag the cell for all columns.

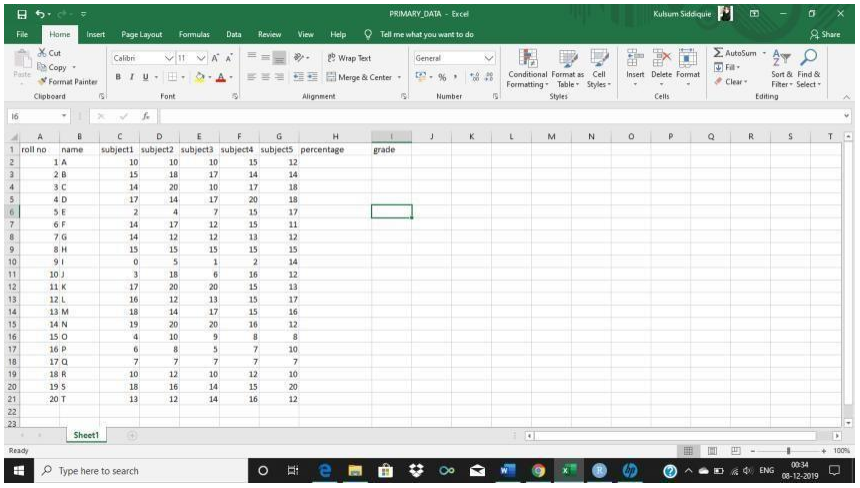


	A	B	C	D	E	F
1	Sr.No	First Name	Surname		Full name	
2	1	Kulsum	siddiqui		Kulsum siddiqui	
3	2	Sumit	jain		Sumitjain	
4	3	Yadnesh	shimpi		Yadneshshimpi	
5	4	Priyanka	kurkure		Priyankakurkure	
6	5	Atul	Pal		AtulPal	
7	6	alexa	google		alexagoogle	
8	7	amit	verma		amitverma	
9	8	salman	khan		salmankhan	
10	9	babita	phogat		babitaphogat	
11	10	virat	kholi		virat kholi	
12						
13						
14						
15						
16						

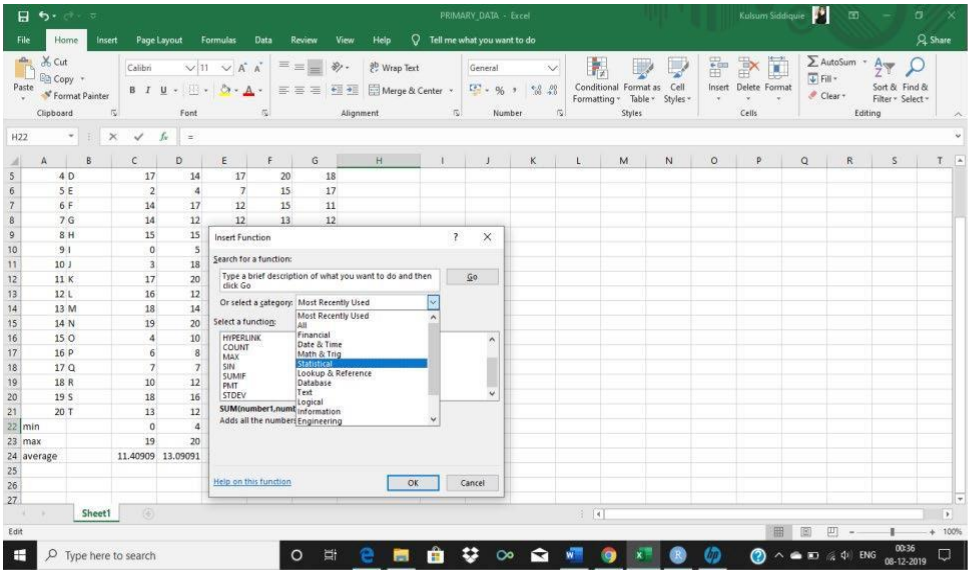
Operation:02 Statistical

Steps:

1. **Store the data into the excel sheet.**



2. **Select Statistical operations from the function selection panel.**



3. ***Finding Minimum value from the columns***

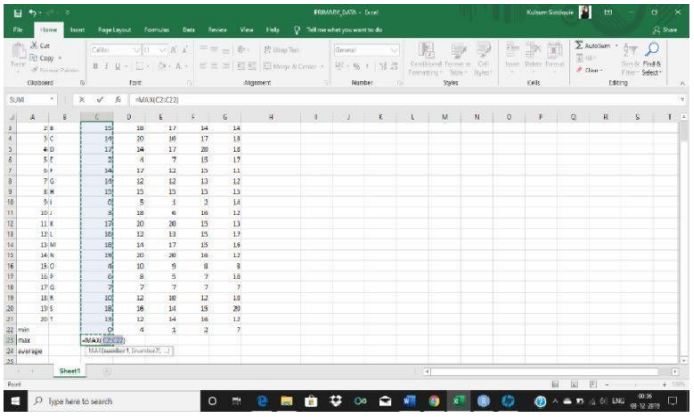
Select the cell, enter function: MIN(c2:c21)

Press enters.

4. Finding the maximum value from the columns

Select the cell, enter the function: MAX(c2:c21)

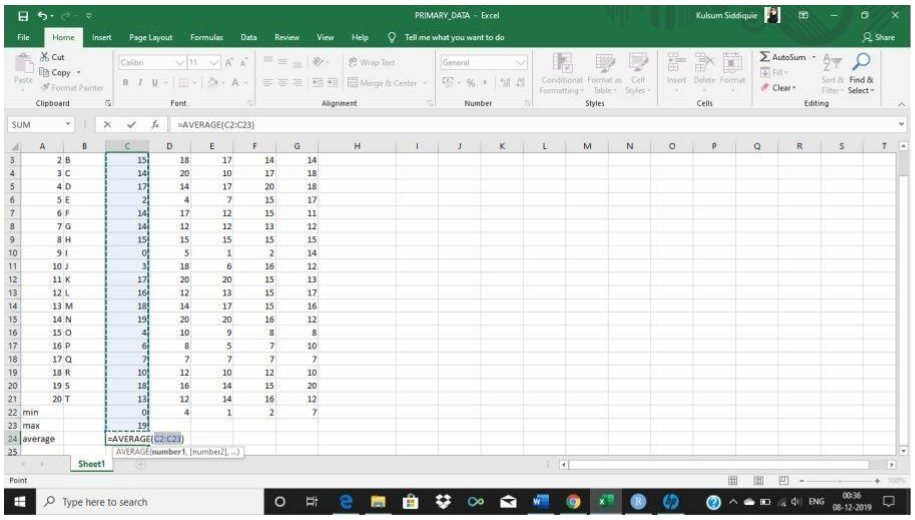
Press enters.



5. Finding the average value from the columns

Select the cell, enter the function: AVERAGE(c2:c21)

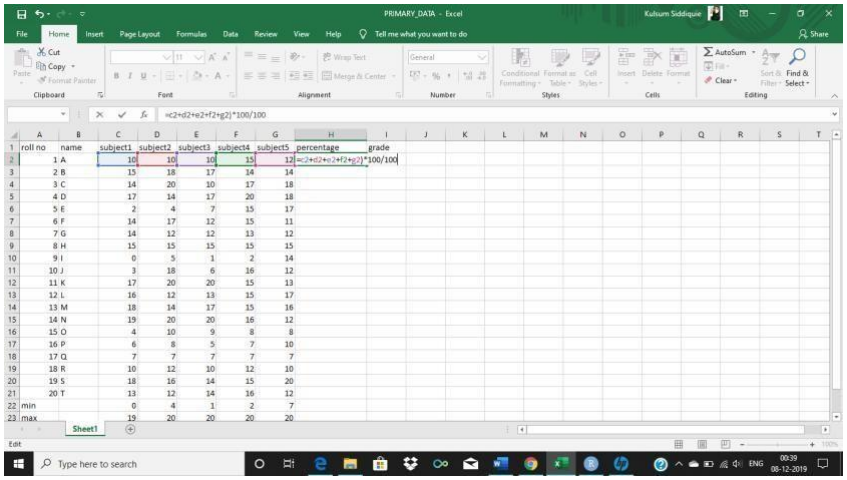
Press enters



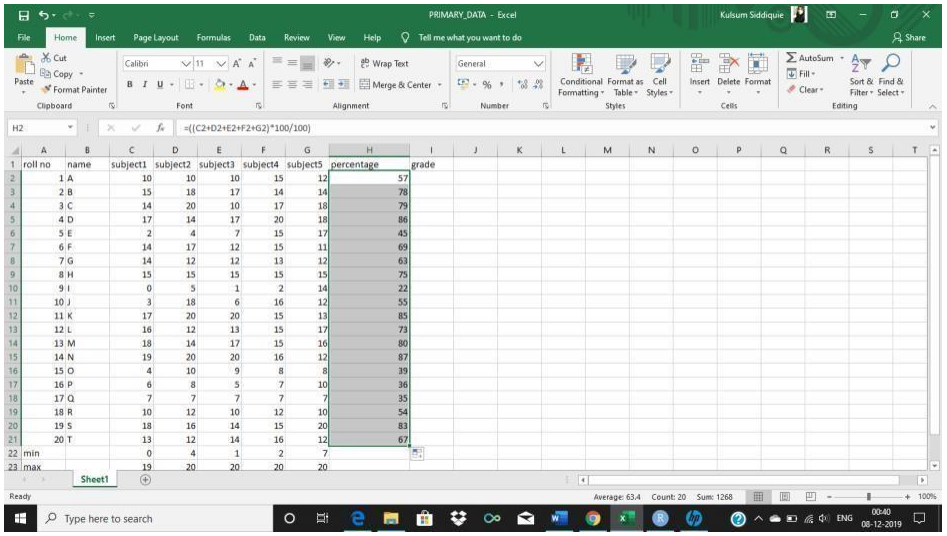
6. Finding the percentage of marks of 5 columns.

Select the cell,enter=((c2+d2+e2+f2+g2)*100)/100

Press enters.



