AKBAR PEERBHOY COLLEGE OF

COMMERCE & ECONOMICS

M. S. Ali Road, Do Taaki, Grant Road (E), Mumbai – 400008.

PRACTICAL JOURNAL

SUBMITTED TO

MASTER OF SCIENCE (INFORMATION TECHNOLOGY) Part-I

Semester - I

Subject: Data Science

University of Mumbai

Submitted by

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Under the guidance of

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DEPARTMENT OF INFORMATION TECHNOLOGY

AKBAR PEERBHOY COLLEGE OF COMMERCE & ECONOMICS

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Anjuman-I-Islam's
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Ref. No. _____

CERTIFICATE

This is to Certify that Mr. / Mrs. Miss_____

Seat No. _____of **M.Sc. IT Part-I, Semester I** has completed the practical work in the subject _____ during the academic year **2025-26** being the partial requirement for the fulfillment of curriculum of Degree in Master of Science in Information Technology, University of Mumbai.

_____
Subject In charge

_____
Coordinator
Prof. Dr. Abdul Sadique

_____
Asst. Director, Professional Course
Prof. Dr. Hanif Lakdawala

_____
Principal
Prof. Dr. Shaukat Ali

_____
External Examiner

College Seal:

Date: _____

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Practical No.	Name of Experiment		Date	Signature
Q1.	**Creating and using database in Cassandra**			
Q2.	**Write the programs for the following:**			
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	C	JSON to HORUS format		
	D	MySql database to HORUS format		
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	D	Write python/R program to pick the content for BillBoards from the given data		
	E	Write a python/R program to generate GML file from given csv file		
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	H	Using the given data Write python/R program to plan the shipping routers from best-fit international logistics		
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	M	Write python program to generate payroll from the given data		
Q6.	**Build the time hub, links and satellites**			
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Q10.	**Data visualisation using power Bi**			

Practical 1

Creating Data Model using Cassandra

Cassandra Data Model

Code:

```
Create keyspace keyspace1 with replication = {'class':'SimpleStrategy','replication_factor': 3};

Use keyspace1;

Create table dept ( dept_id int PRIMARY KEY, dept_name text, dept_loc text);

Create table emp ( emp_id int PRIMARY KEY, emp_name text, dept_id int, email text, phone text );

Insert into dept (dept_id, dept_name, dept_loc) values (1001, 'Accounts', 'Mumbai');

Insert into dept (dept_id, dept_name, dept_loc) values (1002, 'Marketing', 'Delhi');

Insert into dept (dept_id, dept_name, dept_loc) values (1003, 'HR', 'Chennai');

Insert into emp ( emp_id, emp_name, dept_id, email, phone ) values (1001, 'ABCD',1001,
'abcd@company.com', '1122334455');

Insert into emp ( emp_id, emp_name, dept_id, email, phone ) values (1002, 'DEFG',1001,
'defg@company.com', '2233445566');

Insert into emp ( emp_id, emp_name, dept_id, email, phone ) values (1003, 'GHIJ',1002,
'ghij@company.com', '3344556677');

Insert into emp ( emp_id, emp_name, dept_id, email, phone ) values (1004, 'JKLM',1002,
'jklm@company.com', '4455667788');

Insert into emp ( emp_id, emp_name, dept_id, email, phone ) values (1005, 'MNOP',1003,
'mnop@company.com', '5566778899');

Insert into emp ( emp_id, emp_name, dept_id, email, phone ) values (1006, 'MNOP',1003,
'mnop@company.com', '5566778844');

select * from emp;

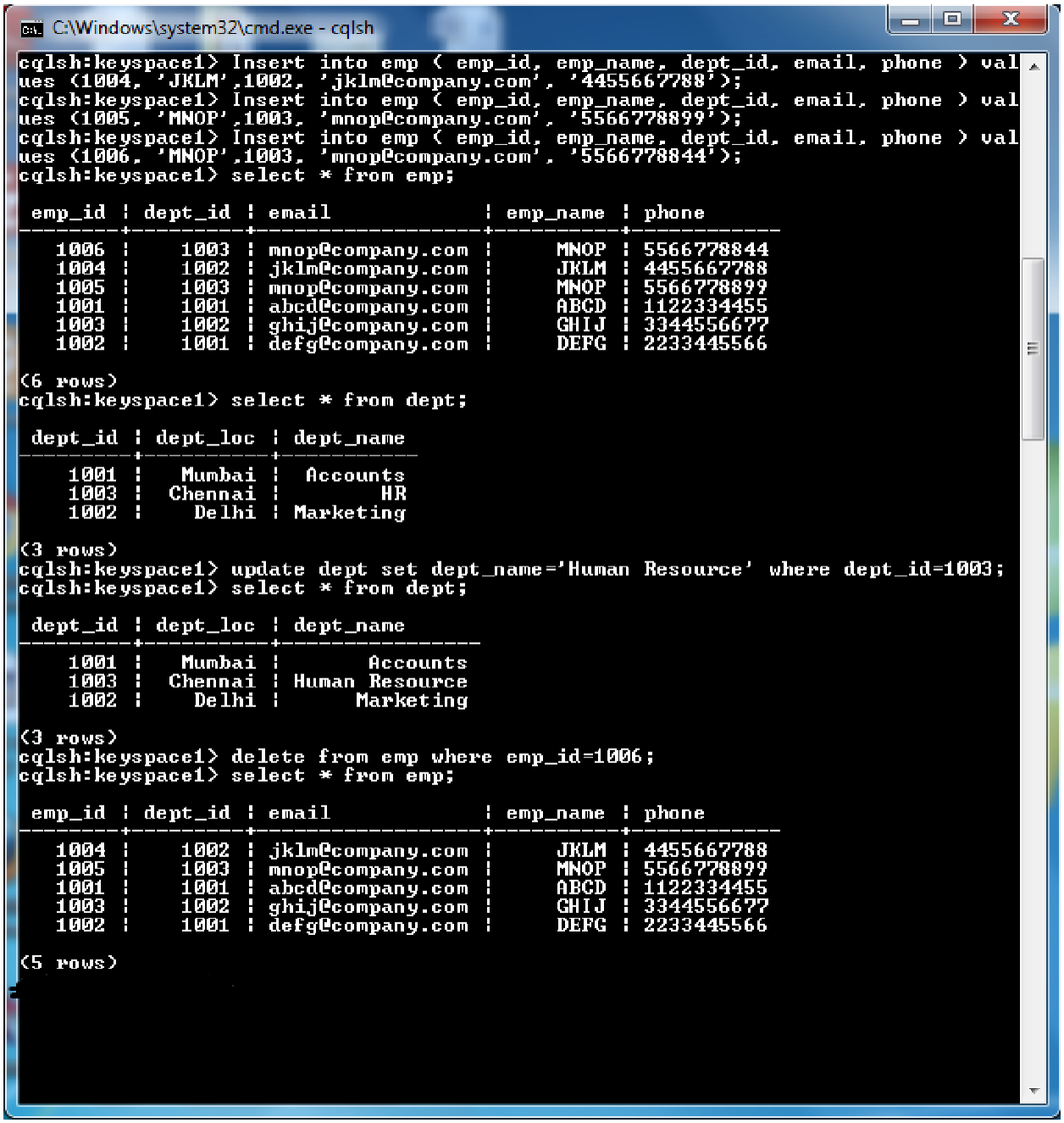
select * from dept;

update dept set dept_name='Human Resource' where dept_id=1003;

delete from emp where emp_id=1006;

select * from emp;
```

Output:


C:\Windows\system32\cmd.exe - cqlsh
cqlsh:keyspace1> Insert into emp (emp_id, emp_name, dept_id, email, phone) val
ues (1004, 'JKLM',1002, 'jklm@company.com', '4455667788');
cqlsh:keyspace1> Insert into emp (emp_id, emp_name, dept_id, email, phone) val
ues (1005, 'MNOP',1003, 'mnop@company.com', '5566778899');
cqlsh:keyspace1> Insert into emp (emp_id, emp_name, dept_id, email, phone) val
ues (1006, 'MNOP',1003, 'mnop@company.com', '5566778844');
cqlsh:keyspace1> select * from emp;
emp_id | dept_id | email | emp_name | phone
1006 | 1003 | mnop@company.com | MNOP | 5566778844
1004 | 1002 | jklm@company.com | JKLM | 4455667788
1005 | 1003 | mnop@company.com | MNOP | 5566778899
1001 | 1001 | abcd@company.com | ABCD | 1122334455
1003 | 1002 | ghij@company.com | GHIJ | 3344556677
1002 | 1001 | defg@company.com | DEFG | 2233445566
(6 rows)
cqlsh:keyspace1> select * from dept;
dept_id | dept_loc | dept_name
1001 | Mumbai | Accounts
1003 | Chennai | HR
1002 | Delhi | Marketing
(3 rows)
cqlsh:keyspace1> update dept set dept_name='Human Resource' where dept_id=1003;
cqlsh:keyspace1> select * from dept;
dept_id | dept_loc | dept_name
1001 | Mumbai | Accounts
1003 | Chennai | Human Resource
1002 | Delhi | Marketing
(3 rows)
cqlsh:keyspace1> delete from emp where emp_id=1006;
cqlsh:keyspace1> select * from emp;
emp_id | dept_id | email | emp_name | phone
1004 | 1002 | jklm@company.com | JKLM | 4455667788
1005 | 1003 | mnop@company.com | MNOP | 5566778899
1001 | 1001 | abcd@company.com | ABCD | 1122334455
1003 | 1002 | ghij@company.com | GHIJ | 3344556677
1002 | 1001 | defg@company.com | DEFG | 2233445566
(5 rows)

Practical 2

Conversion from different formats to HORUS formats

A) Csv to Horus

Code:

```
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/9999-Data/HORUS-CSV-Country.csv'
OutputData.to_csv(sOutputFileName, index = False)
print('CSV to HORUS - Done')
# Utility done
```

Output:

```
In [93]: runfile('H:/VKHCG/05-DS/9999-Data/CSV2HORUS.py', wdir='H:/VKHCG/05-DS/9999-Data')


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
5                       Andorra         AD        AND       20
6                        Angola         AO        AGO       24
7                      Anguilla         AI        AIA      660
8                    Antarctica         AQ        ATA       10
9             Antigua and Barbuda         AG        ATG       28
10                  Argentina         AR        ARG       32
11                    Armenia         AM        ARM       51
12                      Aruba         AW        ABW      533
13                  Australia         AU        AUS       36
14                    Austria         AT        AUT       40
15                 Azerbaijan         AZ        AZE       31
16                    Bahamas         BS        BHS       44
17                    Bahrain         BH        BHR       48
18                 Bangladesh         BD        BGD       50
19                   Barbados         BB        BRB       52
20                    Belarus         BY        BLR      112
21                    Belgium         BE        BEL       56
22                     Belize         BZ        BLZ       84
23                      Benin         BJ        BEN      204
24                    Bermuda         BM        BMU       60
25                     Bhutan         BT        BTN       64
26                    Bolivia         BO        BOL       68
27      Bosnia and Herzegovina         BA        BIH       70
28                   Botswana         BW        BWA       72
29             Bouvet Island          BV        BVT       74
..                        ...        ...        ...      ...
217                Tajikistan         TJ        TJK      762
218  Tanzania, United Republic of         TZ        TZA      834
219                  Thailand         TH        THA      764
220               Timor-Leste         TL        TLS      626
221                      Togo         TG        TGO      768
222                   Tokelau         TK        TKL      772
223                     Tonga         TO        TON      776
224       Trinidad and Tobago         TT        TTO      780
225                   Tunisia         TN        TUN      788
226                    Turkey         TR        TUR      792
227              Turkmenistan         TM        TKM      795
228   Turks and Caicos Islands         TC        TCA      796
229                    Tuvalu         TV        TUV      798
230                    Uganda         UG        UGA      800
231                   Ukraine         UA        UKR      804
232      United Arab Emirates         AE        ARE      784
233            United Kingdom         GB        GBR      826
234   United States of America         US        USA      840
235  US Minor Outlying Islands         UM        UMI      581
236                   Uruguay         UY        URY      858
237                Uzbekistan         UZ        UZB      860
238                   Vanuatu         VU        VUT      548
239  Venezuelaÿ(Bolivarian Republic)         VE        VEN      862
240                  Viet Nam         VN        VNM      704
241          Virgin Islands, US         VI        VIR      850
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
850                 Virgin Islands, US
704                            Viet Nam
862      Venezuelaÿ(Bolivarian Republic)
548                             Vanuatu
860                          Uzbekistan
858                             Uruguay
840          United States of America
826                    United Kingdom
784               United Arab Emirates
804                             Ukraine
800                              Uganda
581          US Minor Outlying Islands
798                              Tuvalu
796           Turks and Caicos Islands
795                        Turkmenistan
792                              Turkey
788                             Tunisia
780               Trinidad and Tobago
776                               Tonga
772                             Tokelau
768                                Togo
626                           Timor-Leste
764                             Thailand
834          Tanzania, United Republic of
762                          Tajikistan
...                                 ...
74                       Bouvet Island
72                            Botswana
70              Bosnia and Herzegovina
68                              Bolivia
64                               Bhutan
64                               Bhutan
60                              Bermuda
204                               Benin
84                               Belize
56                               Belgium
112                              Belarus
52                              Barbados
50                            Bangladesh
48                               Bahrain
44                               Bahamas
31                            Azerbaijan
40                               Austria
36                             Australia
533                                Aruba
51                               Armenia
32                             Argentina
28                   Antigua and Barbuda
10                            Antarctica
660                             Anguilla
24                               Angola
20                              Andorra
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

Code:

```
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/9999-Data/HORUS-XML-Country.csv'
OutputData.to_csv(sOutputFileName, index = False)
print('=====================================================')
print('XML to HORUS - Done')
print('=====================================================')
# Utility done ================================================
```

Output:

```
In [105]: runfile('H:/VKHCG/05-DS/9999-Data/XML2HORUS.py', wdir='H:/VKHCG/05-DS/9999-Data')

=====================================================
Input Data Values ==================================
=====================================================
<root><entry><Country>Afghanistan</Country><Country>Afghanistan</Country><ISO-2-CODE>AF</
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c) JSON to HORUS Format

Code:

```
# Utility Start JSON to HORUS ================================
# Standard Tools
#=============================================================
import pandas as pd
# Input Agreement ============================================
sInputFileName='C:/VKHCG/05-DS/9999-Data/Country_Code.json'
InputData=pd.read_json(sInputFileName, orient='index', 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/9999-Data/HORUS-JSON-Country.csv'
OutputData.to_csv(sOutputFileName, index = False)
print('JSON to HORUS - Done')
# Utility done ===============================================
```

Output:

```
In [117]: runfile('H:/VKHCG/05-DS/9999-Data/JSON2HORUS.py', wdir='H:/VKHCG/05-DS/9999-Data')

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
5                       Andorra         AD        AND       20
6                        Angola         AO        AGO       24
7                      Anguilla         AI        AIA      660
8                    Antarctica         AQ        ATA       10
9             Antigua and Barbuda         AG        ATG       28
10                    Argentina         AR        ARG       32
11                      Armenia         AM        ARM       51
12                        Aruba         AW        ABW      533
13                    Australia         AU        AUS       36
14                      Austria         AT        AUT       40
15                   Azerbaijan         AZ        AZE       31
16                      Bahamas         BS        BHS       44
17                      Bahrain         BH        BHR       48
18                   Bangladesh         BD        BGD       50
19                     Barbados         BB        BRB       52
20                      Belarus         BY        BLR      112
21                      Belgium         BE        BEL       56
22                       Belize         BZ        BLZ       84
23                        Benin         BJ        BEN      204
24                      Bermuda         BM        BMU       60
25                       Bhutan         BT        BTN       64
26                      Bolivia         BO        BOL       68
27      Bosnia and Herzegovina         BA        BIH       70
28                     Botswana         BW        BWA       72
29                 Bouvet Island         BV        BVT       74
..                           ...        ...        ...      ...
217                   Tajikistan         TJ        TJK      762
218  Tanzania, United Republic of         TZ        TZA      834
219                     Thailand         TH        THA      764
220                   Timor-Leste         TL        TLS      626
221                         Togo         TG        TGO      768
222                      Tokelau         TK        TKL      772
223                        Tonga         TO        TON      776
224          Trinidad and Tobago         TT        TTO      780
225                      Tunisia         TN        TUN      788
226                       Turkey         TR        TUR      792
227                 Turkmenistan         TM        TKM      795
228  Turks and Caicos Islands         TC        TCA      796
229                       Tuvalu         TV        TUV      798
230                       Uganda         UG        UGA      800
231                      Ukraine         UA        UKR      804
232       United Arab Emirates         AE        ARE      784
233             United Kingdom         GB        GBR      826
234    United States of America         US        USA      840
235  US Minor Outlying Islands         UM        UMI      581
236                      Uruguay         UY        URY      858
237                   Uzbekistan         UZ        UZB      860
238                      Vanuatu         VU        VUT      548
239  Venezuelaÿ(Bolivarian Republic)         VE        VEN      862
240                     Viet Nam         VN        VNM      704
241         Virgin Islands, US         VI        VIR      850
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
850                        Virgin Islands, US
704                               Viet Nam
862           Venezuelaÿ(Bolivarian Republic)
548                               Vanuatu
860                             Uzbekistan
858                                Uruguay
840                  United States of America
826                        United Kingdom
784                    United Arab Emirates
804                               Ukraine
800                                Uganda
581                  US Minor Outlying Islands
798                                Tuvalu
796                  Turks and Caicos Islands
795                             Turkmenistan
792                                Turkey
788                               Tunisia
780                    Trinidad and Tobago
776                                Tonga
772                              Tokelau
768                                 Togo
626                            Timor-Leste
764                              Thailand
834           Tanzania, United Republic of
762                             Tajikistan
...                                    ...
74                          Bouvet Island
72                               Botswana
70                 Bosnia and Herzegovina
68                               Bolivia
64                                Bhutan
60                               Bermuda
204                               Benin
84                                Belize
64                                Bhutan
60                               Bermuda
204                               Benin
84                                Belize
56                               Belgium
112                              Belarus
52                              Barbados
50                             Bangladesh
48                              Bahrain
44                               Bahamas
31                             Azerbaijan
40                               Austria
36                             Australia
533                                Aruba
51                               Armenia
32                             Argentina
28                   Antigua and Barbuda
10                            Antarctica
660                             Anguilla
24                               Angola
20                              Andorra
16                       American Samoa
12                             Algeria
8                              Albania
248                        Aland Islands
4                           Afghanistan

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

d) MySql Database to HORUS Format

Code :

```
import pandas as pd
import sqlite3 as sq
# Input Agreement ========================================
sInputFileName='C:/VKHCG/05-DS/9999-Data/utility.db'
sInputTable='Country_Code'
conn = sq.connect(sInputFileName)
sSQL='select * FROM ' + sInputTable + ';'
InputData=pd.read_sql_query(sSQL, conn)
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/9999-Data/HORUS-CSV-Country.csv'
OutputData.to_csv(sOutputFileName, index = False)
print('Database to HORUS - Done')
# Utility done ============================================
```

Output:

```
In [6]: runfile('C:/VKHCG/05-DS/9999-Data/DATABASE2HORUS.py', wdir='C:/VKHCG/05-DS/9999-Data')


Input Data Values ===================================
     index                         Country ISO-2-CODE ISO-3-Code  ISO-M49
0        0                     Afghanistan         AF        AFG        4
1        1                   Aland Islands         AX        ALA      248
2        2                         Albania         AL        ALB        8
3        3                         Algeria         DZ        DZA       12
4        4                  American Samoa         AS        ASM       16
5        5                         Andorra         AD        AND       20
6        6                          Angola         AO        AGO       24
7        7                        Anguilla         AI        AIA      660
8        8                      Antarctica         AQ        ATA       10
9        9             Antigua and Barbuda         AG        ATG       28
10      10                       Argentina         AR        ARG       32
11      11                         Armenia         AM        ARM       51
12      12                           Aruba         AW        ABW      533
13      13                       Australia         AU        AUS       36
14      14                         Austria         AT        AUT       40
15      15                      Azerbaijan         AZ        AZE       31
16      16                         Bahamas         BS        BHS       44
17      17                         Bahrain         BH        BHR       48
18      18                      Bangladesh         BD        BGD       50
19      19                        Barbados         BB        BRB       52
20      20                         Belarus         BY        BLR      112
21      21                         Belgium         BE        BEL       56
22      22                          Belize         BZ        BLZ       84
23      23                           Benin         BJ        BEN      204
24      24                         Bermuda         BM        BMU       60
25      25                          Bhutan         BT        BTN       64
26      26                         Bolivia         BO        BOL       68
27      27           Bosnia and Herzegovina         BA        BIH       70
28      28                        Botswana         BW        BWA       72