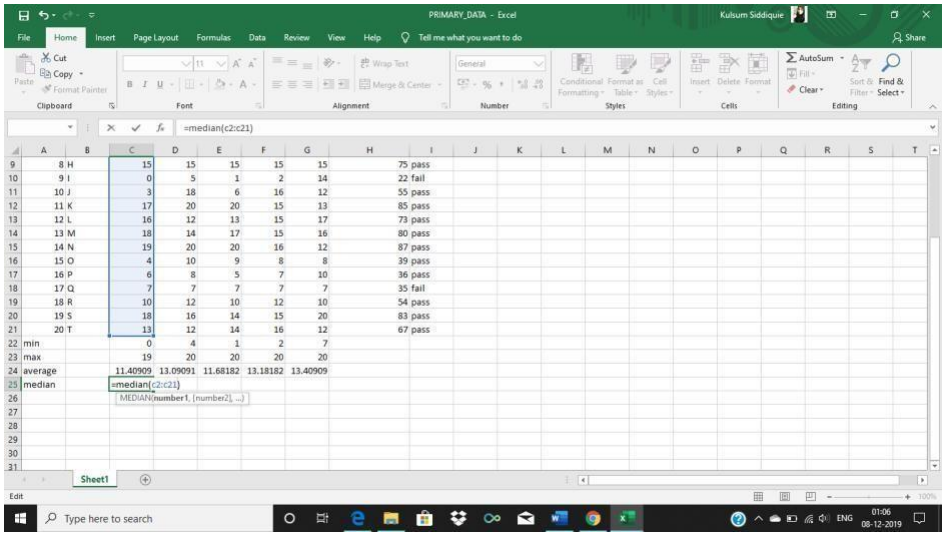
Drag the cell to find the percentages for the whole column.



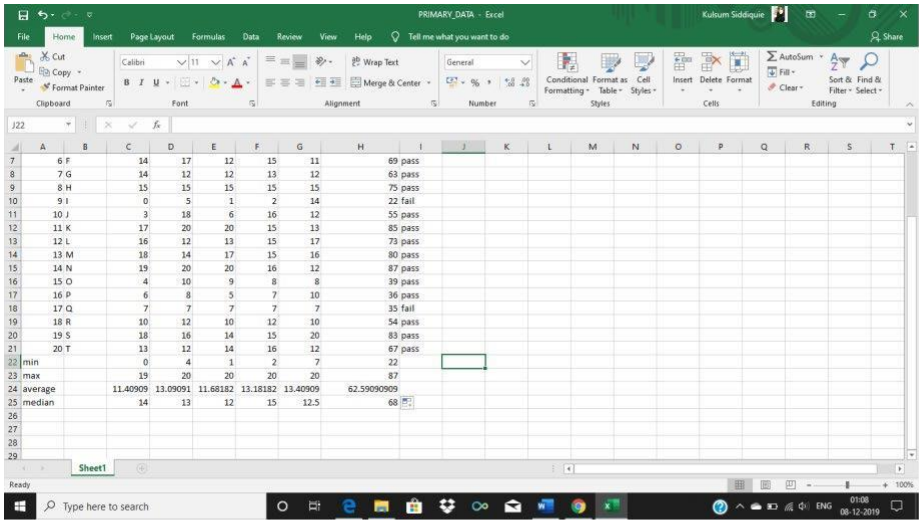
7. Finding median from the column data.

Select the cell, enter the formula:

=median(c2:c21)Press enters.



Drag the same for all the column.



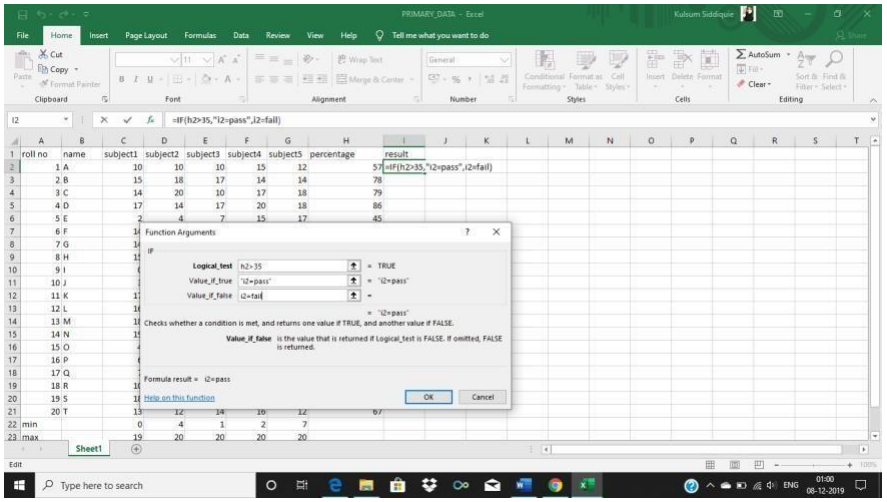
Operation:03 Logical

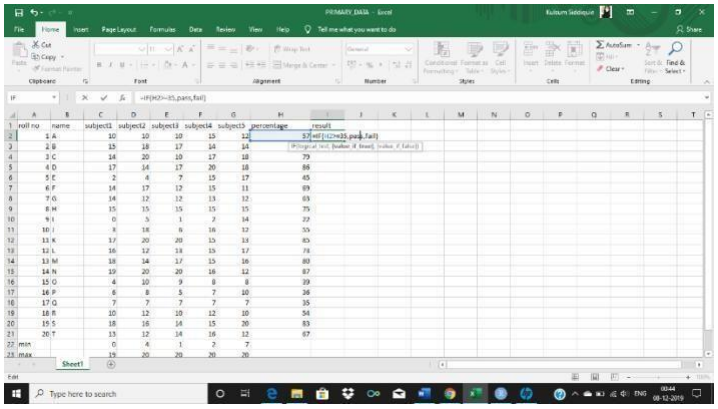
1. **Select Logical operations from the set of given lists.**
2. **Select "IF" from the list of logical operations.**
3. **Select the cells, write the formula for if**

condition:IF(H2>35," Pass"," Fail")

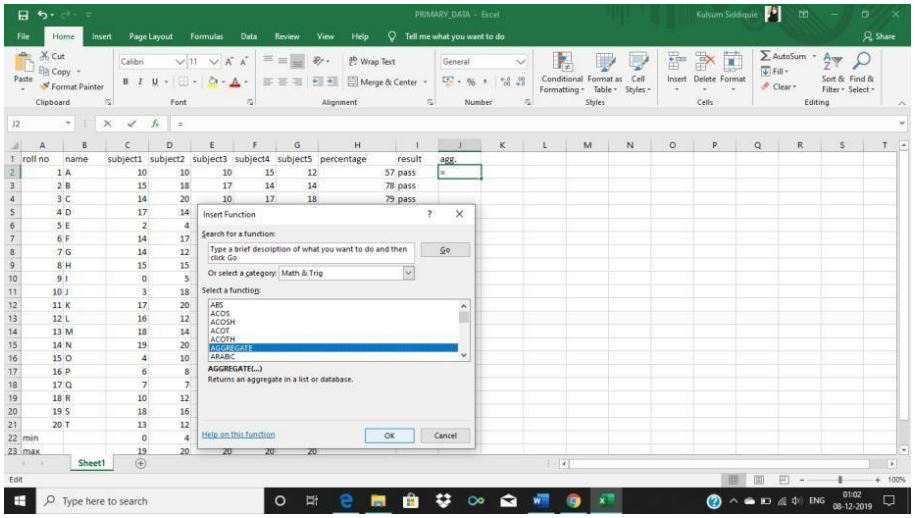
4. **Press enters.**

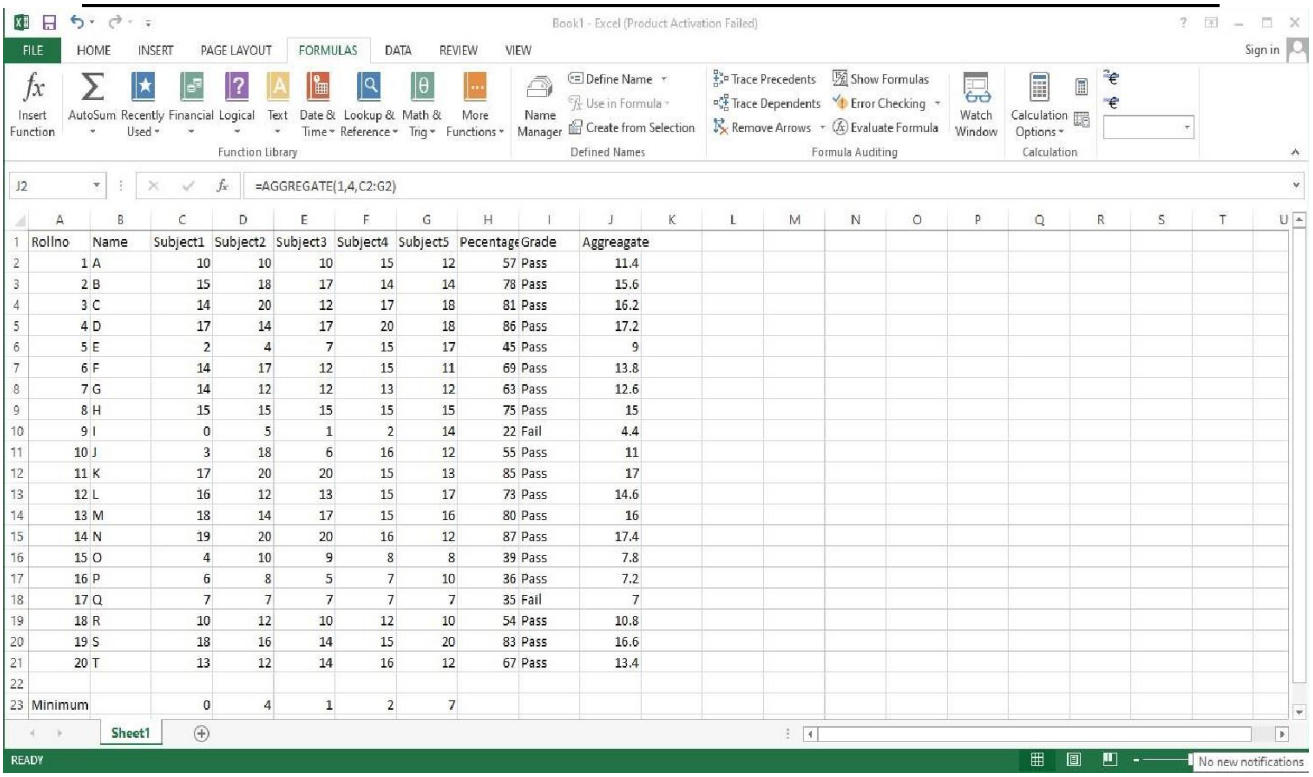
5. **Drag the same for column.**





Operation: Maths and Trig.





	A	B	C	D	E	F	G	H	I	J
1	Rollno	Name	Subject1	Subject2	Subject3	Subject4	Subject5	Pecentage	Grade	Aggreagate
2	1	A	10	10	10	15	12	57	Pass	11.4
3	2	B	15	18	17	14	14	78	Pass	15.6
4	3	C	14	20	12	17	18	81	Pass	16.2
5	4	D	17	14	17	20	18	86	Pass	17.2
6	5	E	2	4	7	15	17	45	Pass	9
7	6	F	14	17	12	15	11	69	Pass	13.8
8	7	G	14	12	12	13	12	63	Pass	12.6
9	8	H	15	15	15	15	15	75	Pass	15
10	9	I	0	5	1	2	14	22	Fail	4.4
11	10	J	3	18	6	16	12	55	Pass	11
12	11	K	17	20	20	15	13	85	Pass	17
13	12	L	16	12	13	15	17	73	Pass	14.6
14	13	M	18	14	17	15	16	80	Pass	16
15	14	N	19	20	20	16	12	87	Pass	17.4
16	15	O	4	10	9	8	8	39	Pass	7.8
17	16	P	6	8	5	7	10	36	Pass	7.2
18	17	Q	7	7	7	7	7	35	Fail	7
19	18	R	10	12	10	12	10	54	Pass	10.8
20	19	S	18	16	14	15	20	83	Pass	16.6
21	20	T	13	12	14	16	12	67	Pass	13.4
22										
23	Minimum		0	4	1	2	7			

Practical 4

Aim: Collect the secondary data in excel and apply scientific method

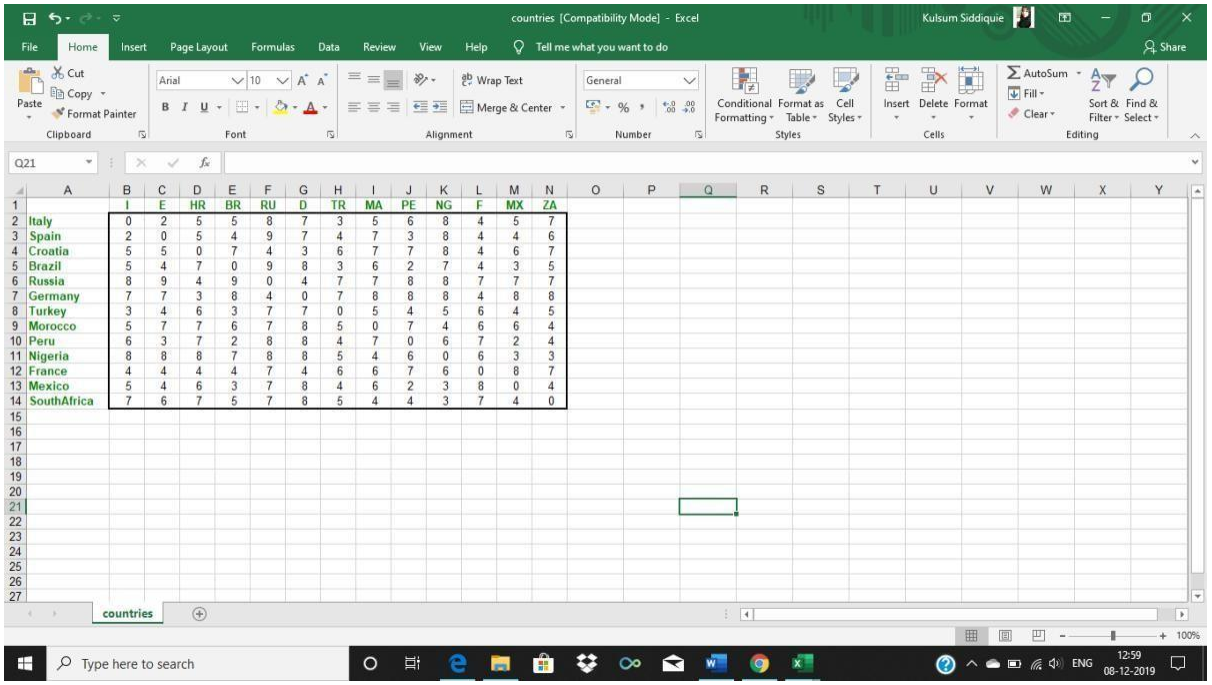
---

1. **Store the secondary data in Excel.**

The data stored below in the excel is sheet the data downloaded from the source:

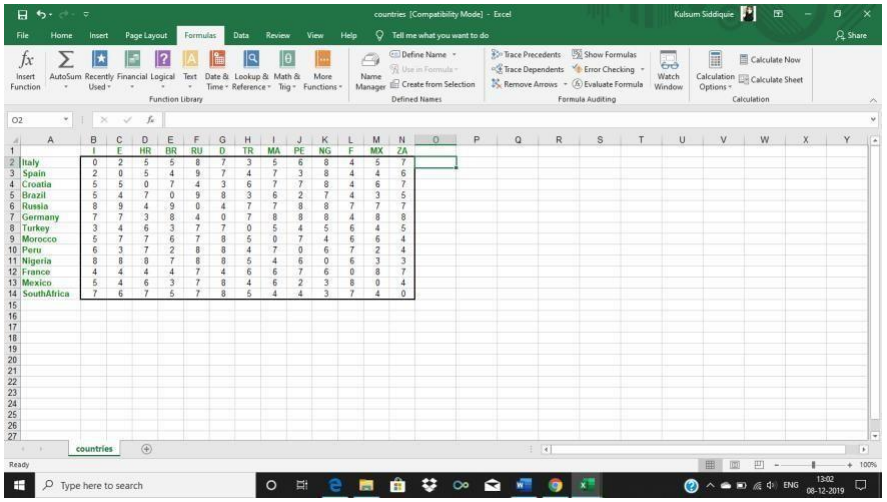
https://www.fbbva.es/microsite/multivariate-statistics/data.html

For performing scientific operations.

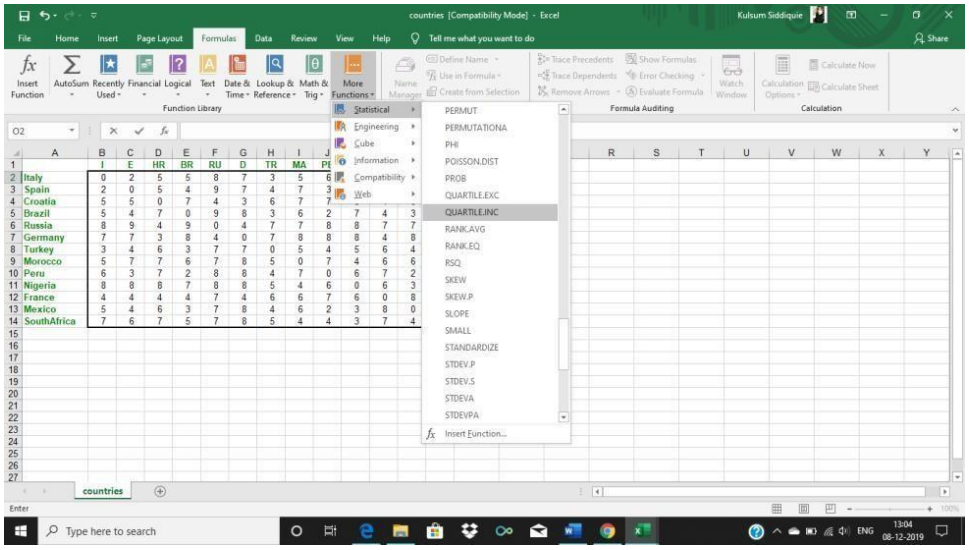


	I	E	HR	BR	RU	D	TR	MA	PE	NG	F	MX	ZA
Italy	0	2	5	5	8	7	3	5	6	8	4	5	7
Spain	2	0	5	4	9	7	4	7	3	8	4	4	6
Croatia	5	5	0	7	4	3	6	7	7	8	4	6	7
Brazil	5	4	7	0	9	8	3	6	2	7	4	3	5
Russia	8	9	4	9	0	4	7	7	8	8	7	7	7
Germany	7	7	3	8	4	0	7	8	8	8	4	8	8
Turkey	3	4	6	3	7	7	0	5	4	5	6	4	5
Morocco	5	7	7	6	7	8	5	0	7	4	6	6	4
Peru	6	3	7	2	8	8	4	7	0	6	7	2	4
Nigeria	8	8	8	7	8	8	5	4	6	0	6	3	3
France	4	4	4	4	7	4	6	6	7	6	0	8	7
Mexico	5	4	6	3	7	8	4	6	2	3	8	0	4
SouthAfrica	7	6	7	5	7	8	5	4	4	3	7	4	0

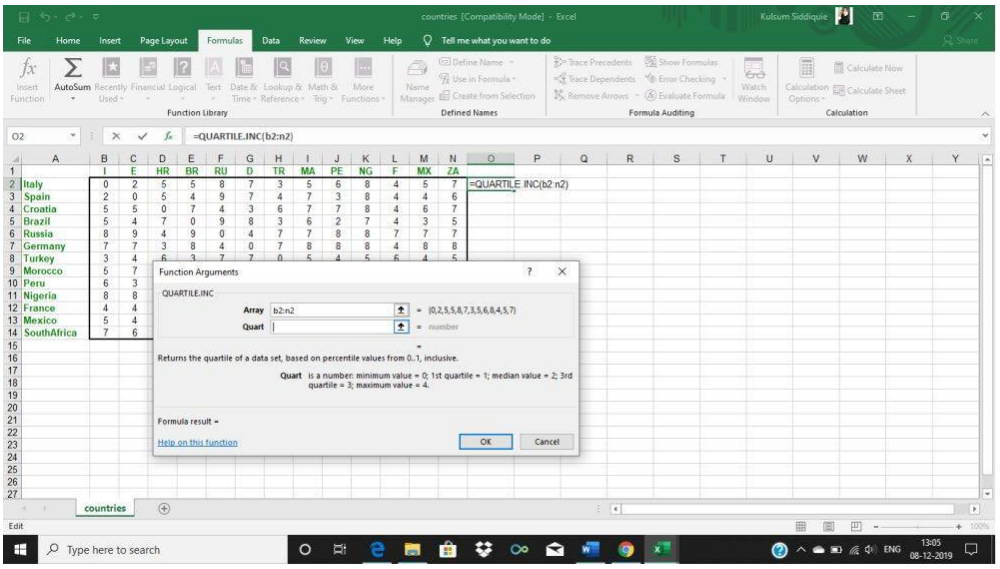
2. Select the cell.