29      29                  Bouvet Island         BV        BVT       74
..     ...                            ...        ...        ...      ...
217    217                     Tajikistan         TJ        TJK      762
218    218  Tanzania, United Republic of         TZ        TZA      834
219    219                       Thailand         TH        THA      764
220    220                    Timor-Leste         TL        TLS      626
221    221                           Togo         TG        TGO      768
222    222                        Tokelau         TK        TKL      772
223    223                          Tonga         TO        TON      776
224    224           Trinidad and Tobago         TT        TTO      780
225    225                        Tunisia         TN        TUN      788
226    226                         Turkey         TR        TUR      792
227    227                   Turkmenistan         TM        TKM      795
228    228    Turks and Caicos Islands         TC        TCA      796
229    229                         Tuvalu         TV        TUV      798
230    230                         Uganda         UG        UGA      800
231    231                        Ukraine         UA        UKR      804
232    232        United Arab Emirates         AE        ARE      784
233    233              United Kingdom         GB        GBR      826
234    234     United States of America         US        USA      840
235    235    US Minor Outlying Islands         UM        UMI      581
236    236                        Uruguay         UY        URY      858
237    237                     Uzbekistan         UZ        UZB      860
238    238                        Vanuatu         VU        VUT      548
239    239  Venezuelaÿ(Bolivarian Republic)         VE        VEN      862
240    240                       Viet Nam         VN        VNM      704
241    241           Virgin Islands, US          VI        VIR      850
242    242    Wallis and Futuna Islands         WF        WLF      876
243    243                Western Sahara         EH        ESH      732
244    244                         Yemen         YE        YEM      887
245    245                        Zambia         ZM        ZMB      894
246    246                      Zimbabwe         ZW        ZWE      716

[247 rows x 5 columns]
=====================================================
```

```
Process Data Values ================================
              index                      CountryName
CountryNumber
716             246                         Zimbabwe
894             245                           Zambia
887             244                            Yemen
732             243                   Western Sahara
876             242       Wallis and Futuna Islands
850             241             Virgin Islands, US
704             240                         Viet Nam
862             239  Venezuelaÿ(Bolivarian Republic)
548             238                          Vanuatu
860             237                       Uzbekistan
858             236                          Uruguay
840             234          United States of America
826             233                   United Kingdom
784             232              United Arab Emirates
804             231                          Ukraine
800             230                           Uganda
581             235       US Minor Outlying Islands
798             229                           Tuvalu
796             228        Turks and Caicos Islands
795             227                     Turkmenistan
792             226                           Turkey
788             225                          Tunisia
780             224              Trinidad and Tobago
776             223                            Tonga
772             222                          Tokelau
768             221                             Togo
626             220                       Timor-Leste
764             219                         Thailand
834             218     Tanzania, United Republic of
762             217                       Tajikistan
...             ...                              ...
74               29                   Bouvet Island
72               28                        Botswana
70               27           Bosnia and Herzegovina
70               27           Bosnia and Herzegovina
68               26                          Bolivia
64               25                           Bhutan
60               24                          Bermuda
204              23                            Benin
84               22                           Belize
56               21                          Belgium
112              20                          Belarus
52               19                         Barbados
50               18                       Bangladesh
48               17                          Bahrain
44               16                          Bahamas
31               15                       Azerbaijan
40               14                          Austria
36               13                        Australia
533              12                            Aruba
51               11                          Armenia
32               10                        Argentina
28                9              Antigua and Barbuda
10                8                       Antarctica
660               7                         Anguilla
24                6                           Angola
20                5                          Andorra
16                4                   American Samoa
12                3                          Algeria
8                 2                          Albania
248               1                   Aland Islands
4                 0                      Afghanistan

[247 rows x 2 columns]
====================================================
Database to HORUS - Done
```

e) 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('=====================================================')
```

f) i. Video to HORUS Format

Code:

Movies to Frames

```
import os
import shutil
import cv2
#============================================================
sInputFileName='C:/VKHCG/05-DS/9999-Data/dog.mp4'
sDataBaseDir='C:/VKHCG/05-DS/9999-Data/temp'
if os.path.exists(sDataBaseDir):
shutil.rmtree(sDataBaseDir)
if not os.path.exists(sDataBaseDir):
os.makedirs(sDataBaseDir)
print('=====================================================')
print('Start Movie to Frames')
print('=====================================================')
vidcap = cv2.VideoCapture(sInputFileName)
success,image = vidcap.read()
count = 0
while success:
success,image = vidcap.read()
sFrame=sDataBaseDir + str('/dog-frame-' + str(format(count, '04d'))+ '.jpg')
print('Extracted: ', sFrame)
cv2.imwrite(sFrame, image)
if os.path.getsize(sFrame) == 0:
count += -1
os.remove(sFrame)
print('Removed: ', sFrame)
if cv2.waitKey(10) == 27: # exit if Escape is hit
break
count += 1
print('=====================================================')
print('Generated : ', count, ' Frames')
print('=====================================================')
print('Movie to Frames HORUS - Done')
print('=====================================================')
# Utility done ============================================
```

Output:

```
In [72]: runfile('C:/VKHCG/05-DS/9999-Data/MOVIE2HORUSFrame.py', wdir='C:/VKHCG/
05-DS/9999-Data')


==================================================
Start Movie to Frames
==================================================
Extracted:  C:/VKHCG/05-DS/9999-Data/temp/dog-frame-0000.jpg
Extracted:  C:/VKHCG/05-DS/9999-Data/temp/dog-frame-0001.jpg
Extracted:  C:/VKHCG/05-DS/9999-Data/temp/dog-frame-0002.jpg
Extracted:  C:/VKHCG/05-DS/9999-Data/temp/dog-frame-0003.jpg
Extracted:  C:/VKHCG/05-DS/9999-Data/temp/dog-frame-0004.jpg
Extracted:  C:/VKHCG/05-DS/9999-Data/temp/dog-frame-0005.jpg
Extracted:  C:/VKHCG/05-DS/9999-Data/temp/dog-frame-0006.jpg
Extracted:  C:/VKHCG/05-DS/9999-Data/temp/dog-frame-0007.jpg
Extracted:  C:/VKHCG/05-DS/9999-Data/temp/dog-frame-0008.jpg
Extracted:  C:/VKHCG/05-DS/9999-Data/temp/dog-frame-0009.jpg
Extracted:  C:/VKHCG/05-DS/9999-Data/temp/dog-frame-0010.jpg
Extracted:  C:/VKHCG/05-DS/9999-Data/temp/dog-frame-0011.jpg
Extracted:  C:/VKHCG/05-DS/9999-Data/temp/dog-frame-0012.jpg
Extracted:  C:/VKHCG/05-DS/9999-Data/temp/dog-frame-0013.jpg
Extracted:  C:/VKHCG/05-DS/9999-Data/temp/dog-frame-0014.jpg
Extracted:  C:/VKHCG/05-DS/9999-Data/temp/dog-frame-0015.jpg
Extracted:  C:/VKHCG/05-DS/9999-Data/temp/dog-frame-0016.jpg
Extracted:  C:/VKHCG/05-DS/9999-Data/temp/dog-frame-0017.jpg
Extracted:  C:/VKHCG/05-DS/9999-Data/temp/dog-frame-0018.jpg
Extracted:  C:/VKHCG/05-DS/9999-Data/temp/dog-frame-0019.jpg
Extracted:  C:/VKHCG/05-DS/9999-Data/temp/dog-frame-0020.jpg
Extracted:  C:/VKHCG/05-DS/9999-Data/temp/dog-frame-0021.jpg
Extracted:  C:/VKHCG/05-DS/9999-Data/temp/dog-frame-0022.jpg
Extracted:  C:/VKHCG/05-DS/9999-Data/temp/dog-frame-0023.jpg
Extracted:  C:/VKHCG/05-DS/9999-Data/temp/dog-frame-0024.jpg
Extracted:  C:/VKHCG/05-DS/9999-Data/temp/dog-frame-0025.jpg
Extracted:  C:/VKHCG/05-DS/9999-Data/temp/dog-frame-0026.jpg
Extracted:  C:/VKHCG/05-DS/9999-Data/temp/dog-frame-0027.jpg
Extracted:  C:/VKHCG/05-DS/9999-Data/temp/dog-frame-0028.jpg

Extracted:  C:/VKHCG/05-DS/9999-Data/temp/dog-frame-0079.jpg
Extracted:  C:/VKHCG/05-DS/9999-Data/temp/dog-frame-0080.jpg
Extracted:  C:/VKHCG/05-DS/9999-Data/temp/dog-frame-0081.jpg
Extracted:  C:/VKHCG/05-DS/9999-Data/temp/dog-frame-0082.jpg
Extracted:  C:/VKHCG/05-DS/9999-Data/temp/dog-frame-0083.jpg
Extracted:  C:/VKHCG/05-DS/9999-Data/temp/dog-frame-0084.jpg
Extracted:  C:/VKHCG/05-DS/9999-Data/temp/dog-frame-0085.jpg
Extracted:  C:/VKHCG/05-DS/9999-Data/temp/dog-frame-0086.jpg
Extracted:  C:/VKHCG/05-DS/9999-Data/temp/dog-frame-0087.jpg
Extracted:  C:/VKHCG/05-DS/9999-Data/temp/dog-frame-0088.jpg
Extracted:  C:/VKHCG/05-DS/9999-Data/temp/dog-frame-0089.jpg
Extracted:  C:/VKHCG/05-DS/9999-Data/temp/dog-frame-0090.jpg
Extracted:  C:/VKHCG/05-DS/9999-Data/temp/dog-frame-0091.jpg
Extracted:  C:/VKHCG/05-DS/9999-Data/temp/dog-frame-0092.jpg
Extracted:  C:/VKHCG/05-DS/9999-Data/temp/dog-frame-0093.jpg
Extracted:  C:/VKHCG/05-DS/9999-Data/temp/dog-frame-0094.jpg
Extracted:  C:/VKHCG/05-DS/9999-Data/temp/dog-frame-0095.jpg
Extracted:  C:/VKHCG/05-DS/9999-Data/temp/dog-frame-0096.jpg
Extracted:  C:/VKHCG/05-DS/9999-Data/temp/dog-frame-0097.jpg
Extracted:  C:/VKHCG/05-DS/9999-Data/temp/dog-frame-0098.jpg
Extracted:  C:/VKHCG/05-DS/9999-Data/temp/dog-frame-0099.jpg
Extracted:  C:/VKHCG/05-DS/9999-Data/temp/dog-frame-0100.jpg
Extracted:  C:/VKHCG/05-DS/9999-Data/temp/dog-frame-0101.jpg
==================================================
Generated :  101  Frames
==================================================
Movie to Frames HORUS - Done
==================================================
```