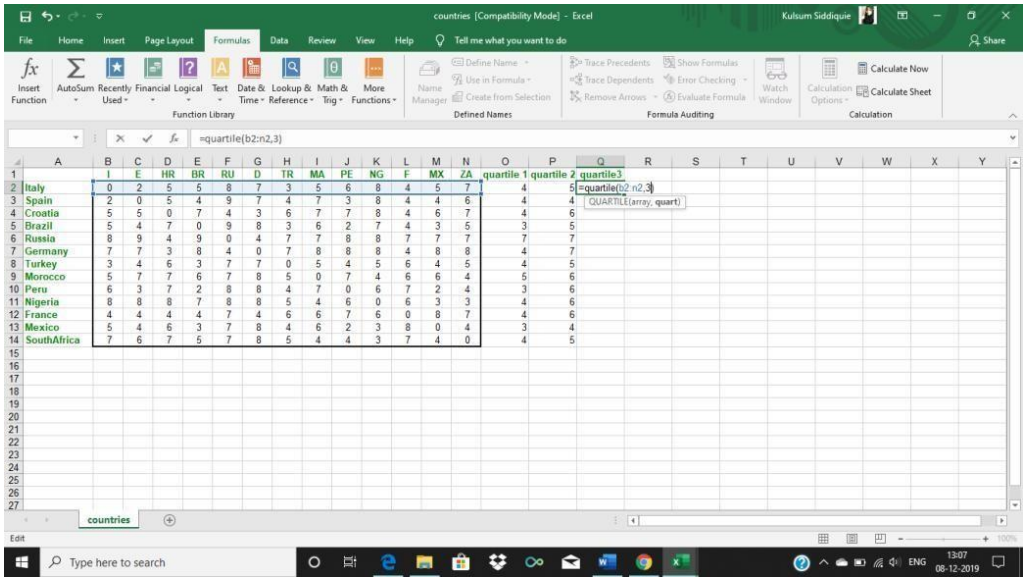
3. From the list of functions, select Statistical, from the statistical functional select:Quartile.



4. **Enter the number of cells as input array, select quartile from 0 to4,Select 1st quartile that gives 25th quartile results:**



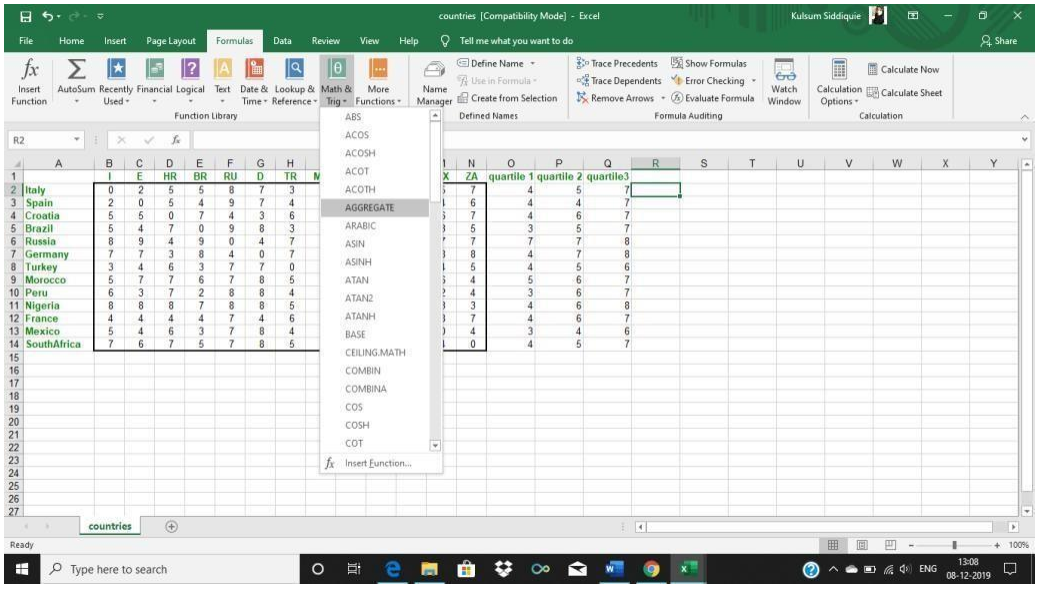
Select the 2nd quartile 3rd quartile, that gives result for 50th and 75th sample.



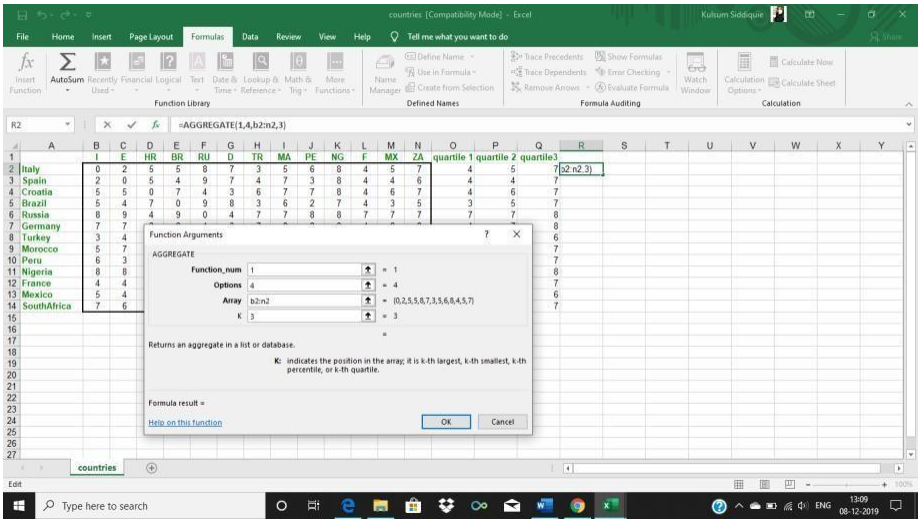
Operation: Aggregate function.

Steps:

1. **select the cell**
2. **Select math and trig. From the list of functions.**
3. **Select the aggregate function from the list.**
4. **Click ok. Then enter**



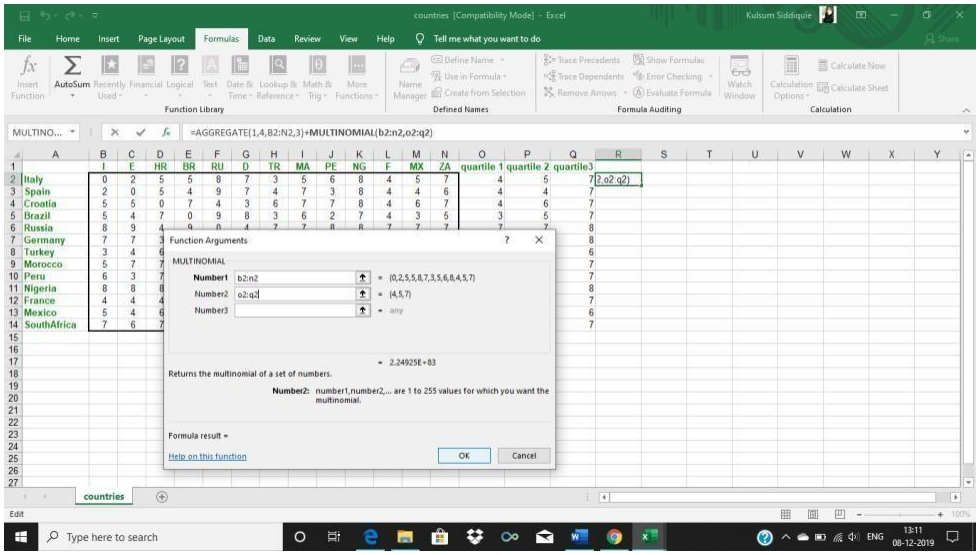
5 .fill the necessary details in the dialog box of the function that appears.

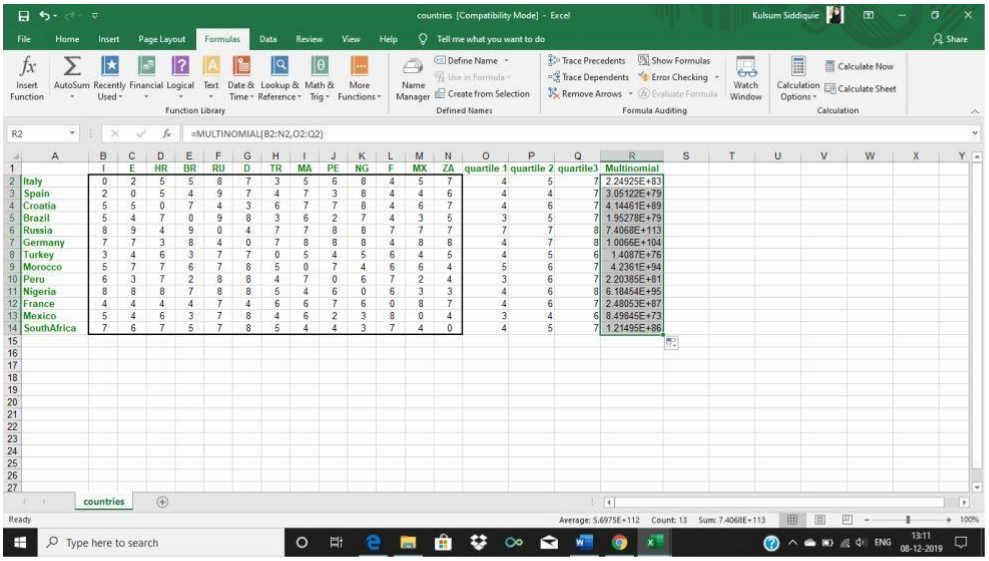


Operation: Multinomial function.

Steps:

1. **select the cell**
2. **Select math and trig. From the list of functions.**
3. **Multinomial function from the list.**
4. **Fill the list of numbers in the array**
5. **Click ok. Then enter**
6. **Drag the cell for all columns.**

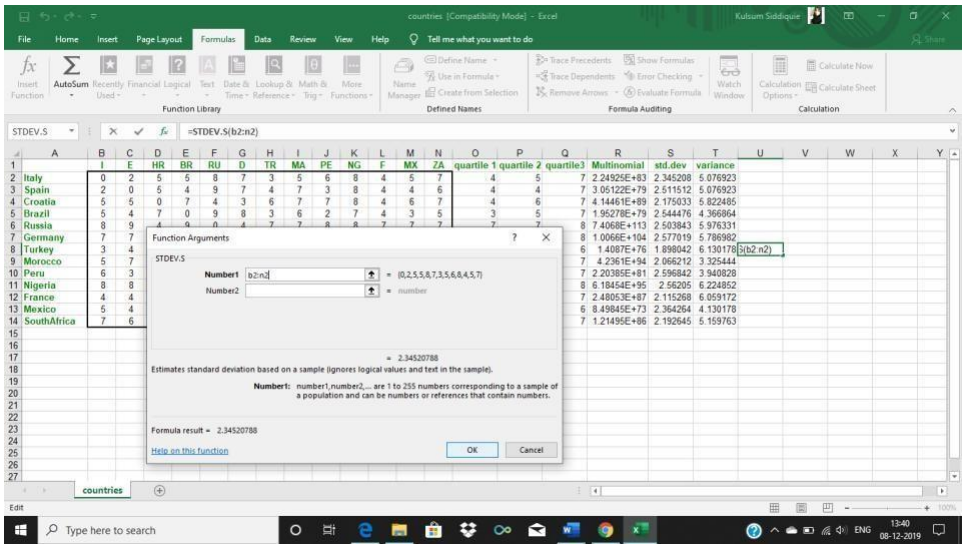




Operation: Standard Variation function.

Steps:

1. **select the cell**
2. **Select statistical. From the list of functions.**
3. **Select the standard deviation function from the list.**
4. **Click ok. Then enter**
5. **Select the cells for calculation, press enter.**
6. **Drag for whole column.**

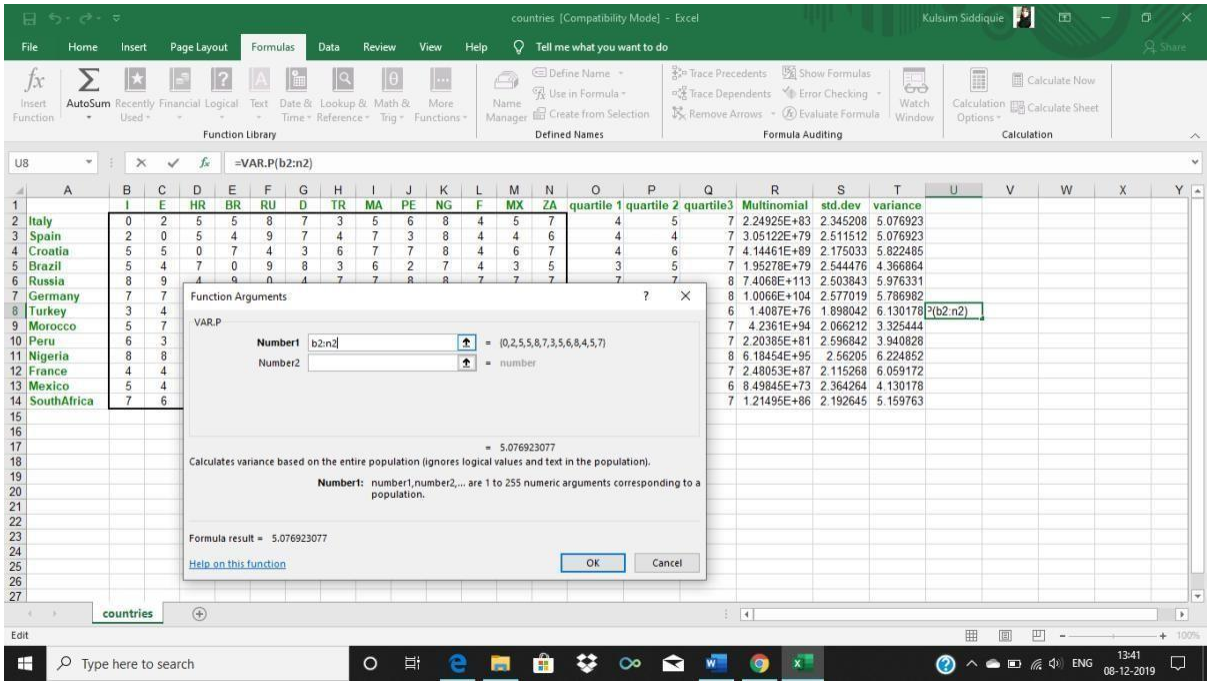


Operation: Variance function.

Steps:

1. **select the cell**
2. **Select statistical. From the list of functions.**
3. **Select the variance function from the list.**
4. **Click ok. Then enter**
5. **Select the cells for calculation, press enter.**