ii. Frames to Horus

```
from scipy.misc import imread
import pandas as pd
import matplotlib.pyplot as plt
import numpy as np
import os
# Input Agreement ========================================
sDataBaseDir='C:/VKHCG/05-DS/9999-Data/temp'
f=0
for file in os.listdir(sDataBaseDir):
if file.endswith(".jpg"):
f += 1
sInputFileName=os.path.join(sDataBaseDir, file)
print('Process : ', sInputFileName)
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)
ProcessFrameData=pd.DataFrame(np.reshape(ProcessRawData, (x, y)))
ProcessFrameData['Frame']=file
print('=====================================================')
print('Process Data Values ================================')
print('=====================================================')
plt.imshow(InputData)
plt.show()
if f == 1:
ProcessData=ProcessFrameData
else:
ProcessData=ProcessData.append(ProcessFrameData)
if f > 0:
sColumns= ['XAxis','YAxis','Red', 'Green', 'Blue','Alpha','FrameName']
ProcessData.columns=sColumns
print('=====================================================')
ProcessFrameData.index.names =['ID']
print('Rows: ',ProcessData.shape[0])
print('Columns :',ProcessData.shape[1])
print('=====================================================')
# Output Agreement ========================================
```

g) Audio to HORUS Format

Code:

```
# Utility Start Audio to HORUS ==============================
# Standard Tools
#============================================================
from scipy.io import wavfile
import pandas as pd
import matplotlib.pyplot as plt
import numpy as np
#============================================================
def show_info(aname, a,r):
print ('----------')
print ("Audio:", aname)
print ('----------')
print ("Rate:", r)
print ('----------')
print ("shape:", a.shape)
print ("dtype:", a.dtype)
print ("min, max:", a.min(), a.max())
print ('----------')
plot_info(aname, a,r)
#============================================================
def plot_info(aname, a,r):
sTitle= 'Signal Wave - '+ aname + ' at ' + str(r) + 'hz'
plt.title(sTitle)
sLegend=[]
for c in range(a.shape[1]):
sLabel = 'Ch' + str(c+1)
sLegend=sLegend+[str(c+1)]
plt.plot(a[:,c], label=sLabel)
plt.legend(sLegend)
plt.show()
#============================================================
sInputFileName='C:/VKHCG/05-DS/9999-Data/2ch-sound.wav'
print('=====================================================')
print('Processing : ', sInputFileName)
print('=====================================================')
InputRate, InputData = wavfile.read(sInputFileName)
show_info("2 channel", InputData,InputRate)
ProcessData=pd.DataFrame(InputData)
sColumns= ['Ch1','Ch2']
ProcessData.columns=sColumns
OutputData=ProcessData
sOutputFileName='C:/VKHCG/05-DS/9999-Data/HORUS-Audio-2ch.csv'
OutputData.to_csv(sOutputFileName, index = False)
```

```
#=============================================================
sInputFileName='C:/VKHCG/05-DS/9999-Data/4ch-sound.wav'
print('=====================================================')
print('Processing : ', sInputFileName)
print('=====================================================')
InputRate, InputData = wavfile.read(sInputFileName)
show_info("4 channel", InputData,InputRate)
ProcessData=pd.DataFrame(InputData)
sColumns= ['Ch1','Ch2','Ch3', 'Ch4']
ProcessData.columns=sColumns
OutputData=ProcessData
sOutputFileName='C:/VKHCG/05-DS/9999-Data/HORUS-Audio-4ch.csv'
OutputData.to_csv(sOutputFileName, index = False)
#=============================================================
sInputFileName='C:/VKHCG/05-DS/9999-Data/6ch-sound.wav'
print('=====================================================')
print('Processing : ', sInputFileName)
print('=====================================================')
InputRate, InputData = wavfile.read(sInputFileName)
show_info("6 channel", InputData,InputRate)
ProcessData=pd.DataFrame(InputData)
sColumns= ['Ch1','Ch2','Ch3', 'Ch4', 'Ch5','Ch6']
ProcessData.columns=sColumns
OutputData=ProcessData
sOutputFileName='C:/VKHCG/05-DS/9999-Data/HORUS-Audio-6ch.csv'
OutputData.to_csv(sOutputFileName, index = False)
#=============================================================
sInputFileName='C:/VKHCG/05-DS/9999-Data/8ch-sound.wav'
print('=====================================================')
print('Processing : ', sInputFileName)
print('=====================================================')
InputRate, InputData = wavfile.read(sInputFileName)
show_info("8 channel", InputData,InputRate)
ProcessData=pd.DataFrame(InputData)
sColumns= ['Ch1','Ch2','Ch3', 'Ch4', 'Ch5','Ch6','Ch7','Ch8']
ProcessData.columns=sColumns
OutputData=ProcessData
sOutputFileName='C:/VKHCG/05-DS/9999-Data/HORUS-Audio-8ch.csv'
OutputData.to_csv(sOutputFileName, index = False)
print('=====================================================')
print('Audio to HORUS - Done')
```

Practical 3

Utilities and Auditing

A. Fixers Utilities:

Fixers enable your solution to take your existing data and fix a specific quality issue.

```
#---------------------------- Program to Demonstrate Fixers utilities -------------------
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:

```
In [10]: runfile('C:/Users/MSCIT/.spyder-py3/temp.py',
wdir='C:/Users/MSCIT/.spyder-py3')


#1 Removing leading or lagging spaces from a data entry
>  Data Science with too many spaces is bad!!!  <
> Data Science with too many spaces is bad!!! <

#2 Removing nonprintable characters from a data entry
Bad Data :  Data Science with¬ funny characters is ┼bad!!!
Clean Data :  DataScience with funny characters is bad!!!

# 3 Reformatting data entry to match specific formatting
criteria.
Bad Data :  2019-10-31
Good Data :  31 October 2019
```

B. Averaging of Data

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:

```
3561      DE     Munich   48.1480

[3562 rows x 3 columns]
Country  Place_Name
DE       Munich        48.143223
GB       London        51.509406
US       New York      40.747044
Name: Latitude, dtype: float64
```

D. Outlier Detection

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:

```
In [35]: runfile('C:/Users/MSCIT/.spyder-py3/temp.py',
wdir='C:/Users/MSCIT/.spyder-py3')


############################
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
1915      GB     London   51.4739
1916      GB     London   51.5491
1917      GB     London   51.5085
```