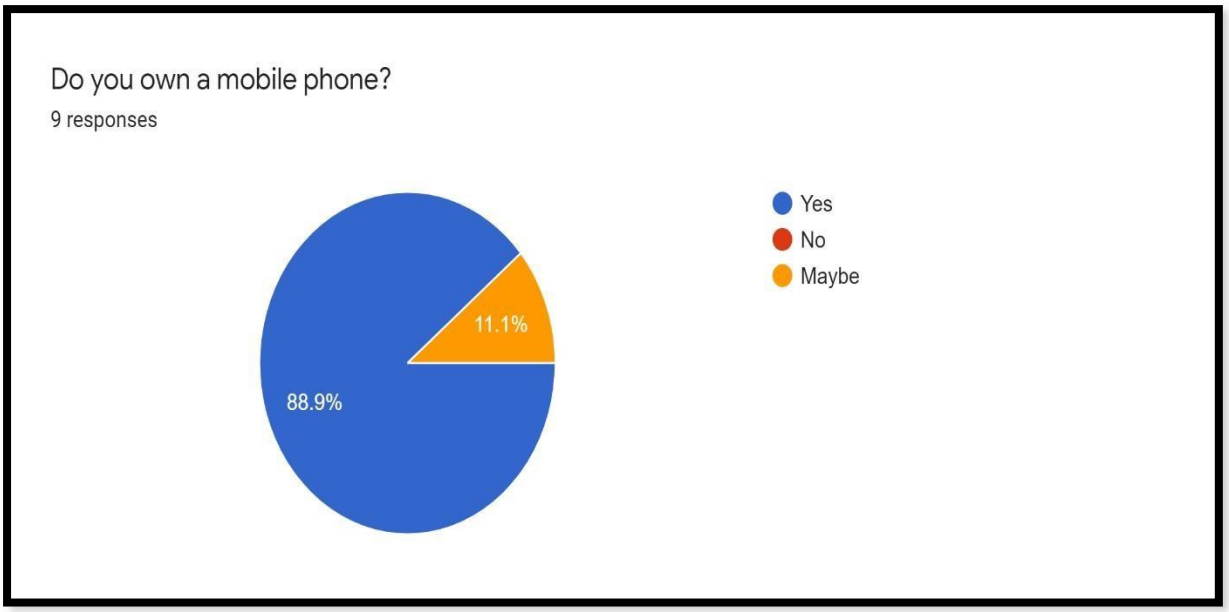
Drag for whole column



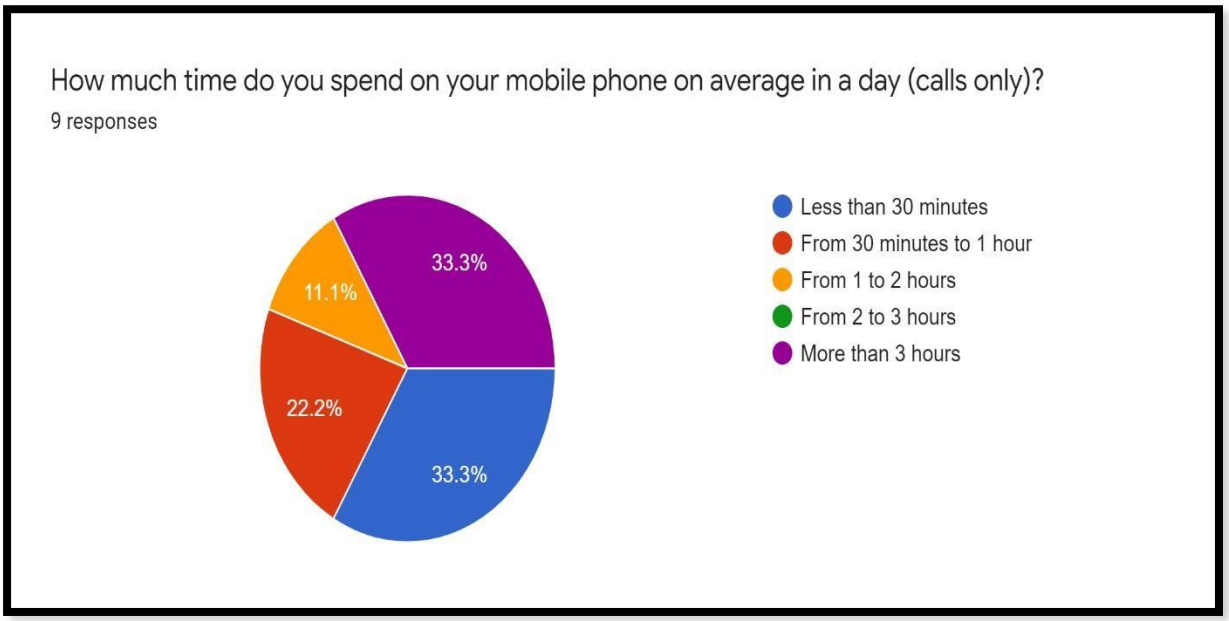
Practical 5

Aim: Design the survey from and collect the suitable data and perform analysis

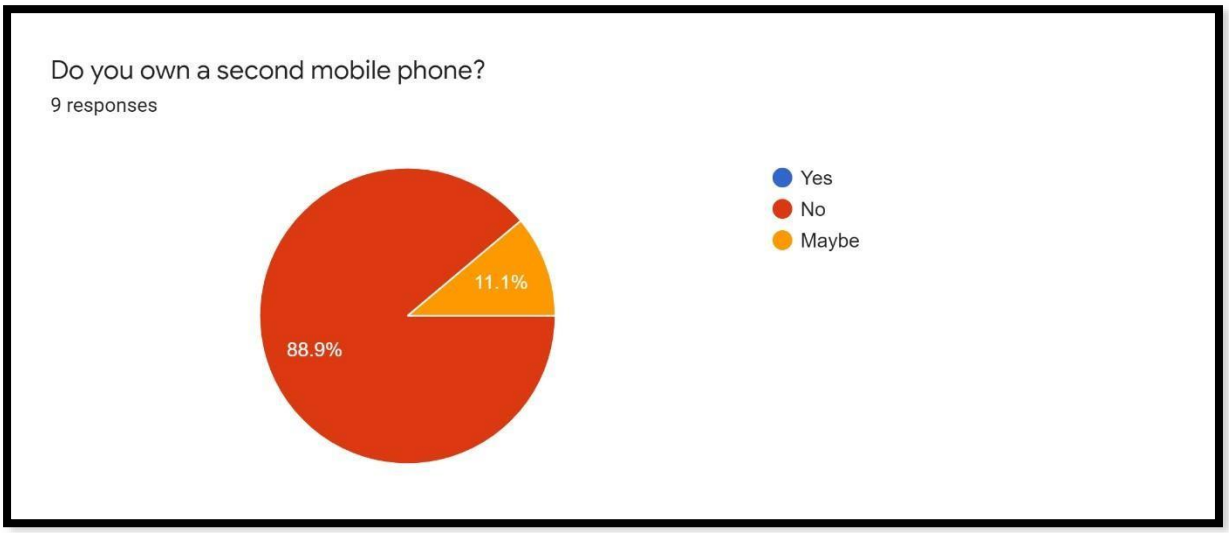
Mobile Phone Usage



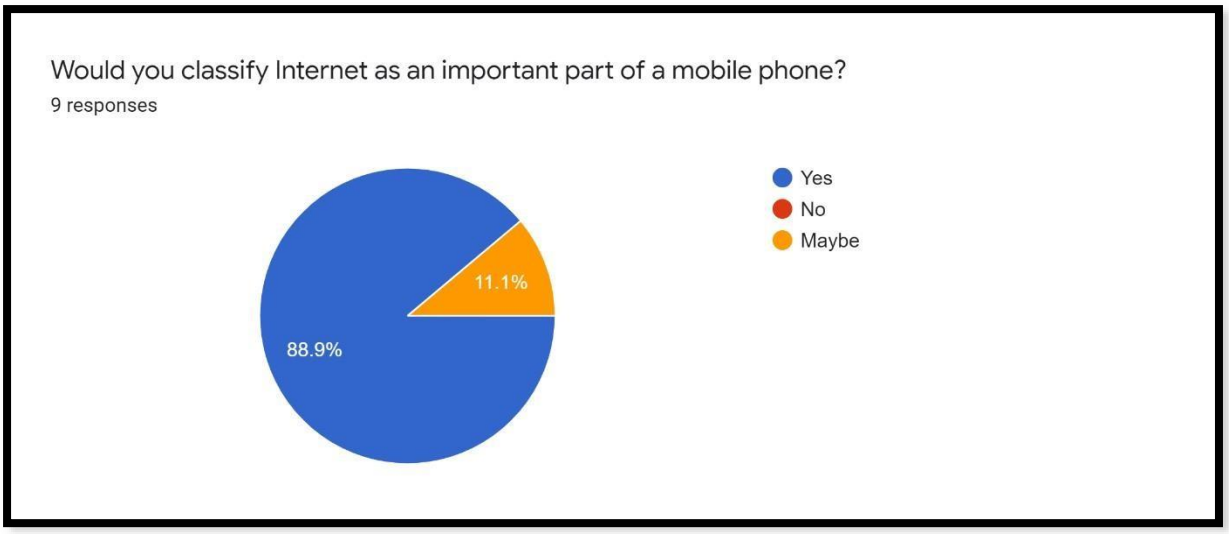
According to the survey, in todays world everyone carries with their own mobiles phones. Usage of mobiles goes at the huge extend. Everyone is dealing the new technology application and also aware of latest trends. The usage of mobile is consistently increases at huge extend. Everyone carries with the self owned mobile phones. But the truth is todays world is unaware of proper usage of mobile phones. And according to the survey 88.9% population having their own mobile phones and 11.1 using their colleagues mobile phones.



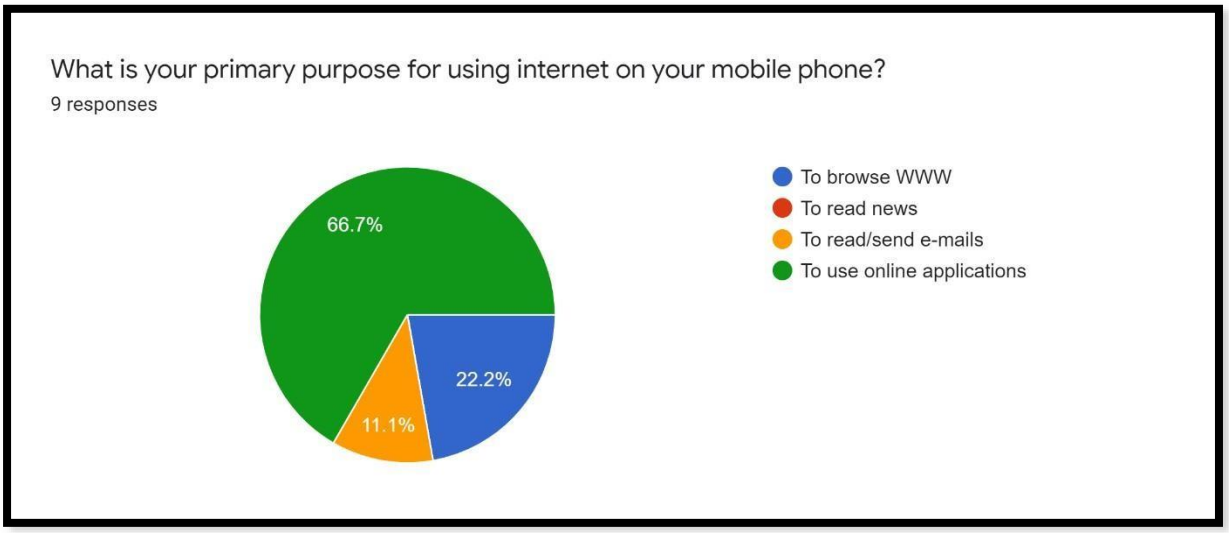
Large Number of people are busy on call more than 3hours. 33.3% population are busy on mobile phones at huge extend. The survey tells that 22.2% people are busy on calls from 1-2 hours respectively. But very few 22.2% population are using 30min to 1 hour only on daily usage. Then 11.1% population are busy on calls for 1-2 hours maximum time respectively.



In todays world everyone having the 2 mobile phones. From the survey we get know that 88.9% population having 2 cell phones for their daily purpose need. But only 11.1% are not dealing with the usage of 2 mobile phones.

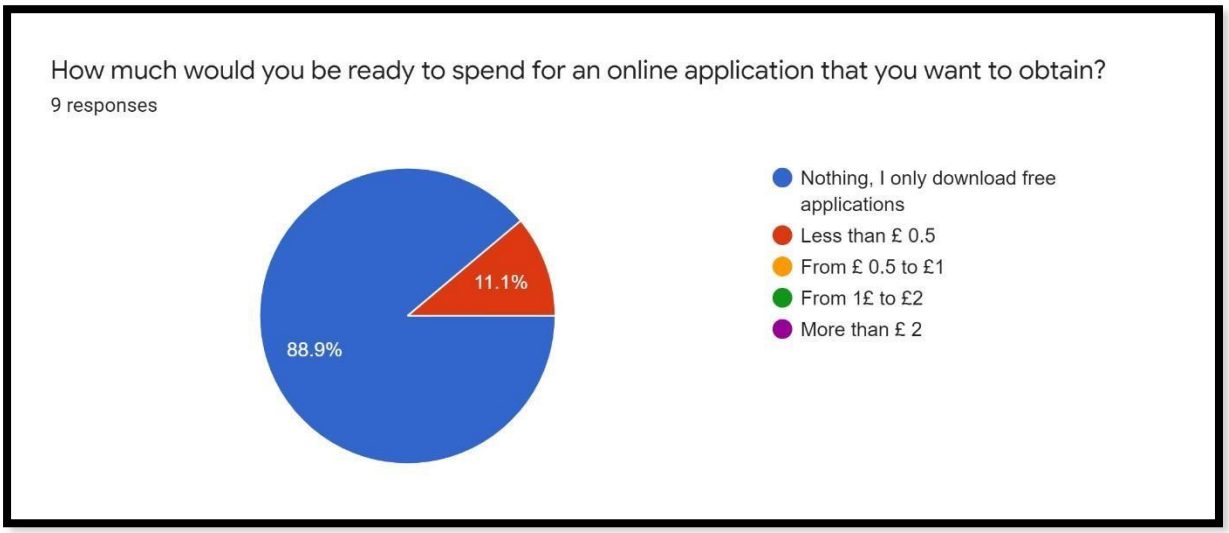


In todays world everyone having the 2 mobile phones. From the survey we get know that 88.9% population having 2 cell phones for their daily purpose need. But only 11.1% are not dealing with the usage of 2 mobile phones.



According to the survey, 66.7% using the online application for using internet on mobile phones. But from that 11.1% population use it only for reading and sending the emails.

And 22.2% population are busy in dealing with browser to browse www on the internet through the mobile phone usage.



According to survey of this questionnaire, we came to an conclusion that 88.9% using the internet for downloading the free application only. But 11.1% are ready for spending less than 0.5 total cost for the download of the paid applications.

We came to conclusion that more 10% population are reading some cost to the application which are paid to use, and apart from that 90% population are using the free download applications only according to their need and use also.

Practical 6

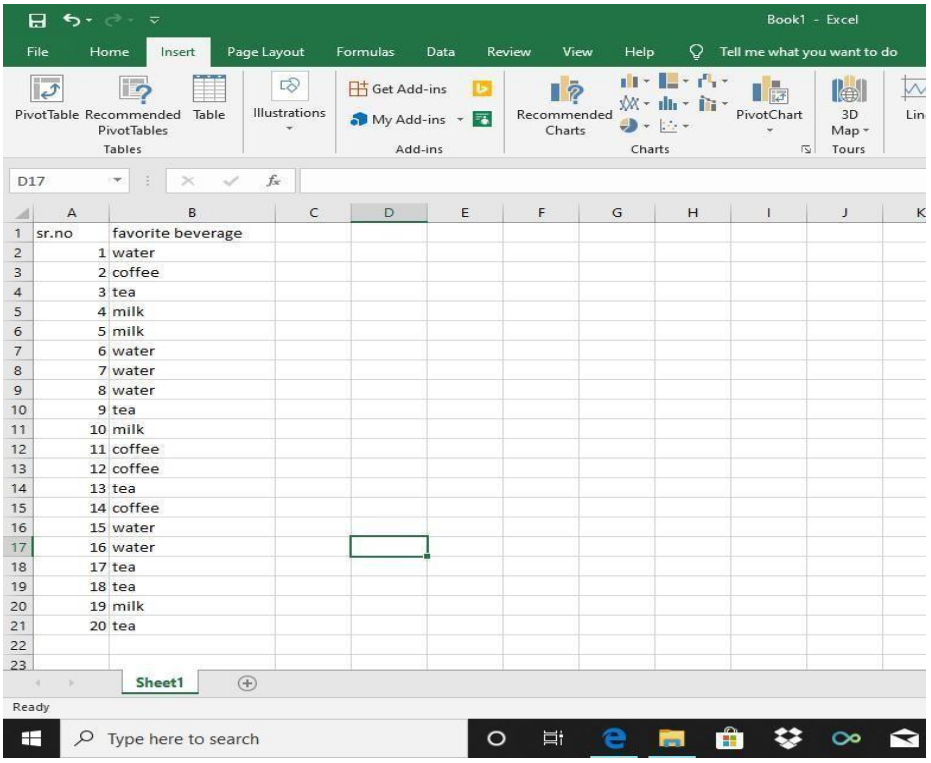
Aim: Implement the different scales of measurement on data: Nominal & Ordinal

Nominal data, also called categorical data, does not have does not have a natural sequence. Instead, the data is typically in named categories or labels without numeric significance.

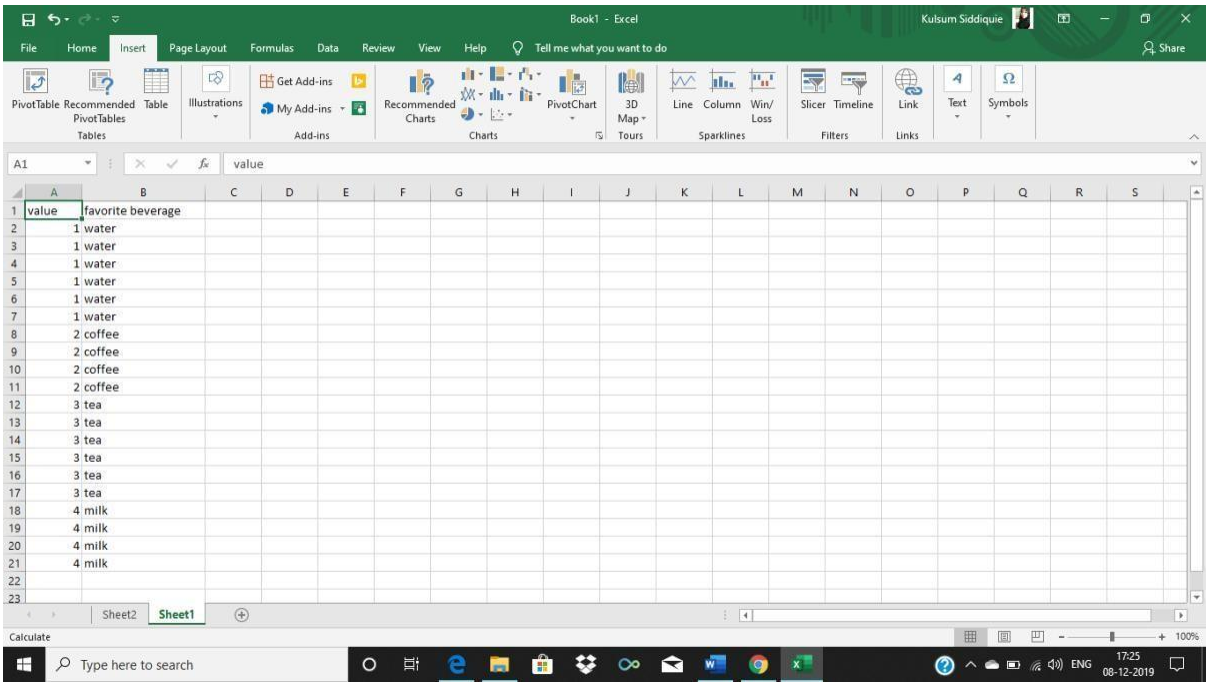
For example, is a survey question below that asks for a favourite beverage, with choices of coffee, tea, water, or milk will generate nominal data in 4 categories as in the bar chart.

Steps:

1. **Store the data into excel format consisting of customer serial no. and preferred beverage.**

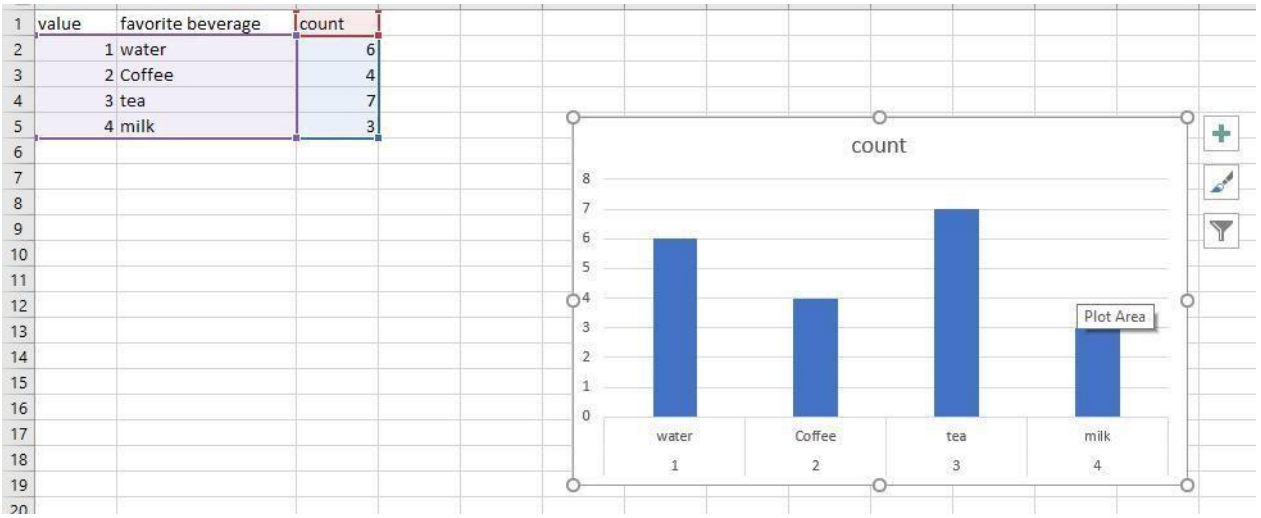


2. Sort the data by giving label to the selection by using if conditions.



	A	B
1	value	favorite beverage
2	1	water
3	1	water
4	1	water
5	1	water
6	1	water
7	1	water
8	2	coffee
9	2	coffee
10	2	coffee
11	2	coffee
12	3	tea
13	3	tea
14	3	tea
15	3	tea
16	3	tea
17	3	tea
18	4	milk
19	4	milk
20	4	milk
21	4	milk

3. Represent the data through the help of bar graph presented:



	value	favorite beverage	count
2	1	water	6
3	2	Coffee	4
4	3	tea	7
5	4	milk	3

Ordinal Data:

Ordinal data has a distinct order or natural sequence. An example is survey data collected in response to the question like this:

How old are you?

- **Under 18**
- **18-20**
- **21-30**
- **31-45**
- **45+**

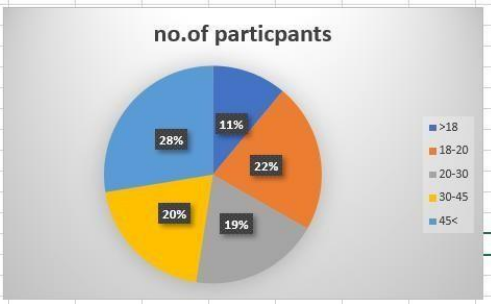
The chart above shows how the data can be plotted in an Excel column chart that follows the natural order.

4. **For Ordinal data, enter the data:**

Age group	no.of particpants
>18	45
18-20	90
20-30	78
30-45	81
45<	112

5. Plot the information into percentage pie diagram and bar graph in increasing to decreasing order of the ages.

Age group	no.of particpants
>18	45
18-20	90
20-30	78
30-45	81
45<	112



Age group	no.of particpants
>18	45
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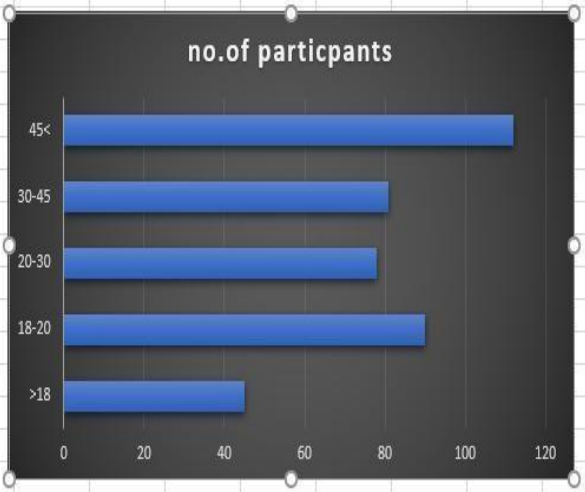
45<	112



Practical 7

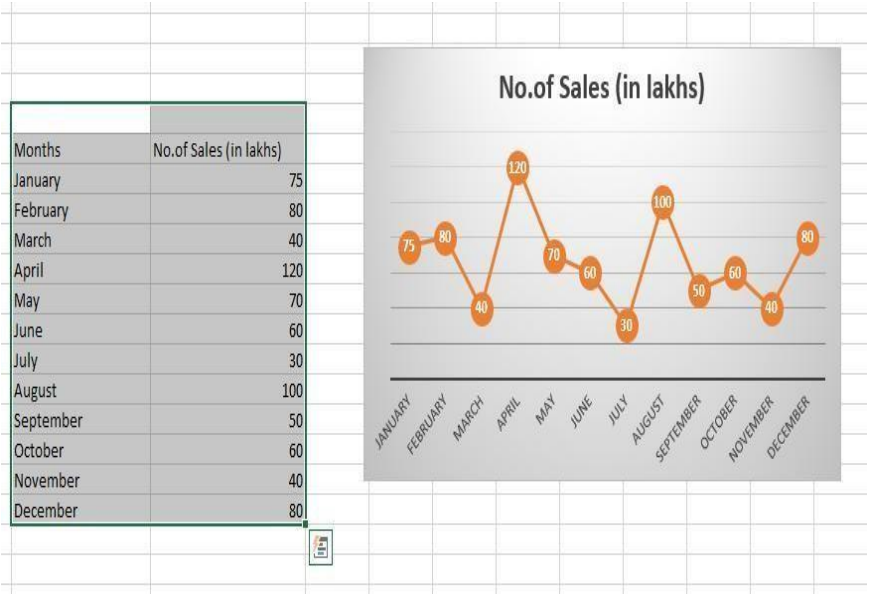
Aim: Implement the different scales of measurement on data: Ratio and Interval

Interval data is like ordinal except we can say the intervals between each value are equally split. The most common example is temperature in degrees Fahrenheit. The difference between 29 and 30 degrees is the same magnitude as the difference between 78 and 79 (although I know I prefer the latter). With attitudinal scales and the Likert questions you usually see on a survey, these are rarely interval, although many points on the scale likely are of equal intervals.

Ratio data is interval data with a natural zero point. For example, time is ratio since 0 time is meaningful. Degrees Kelvin has a 0 point (absolute 0) and the steps in both these scales have the same degree of magnitude.

Steps:

1. **Enter the data of sales months of the year.**
2. **Represent the data with respect to months, where the differencebetween each month is equally 1 month on the X axis.**

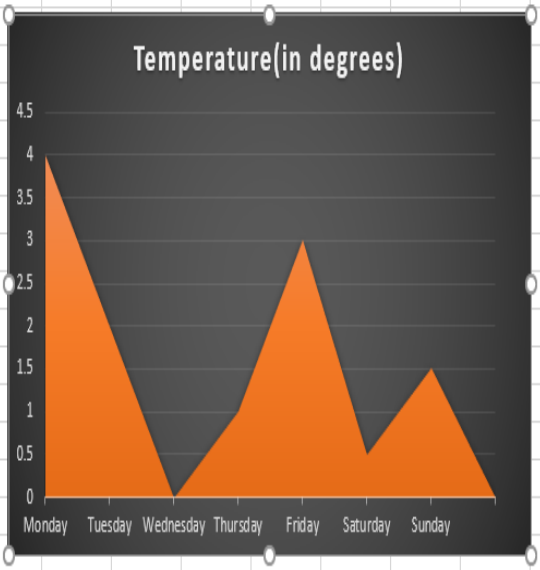


Months	No.of Sales (in lakhs)
January	75
February	80
March	40
April	120
May	70
June	60
July	30
August	100
September	50
October	60
November	40
December	80

Steps:

1. **Enter the data of temperature of the week in Artic circle.**
2. **Represent the data with respect to week days, where the difference between each day is 24hrs and also the temperature can be absolute zero i.e. 0 Celsius.**

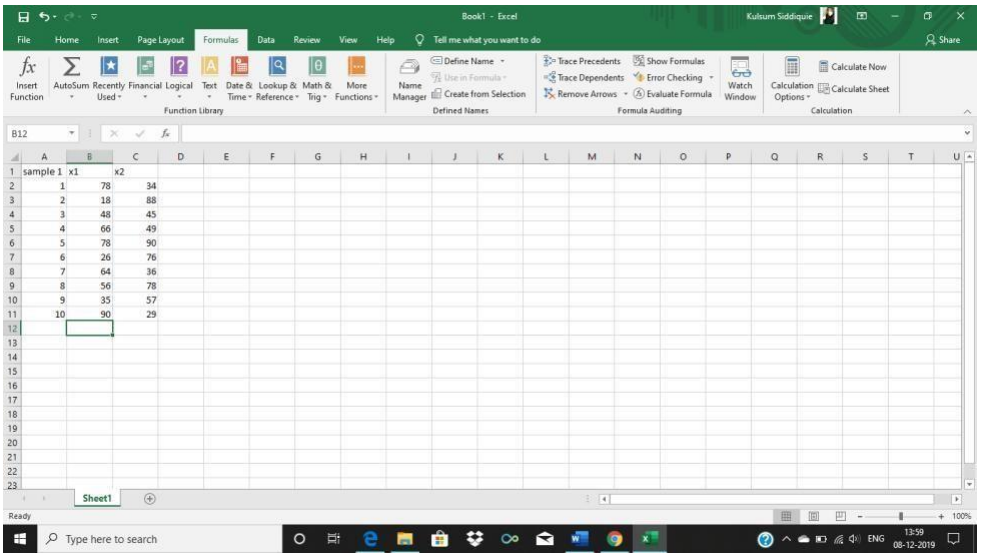
Days	Temperature(in degrees)
Monday	4
Tuesday	2
Wednesday	0
Thursday	1
Friday	3
Saturday	0.5
Sunday	1.5



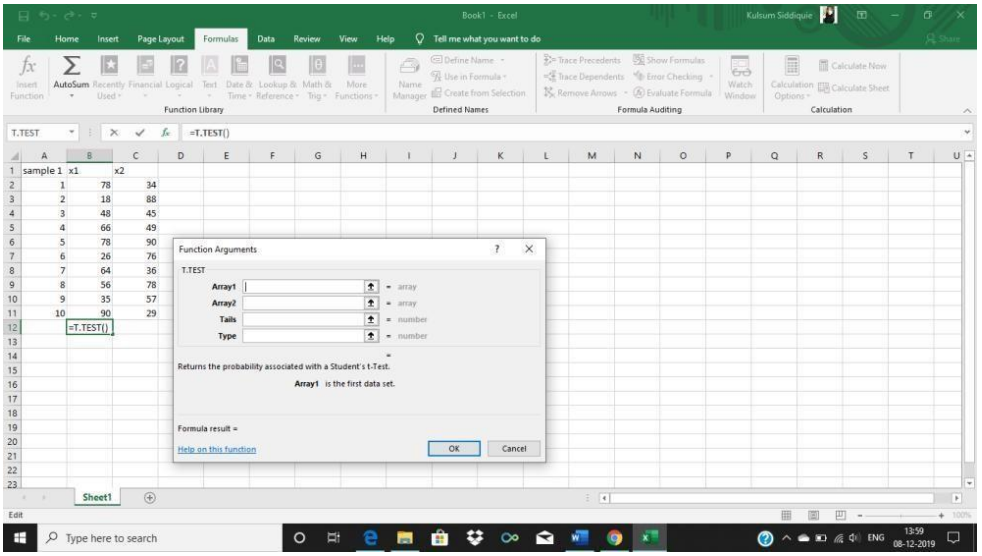
Practical 8
Aim: Perform t-test on the data.

Steps:

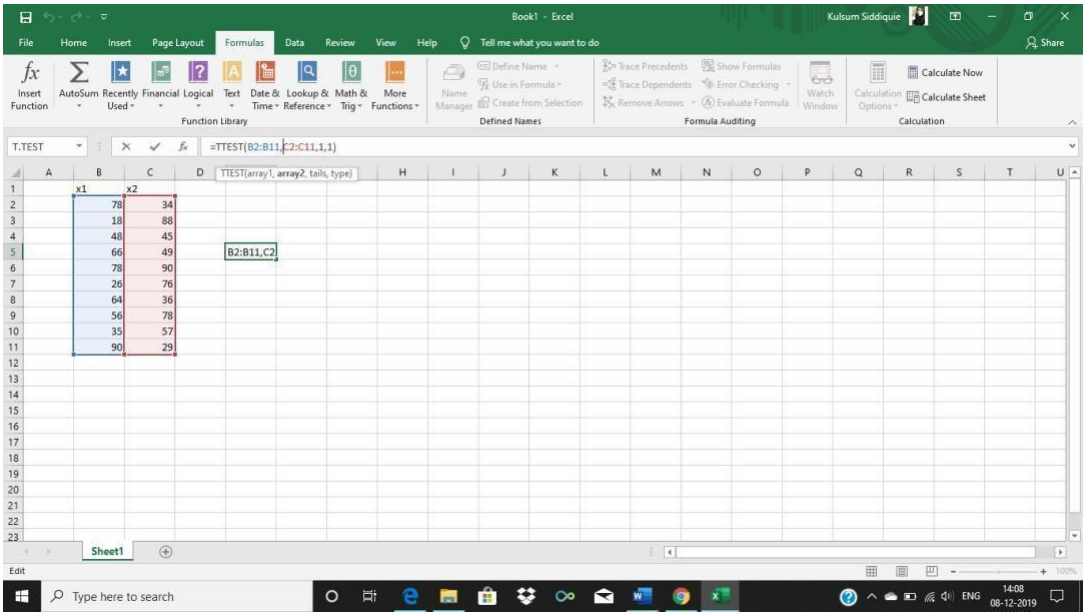
1. **Store the two arrays of data. In excel.**



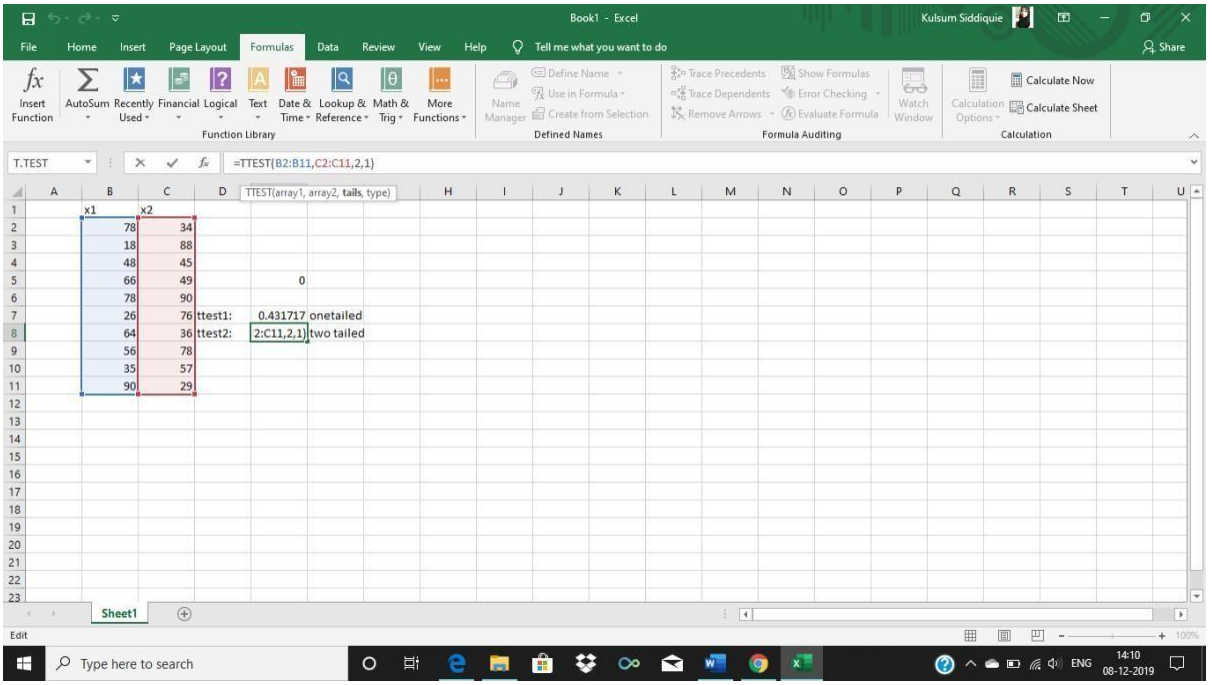
2. **Select the cell, enter the function: test (array1, array2, tails, type)**



3. **Enter for one tailed test:**
=ttest (b2: b11, c2:c11,1,1)
Press enters.



4. **Enter for two tailed test:**



=ttest (b2: b11, c2:c11,1)
Press enters.