```
[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  51.50617687562166
     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
1957      GB     London   51.5115
1958      GB     London   51.5092
1959      GB     London   51.5092
1960      GB     London   51.5092
1961      GB     London   51.5092
1962      GB     London   51.5092
```

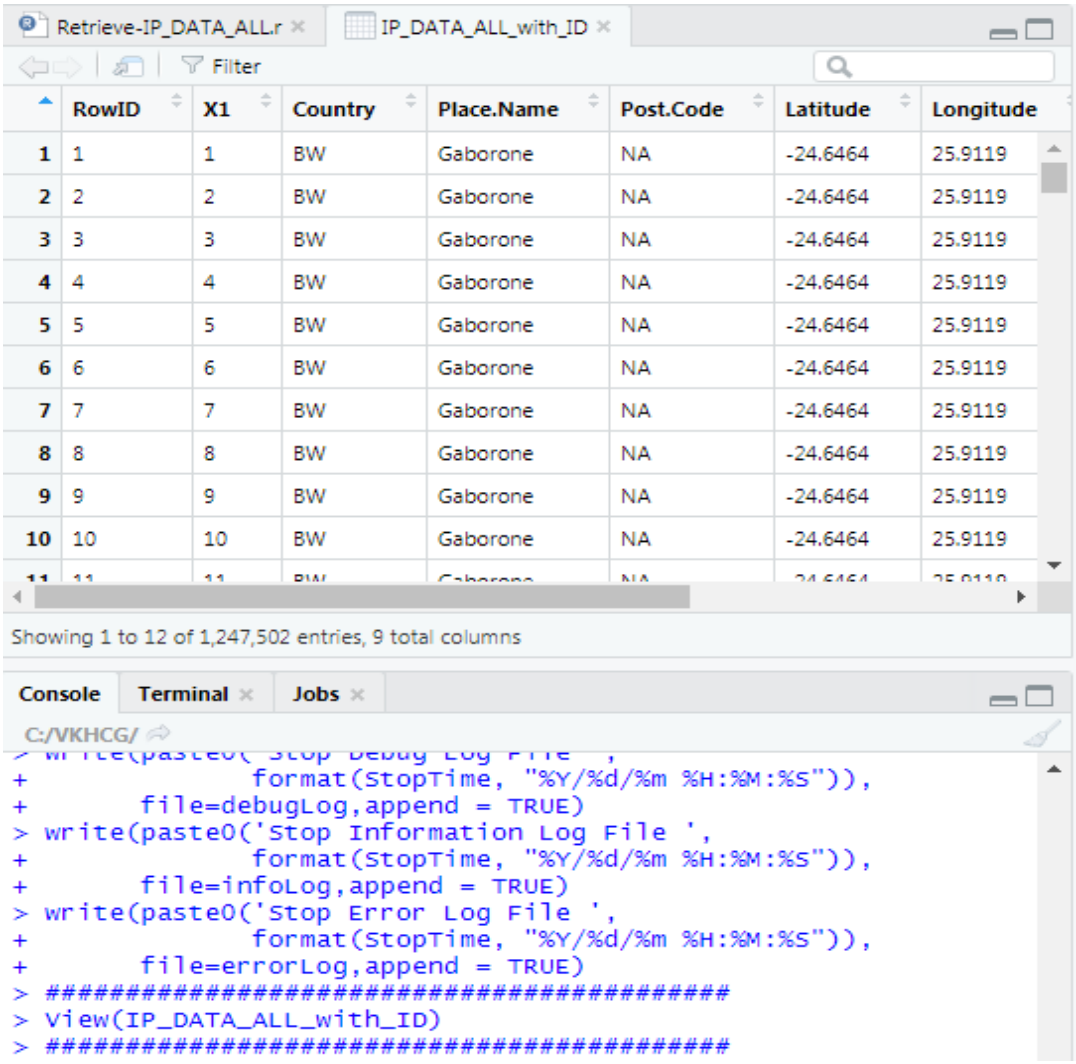
E. Logging

Code:

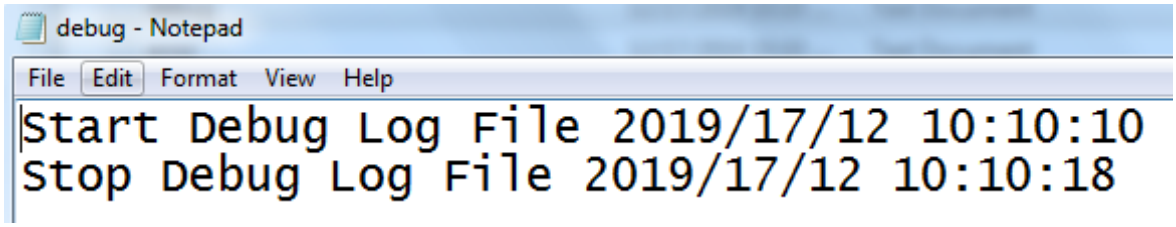
```
import sys
import os
import logging
import uuid
import shutil
    import time
if sys.platform == 'linux':
Base=os.path.expanduser('~') + '/VKHCG'
else:
    Base='C:/VKHCG'
sCompanies=['01-Vermeulen','02-Krennwallner','03-Hillman','04-Clark']
sLayers=['01-Retrieve','02-Assess','03-Process','04-Transform','05-Organise','
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)
skey=str(uuid.uuid4())
sLogFile=Base + '/' + sCompany + '/' + sLayer + '/Logging/
Logging_'+skey+'.log'
print('Set up:',sLogFile)
logging.basicConfig(level=logging.DEBUG,
format='%(asctime)s %(name)-12s %(levelname)-8s %(message)s',
datefmt='%m-%d %H:%M',
filename=sLogFile,
filemode='w')
console = logging.StreamHandler()
console.setLevel(logging.INFO)
formatter = logging.Formatter('%(name)-12s: %(levelname)-8s %(message)s')
console.setFormatter(formatter)
logging.getLogger('').addHandler(console)
```

```
logging.info('Practical Data Science is fun!.')
for sLevel in sLevels:
sApp='Application-'+ 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.')
```

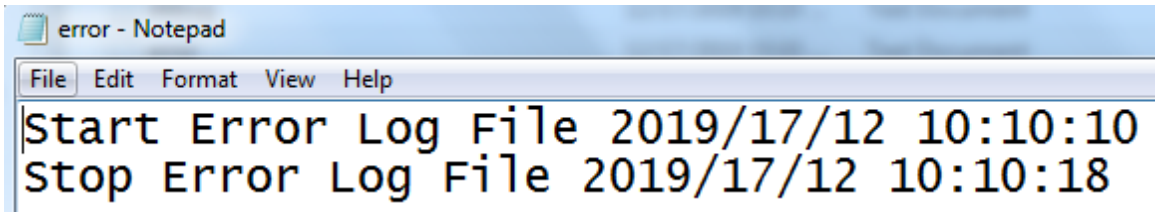
Output:



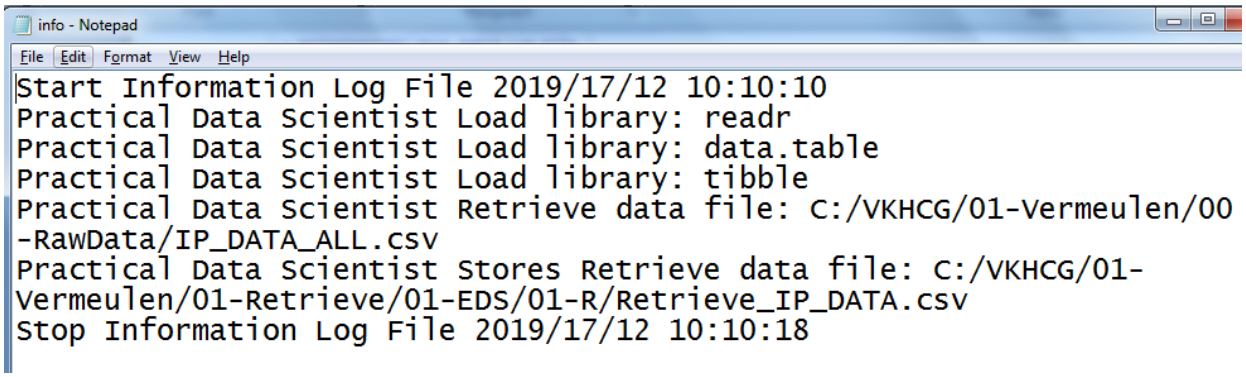
Debug.txt



Error.txt



Info.txt



Practical 4

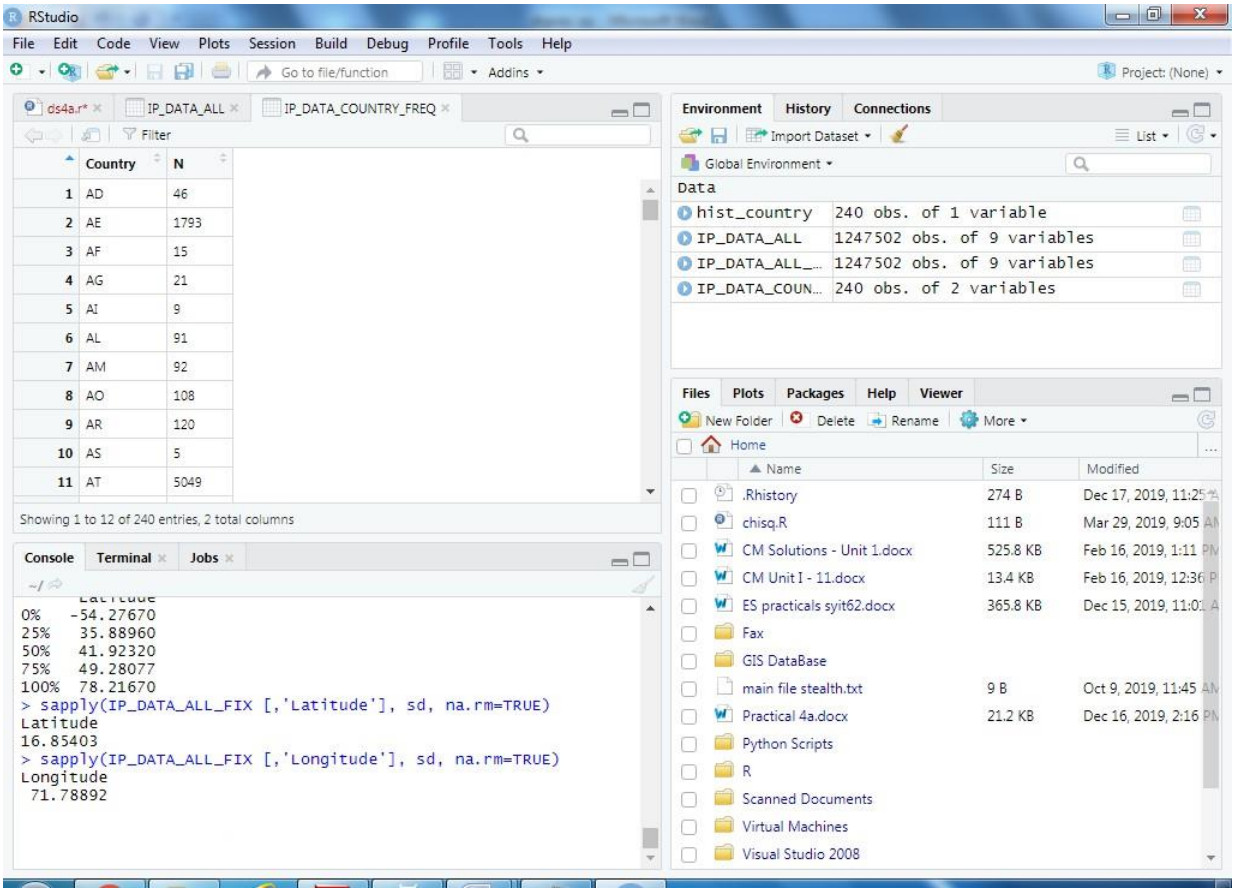
Retrieve Superstep

A. Perform the following data processing using R.

Code:

```
library(readr)
IP_DATA_ALL <- read_csv("C:/VKHCG/01-Vermeulen/00-RawData/IP_DATA_ALL.csv")
View(IP_DATA_ALL)
spec(IP_DATA_ALL)
IP_DATA_ALL_FIX=set_tidy_names(IP_DATA_ALL, syntactic = TRUE, quiet = TRUE)
library(tibble)
set_tidy_names(IP_DATA_ALL, syntactic = TRUE, quiet = FALSE)
sapply(IP_DATA_ALL_FIX, typeof)
library(data.table)
hist_country=data.table(Country=unique(IP_DATA_ALL_FIX[is.na(IP_DATA_ALL_FIX
['Country']) == 0, ]$Country
))
IP_DATA_COUNTRY_FREQ=data.table(with(IP_DATA_ALL_FIX, table(Country)))
View(IP_DATA_COUNTRY_FREQ)
sapply(IP_DATA_ALL_FIX[,'Latitude'], min, na.rm=TRUE)
sapply(IP_DATA_ALL_FIX[,'Country'], min, na.rm=TRUE)
sapply(IP_DATA_ALL_FIX[,'Latitude'], max, na.rm=TRUE)
sapply(IP_DATA_ALL_FIX[,'Country'], max, na.rm=TRUE)
sapply(IP_DATA_ALL_FIX [,'Latitude'], mean, na.rm=TRUE)
sapply(IP_DATA_ALL_FIX [,'Latitude'], median, na.rm=TRUE)
sapply(IP_DATA_ALL_FIX [,'Latitude'], range, na.rm=TRUE)
sapply(IP_DATA_ALL_FIX [,'Latitude'], quantile, na.rm=TRUE)
sapply(IP_DATA_ALL_FIX [,'Latitude'], sd, na.rm=TRUE)
sapply(IP_DATA_ALL_FIX [,'Longitude'], sd, na.rm=TRUE)
```

Output:


RStudio
File Edit Code View Plots Session Build Debug Profile Tools Help
Go to file/function
Addins
Project: (None)
ds4a.r*
IP_DATA_ALL
IP_DATA_COUNTRY_FREQ
Filter
Country N
1 AD 46
2 AE 1793
3 AF 15
4 AG 21
5 AI 9
6 AL 91
7 AM 92
8 AO 108
9 AR 120
10 AS 5
11 AT 5049
Showing 1 to 12 of 240 entries, 2 total columns
Console Terminal Jobs
0% -54.27670
25% 35.88960
50% 41.92320
75% 49.28077
100% 78.21670
> sapply(IP_DATA_ALL_FIX [,'Latitude'], sd, na.rm=TRUE)
Latitude
16.85403
> sapply(IP_DATA_ALL_FIX [,'Longitude'], sd, na.rm=TRUE)
Longitude
71.78892
Environment History Connections
Import Dataset
List
Global Environment
Data
hist_country 240 obs. of 1 variable
IP_DATA_ALL 1247502 obs. of 9 variables
IP_DATA_ALL_... 1247502 obs. of 9 variables
IP_DATA_COUN... 240 obs. of 2 variables
Files Plots Packages Help Viewer
New Folder Delete Rename More
Home
Name Size Modified
.Rhistory 274 B Dec 17, 2019, 11:25
chisq.R 111 B Mar 29, 2019, 9:05
CM Solutions - Unit 1.docx 525.8 KB Feb 16, 2019, 1:11
CM Unit I - 11.docx 13.4 KB Feb 16, 2019, 12:36
ES practicals syit62.docx 365.8 KB Dec 15, 2019, 11:01
Fax
GIS DataBase
main file stealth.txt 9 B Oct 9, 2019, 11:45
Practical 4a.docx 21.2 KB Dec 16, 2019, 2:16
Python Scripts
R
Scanned Documents
Virtual Machines
Visual Studio 2008

B. Retrive_IP_DATA_ALL.py

Code:

```
import sys
import os
import pandas as pd
#################################################################
Base='C:/VKHCG'
#################################################################
sFileName=Base + '/01-Vermeulen/00-RawData/IP_DATA_ALL.csv'
print('Loading :',sFileName)
IP_DATA_ALL=pd.read_csv(sFileName,header=0,low_memory=False, encoding="latin-1")
#################################################################
sFileDir=Base + '/01-Vermeulen/01-Retrieve/01-EDS/02-Python'
if not os.path.exists(sFileDir):
os.makedirs(sFileDir)
print('Rows:', IP_DATA_ALL.shape[0])
print('Columns:', IP_DATA_ALL.shape[1])
print('### Raw Data Set #########################################')
for i in range(0,len(IP_DATA_ALL.columns)):
print(IP_DATA_ALL.columns[i],type(IP_DATA_ALL.columns[i]))
print('### Fixed Data Set #########################################')
IP_DATA_ALL_FIX=IP_DATA_ALL
for i in range(0,len(IP_DATA_ALL.columns)):
cNameOld=IP_DATA_ALL_FIX.columns[i] + ' '
cNameNew=cNameOld.strip().replace(" ", ".")
IP_DATA_ALL_FIX.columns.values[i] = cNameNew
print(IP_DATA_ALL.columns[i],type(IP_DATA_ALL.columns[i]))
#################################################################
#print(IP_DATA_ALL_FIX.head())
#################################################################
print('Fixed Data Set with ID')
IP_DATA_ALL_with_ID=IP_DATA_ALL_FIX
IP_DATA_ALL_with_ID.index.names = ['RowID']
#print(IP_DATA_ALL_with_ID.head())
sFileName2=sFileDir + '/Retrieve_IP_DATA.csv'
IP_DATA_ALL_with_ID.to_csv(sFileName2, index = True, encoding="latin-1")
#################################################################
print('### Done!! ############################################')
```

Output:

```
In [42]: runfile('C:/Users/MSCIT/.spyder-py3/temp.py',
wdir='C:/Users/MSCIT/.spyder-py3')

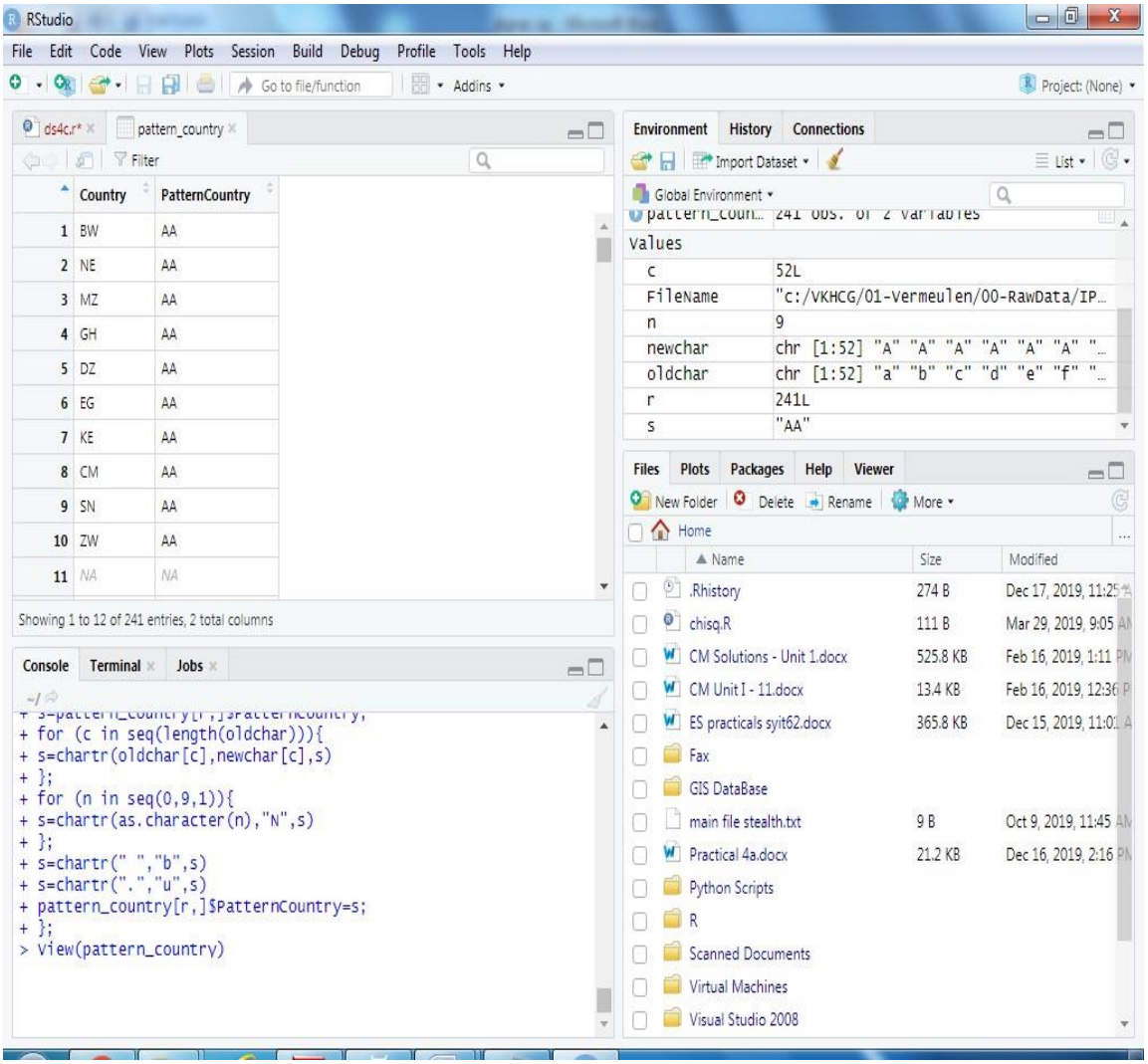

Loading : C:/VKHCG/01-Vermeulen/00-RawData/IP_DATA_ALL.csv
### Raw Data Set #####################################
Unnamed: 0 <class 'str'>
ID <class 'str'>
Country <class 'str'>
Place.Name <class 'str'>
Post.Code <class 'str'>
Latitude <class 'str'>
Longitude <class 'str'>
First.IP.Number <class 'str'>
Last.IP.Number <class 'str'>
### Fixed Data Set ###################################
Unnamed:.0 <class 'str'>
ID <class 'str'>
Country <class 'str'>
Place.Name <class 'str'>
Post.Code <class 'str'>
Latitude <class 'str'>
Longitude <class 'str'>
First.IP.Number <class 'str'>
Last.IP.Number <class 'str'>
```

C. Data Pattern

Code:

```
library(readr)
library(data.table)
FileName=paste0('c:/VKHCG/01-Vermeulen/00-RawData/IP_DATA_ALL.csv')
IP_DATA_ALL <- read_csv(FileName)
hist_country=data.table(Country=unique(IP_DATA_ALL$Country))
pattern_country=data.table(Country=hist_country$Country,
PatternCountry=hist_country$Country)
oldchar=c(letters,LETTERS)
newchar=replicate(length(oldchar),"A")
for (r in seq(nrow(pattern_country))){
s=pattern_country[r,]$PatternCountry;
for (c in seq(length(oldchar))){
s=chartr(oldchar[c],newchar[c],s)
};
for (n in seq(0,9,1)){
s=chartr(as.character(n),"N",s)
};
s=chartr(" ","b",s)
s=chartr(".","u",s)
pattern_country[r,]$PatternCountry=s;
};
View(pattern_country)
```

Output:


RStudio
File Edit Code View Plots Session Build Debug Profile Tools Help
Go to file/function
Addins
Project: (None)
ds4c.r*
pattern_country
Filter
Country PatternCountry
1 BW AA
2 NE AA
3 MZ AA
4 GH AA
5 DZ AA
6 EG AA
7 KE AA
8 CM AA
9 SN AA
10 ZW AA
11 NA NA
Showing 1 to 12 of 241 entries, 2 total columns
Console Terminal Jobs
+ for (c in seq(length(oldchar))){
+ s=chartr(oldchar[c],newchar[c],s)
+ };
+ for (n in seq(0,9,1)){
+ s=chartr(as.character(n),"N",s)
+ };
+ s=chartr(" ","b",s)
+ s=chartr(".","u",s)
+ pattern_country[r,]$PatternCountry=s;
+ };
> view(pattern_country)
Environment History Connections
Import Dataset
List
Global Environment
values
c 52L
FileName "c:/VKHCG/01-Vermeulen/00-RawData/IP...
n 9
newchar chr [1:52] "A" "A" "A" "A" "A" "A" "...
oldchar chr [1:52] "a" "b" "c" "d" "e" "f" "...
r 241L
s "AA"
Files Plots Packages Help Viewer
New Folder Delete Rename More
Home
Name Size Modified
.Rhistory 274 B Dec 17, 2019, 11:25
chisq.R 111 B Mar 29, 2019, 9:05
CM Solutions - Unit 1.docx 525.8 KB Feb 16, 2019, 1:11
CM Unit I - 11.docx 13.4 KB Feb 16, 2019, 12:36
ES practicals syit62.docx 365.8 KB Dec 15, 2019, 11:01
Fax
GIS DataBase
main file stealth.txt 9 B Oct 9, 2019, 11:45
Practical 4a.docx 21.2 KB Dec 16, 2019, 2:16
Python Scripts
R
Scanned Documents
Virtual Machines
Visual Studio 2008

D. Loading IP_DATA_ALL

Code:

```
##############Retrieve-IP_DATA_ALL.py#######################
# -*- coding: utf-8 -*-
################################################################
import sys
import os
import pandas as pd
################################################################
Base='C:/VKHCG'
################################################################
sFileName=Base + '/01-Vermeulen/00-RawData/IP_DATA_ALL.csv'
print('Loading :',sFileName)
IP_DATA_ALL=pd.read_csv(sFileName,header=0,low_memory=False, encoding="latin-1")
################################################################
sFileDir=Base + '/01-Vermeulen/01-Retrieve/01-EDS/02-Python'
if not os.path.exists(sFileDir):
os.makedirs(sFileDir)
print('Rows:', IP_DATA_ALL.shape[0])
print('Columns:', IP_DATA_ALL.shape[1])
print('### Raw Data Set #####################################')
for i in range(0,len(IP_DATA_ALL.columns)):
print(IP_DATA_ALL.columns[i],type(IP_DATA_ALL.columns[i]))
print('### Fixed Data Set #####################################')
IP_DATA_ALL_FIX=IP_DATA_ALL
for i in range(0,len(IP_DATA_ALL.columns)):
cNameOld=IP_DATA_ALL_FIX.columns[i] + ' '
cNameNew=cNameOld.strip().replace(" ", ".")
IP_DATA_ALL_FIX.columns.values[i] = cNameNew
print(IP_DATA_ALL.columns[i],type(IP_DATA_ALL.columns[i]))
################################################################
#print(IP_DATA_ALL_FIX.head())
################################################################
print('Fixed Data Set with ID')
IP_DATA_ALL_with_ID=IP_DATA_ALL_FIX
IP_DATA_ALL_with_ID.index.names = ['RowID']
#print(IP_DATA_ALL_with_ID.head())
sFileName2=sFileDir + '/Retrieve_IP_DATA.csv'
IP_DATA_ALL_with_ID.to_csv(sFileName2, index = True, encoding="latin-1")
################################################################
print('### Done!! ############################################')
################################################################
```

Output:

```
In [59]: runfile('C:/Users/MSCIT/.spyder-py3/temp.py', wdir='C:/
Users/MSCIT/.spyder-py3')


Loading : C:/VKHCG/01-Vermeulen/00-RawData/COUNTRY-CODES.csv
### Raw Data Set #####################################
Code <class 'str'>
Country name <class 'str'>
Year <class 'str'>
country code top-level domain <class 'str'>
### Fixed Data Set #####################################
Code <class 'str'>
Country.name <class 'str'>
Year <class 'str'>
country.code.top-level.domain <class 'str'>
```

E. Program to connect to different data sources.

SQLite:

Code:

```
########################################## ######################
# -*- coding: utf-8 -*-
######################################################################
import sqlite3 as sq
import pandas as pd
######################################################################
Base='C:/VKHCG'
sDatabaseName=Base + '/01-Vermeulen/00-RawData/SQLite/vermeulen.db'
conn = sq.connect(sDatabaseName)
######################################################################
sFileName='C:/VKHCG/01-Vermeulen/01-Retrieve/01-EDS/02-Python/Retrieve_IP_DATA.csv'
print('Loading :',sFileName)
IP_DATA_ALL_FIX=pd.read_csv(sFileName,header=0,low_memory=False)
IP_DATA_ALL_FIX.index.names = ['RowIDCSV']
sTable='IP_DATA_ALL'
print('Storing :',sDatabaseName,' Table:',sTable)
IP_DATA_ALL_FIX.to_sql(sTable, conn, if_exists="replace")
print('Loading :',sDatabaseName,' Table:',sTable)
TestData=pd.read_sql_query("select * from IP_DATA_ALL;", conn)
print('#################')
print('## Data Values')
print('#################')
print(TestData)
print('#################')
print('## Data Profile')
print('#################')
print('Rows :',TestData.shape[0])
print('Columns :',TestData.shape[1])
print('#################')
print('### Done!! ############################################')
```

Output:

```
In [9]: runfile('C:/Users/MSCIT/.spyder-py3/temp.py', wdir='C:/Users/
MSCIT/.spyder-py3')


Loading : C:/VKHCG/01-Vermeulen/01-Retrieve/01-EDS/02-Python/Retrieve_IP_DATA.csv
Storing : C:/VKHCG/01-Vermeulen/00-RawData/SQLite/vermeulen.db  Table: IP_DATA_ALL
Loading : C:/VKHCG/01-Vermeulen/00-RawData/SQLite/vermeulen.db  Table: IP_DATA_ALL
Data Values
################
        RowIDCSV    RowID       ID  ... Longitude First.IP.Number Last.IP.Number
0              0        0        1  ...   25.9119       692781056      692781567
1              1        1        2  ...   25.9119       692781824      692783103
2              2        2        3  ...   25.9119       692909056      692909311
3              3        3        4  ...   25.9119       692909568      692910079
4              4        4        5  ...   25.9119       693051392      693052415
5              5        5        6  ...   25.9119       693078272      693078527
6              6        6        7  ...   25.9119       693608448      693616639
7              7        7        8  ...   25.9119       696929792      696930047
8              8        8        9  ...   25.9119       700438784      700439039
9              9        9       10  ...   25.9119       702075904      702076927
10            10       10       11  ...   25.9119       702498816      702499839
11            11       11       12  ...   25.9119       702516224      702517247
12            12       12       13  ...   25.9119       774162663      774162667
13            13       13       14  ...   25.9119      1401887232     1401887743
14            14       14       15  ...   25.9119      1754209024     1754209279
15            15       15       16  ...    2.1167       696918528      696919039
16            16       16       17  ...    2.1167       696922112      696924159
17            17       17       18  ...    2.1167       701203456      701203711
18            18       18       19  ...    2.1167       758886912      758887167
19            19       19       20  ...    2.1167      1347294153     1347294160
20            20       20       21  ...    2.1167      1755100096     1755100351
21            21       21       22  ...    2.1167      1755828480     1755828735
22            22       22       23  ...   32.5892       692883456      692883967
23            23       23       24  ...   32.5892       692944896      692946943
24            24       24       25  ...   32.5892       696967168      696971263
25            25       25       26  ...   32.5892       700358656      700360959
26            26       26       27  ...   32.5892       702292992      702294015
```

Practical 5

Assessing Data

5A1. Drop the Columns Where All Elements Are Missing Values

Code:

```
################### Assess-Good-Bad-01.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='Good-or-Bad.csv'
sOutputFileName='Good-or-Bad-01.csv'
Company='01-Vermeulen'
#################################################################
Base='C:/VKHCG'
#################################################################
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(axis=1, how='all')
#####################################################################
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:

```
In [16]: runfile('C:/VKHCG/01-Vermeulen/02-Assess/Assess-Good-
Bad-01.py', wdir='C:/VKHCG/01-Vermeulen/02-Assess')

################################
Working Base : C:/VKHCG  using  win32
################################
Loading : C:/VKHCG/01-Vermeulen/00-RawData/Good-or-Bad.csv
################################
## Raw Data Values
################################
      ID FieldA  FieldB FieldC  FieldD  FieldE    FieldF  FieldG
0    1.0   Good  Better   Best  1024.0     NaN   10241.0       1
1    2.0   Good     NaN   Best   512.0     NaN    5121.0       2
2    3.0   Good  Better    NaN   256.0     NaN     256.0       3
3    4.0   Good  Better   Best     NaN     NaN     211.0       4
4    5.0   Good  Better    NaN    64.0     NaN    6411.0       5
5    6.0   Good     NaN   Best    32.0     NaN      32.0       6
6    7.0    NaN  Better   Best    16.0     NaN    1611.0       7
7    8.0    NaN     NaN   Best     8.0     NaN    8111.0       8
8    9.0    NaN     NaN    NaN     4.0     NaN      41.0       9
9   10.0      A       B      C     2.0     NaN   21111.0      10
10   NaN    NaN     NaN    NaN     NaN     NaN       NaN      11
11  10.0   Good  Better   Best  1024.0     NaN  102411.0      12
12  10.0   Good     NaN   Best   512.0     NaN     512.0      13
13  10.0   Good  Better    NaN   256.0     NaN    1256.0      14
14  10.0   Good  Better   Best     NaN     NaN       NaN      15
15  10.0   Good  Better    NaN    64.0     NaN     164.0      16
16  10.0   Good     NaN   Best    32.0     NaN     322.0      17
17  10.0    NaN  Better   Best    16.0     NaN     163.0      18
18  10.0    NaN     NaN   Best     8.0     NaN     844.0      19
19  10.0    NaN     NaN    NaN     4.0     NaN    4555.0      20
20  10.0      A       B      C     2.0     NaN     111.0      21
################################
## Data Profile
################################
Rows : 21
Columns : 8
################################
## Test Data Values
################################
      ID FieldA  FieldB FieldC  FieldD    FieldF  FieldG
0    1.0   Good  Better   Best  1024.0   10241.0       1
1    2.0   Good     NaN   Best   512.0    5121.0       2
2    3.0   Good  Better    NaN   256.0     256.0       3
3    4.0   Good  Better   Best     NaN     211.0       4
4    5.0   Good  Better    NaN    64.0    6411.0       5
5    6.0   Good     NaN   Best    32.0      32.0       6
6    7.0    NaN  Better   Best    16.0    1611.0       7
7    8.0    NaN     NaN   Best     8.0    8111.0       8
8    9.0    NaN     NaN    NaN     4.0      41.0       9
9   10.0      A       B      C     2.0   21111.0      10
10   NaN    NaN     NaN    NaN     NaN       NaN      11
11  10.0   Good  Better   Best  1024.0  102411.0      12
12  10.0   Good     NaN   Best   512.0     512.0      13
13  10.0   Good  Better    NaN   256.0    1256.0      14
14  10.0   Good  Better   Best     NaN       NaN      15
15  10.0   Good  Better    NaN    64.0     164.0      16
16  10.0   Good     NaN   Best    32.0     322.0      17
17  10.0    NaN  Better   Best    16.0     163.0      18
18  10.0    NaN     NaN   Best     8.0     844.0      19
19  10.0    NaN     NaN    NaN     4.0    4555.0      20
20  10.0      A       B      C     2.0     111.0      21
################################
## Data Profile
################################
Rows : 21
Columns : 7
################################
Done!!
```

5A2. Drop the Columns Where Any of the Elements Is Missing Values

Code:

```
################### Assess-Good-Bad-02.py#############################
# -*- coding: utf-8 -*-
#####################################################################
import sys
import os
import pandas as pd
#####################################################################
Base='C:/VKHCG'
sInputFileName='Good-or-Bad.csv'
sOutputFileName='Good-or-Bad-02.csv'
Company='01-Vermeulen'
#####################################################################
Base='C:/VKHCG'
#####################################################################
print('#################################')
print('Working Base :',Base, ' using ', sys.platform)
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(axis=1, how='any')
```

```
#####################################################################
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:

```
In [22]: runfile('C:/VKHCG/01-Vermeulen/02-Assess/Assess-Good-
Bad-02.py', wdir='C:/VKHCG/01-Vermeulen/02-Assess')

################################
Working Base : C:/VKHCG  using  win32
################################
Loading : C:/VKHCG/01-Vermeulen/00-RawData/Good-or-Bad.csv
################################
## Raw Data Values
################################
      ID FieldA  FieldB FieldC  FieldD  FieldE    FieldF  FieldG
0    1.0   Good  Better   Best  1024.0     NaN   10241.0       1
1    2.0   Good     NaN   Best   512.0     NaN    5121.0       2
2    3.0   Good  Better    NaN   256.0     NaN     256.0       3
3    4.0   Good  Better   Best     NaN     NaN     211.0       4
4    5.0   Good  Better    NaN    64.0     NaN    6411.0       5
5    6.0   Good     NaN   Best    32.0     NaN      32.0       6
6    7.0    NaN  Better   Best    16.0     NaN    1611.0       7
7    8.0    NaN     NaN   Best     8.0     NaN    8111.0       8
8    9.0    NaN     NaN    NaN     4.0     NaN      41.0       9
9   10.0      A       B      C     2.0     NaN   21111.0      10
10   NaN    NaN     NaN    NaN     NaN     NaN       NaN      11
11  10.0   Good  Better   Best  1024.0     NaN  102411.0      12
12  10.0   Good     NaN   Best   512.0     NaN     512.0      13
13  10.0   Good  Better    NaN   256.0     NaN    1256.0      14
14  10.0   Good  Better   Best     NaN     NaN       NaN      15
15  10.0   Good  Better    NaN    64.0     NaN     164.0      16
16  10.0   Good     NaN   Best    32.0     NaN     322.0      17
17  10.0    NaN  Better   Best    16.0     NaN     163.0      18
18  10.0    NaN     NaN   Best     8.0     NaN     844.0      19
19  10.0    NaN     NaN    NaN     4.0     NaN    4555.0      20
20  10.0      A       B      C     2.0     NaN     111.0      21

################################
## Data Profile
################################
Rows : 21
Columns : 8
################################
## Test Data Values
################################
    FieldG
0        1
1        2
2        3
3        4
4        5
5        6
6        7
7        8
8        9
9       10
10      11
11      12
12      13
13      14
14      15
15      16
16      17
17      18
18      19
19      20
20      21
################################
## Data Profile
################################
Rows : 21
Columns : 1
################################
Done!!
```

5A3. Keep Only the Rows That Contain a Maximum of Two Missing Values

Code:

```
###################### Assess-Good-Bad-03.py ################
# -*- 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:

```
In [35]: runfile('C:/VKHCG/01-Vermeulen/02-Assess/Assess-Good-
Bad-03.py', wdir='C:/VKHCG/01-Vermeulen/02-Assess')

################################
Working Base : C:/VKHCG  using  win32
Loading : C:/VKHCG/01-Vermeulen/00-RawData/Good-or-Bad.csv
################################
## Raw Data Values
################################
      ID FieldA  FieldB FieldC  FieldD  FieldE    FieldF  FieldG
0    1.0   Good  Better   Best  1024.0     NaN   10241.0       1
1    2.0   Good     NaN   Best   512.0     NaN    5121.0       2
2    3.0   Good  Better    NaN   256.0     NaN     256.0       3
3    4.0   Good  Better   Best     NaN     NaN     211.0       4
4    5.0   Good  Better    NaN    64.0     NaN    6411.0       5
5    6.0   Good     NaN   Best    32.0     NaN      32.0       6
6    7.0    NaN  Better   Best    16.0     NaN    1611.0       7
7    8.0    NaN     NaN   Best     8.0     NaN    8111.0       8
8    9.0    NaN     NaN    NaN     4.0     NaN      41.0       9
9   10.0      A       B      C     2.0     NaN   21111.0      10
10   NaN    NaN     NaN    NaN     NaN     NaN       NaN      11
11  10.0   Good  Better   Best  1024.0     NaN  102411.0      12
12  10.0   Good     NaN   Best   512.0     NaN     512.0      13
13  10.0   Good  Better    NaN   256.0     NaN    1256.0      14
14  10.0   Good  Better   Best     NaN     NaN       NaN      15
15  10.0   Good  Better    NaN    64.0     NaN     164.0      16
16  10.0   Good     NaN   Best    32.0     NaN     322.0      17
17  10.0    NaN  Better   Best    16.0     NaN     163.0      18
18  10.0    NaN     NaN   Best     8.0     NaN     844.0      19
19  10.0    NaN     NaN    NaN     4.0     NaN    4555.0      20
20  10.0      A       B      C     2.0     NaN     111.0      21
################################
## Data Profile
################################
Rows : 21
Columns : 8
## Test Data Values
#############################
     ID FieldA  FieldB FieldC  FieldD  FieldE    FieldF  FieldG
0   1.0   Good  Better   Best  1024.0     NaN   10241.0       1
1   2.0   Good     NaN   Best   512.0     NaN    5121.0       2
2   3.0   Good  Better    NaN   256.0     NaN     256.0       3
3   4.0   Good  Better   Best     NaN     NaN     211.0       4
4   5.0   Good  Better    NaN    64.0     NaN    6411.0       5
5   6.0   Good     NaN   Best    32.0     NaN      32.0       6
6   7.0    NaN  Better   Best    16.0     NaN    1611.0       7
7   8.0    NaN     NaN   Best     8.0     NaN    8111.0       8
8   9.0    NaN     NaN    NaN     4.0     NaN      41.0       9
9  10.0      A       B      C     2.0     NaN   21111.0      10
11 10.0   Good  Better   Best  1024.0     NaN  102411.0      12
12 10.0   Good     NaN   Best   512.0     NaN     512.0      13
13 10.0   Good  Better    NaN   256.0     NaN    1256.0      14
14 10.0   Good  Better   Best     NaN     NaN       NaN      15
15 10.0   Good  Better    NaN    64.0     NaN     164.0      16
16 10.0   Good     NaN   Best    32.0     NaN     322.0      17
17 10.0    NaN  Better   Best    16.0     NaN     163.0      18
18 10.0    NaN     NaN   Best     8.0     NaN     844.0      19
19 10.0    NaN     NaN    NaN     4.0     NaN    4555.0      20
20 10.0      A       B      C     2.0     NaN     111.0      21
#############################
## Data Profile
#############################
Rows : 20
Columns : 8
#############################
Done!!
```

5A4. Fill All Missing Values with the Mean, Median, Mode, Minimum, and Maximum of the Particular Numeric Column

Code:

```
 # -*- coding: utf-8 -
*###################################################################### Import sys
import os
 import pandas as pd
######################################################################
Base='C:/VKHCG'
 sInputFileName='Good-or-Bad.csv'
sOutputFileNameA='Good-or-Bad-04-A.csv'
sOutputFileNameB='Good-or-Bad-04-B.csv'
sOutputFileNameC='Good-or-Bad-04-C.csv'
sOutputFileNameD='Good-or-Bad-04-D.csv'
sOutputFileNameE='Good-or-Bad-04-E.csv'
Company='01-Vermeulen'
######################################################################
if sys.platform == 'linux':
Base=os.path.expanduser('~') + '/VKHCG'
else:
Base='C:/VKHCG'
 print('##################################')
print('Working Base:',Base,'using',sys.platform)
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.fillna(RawData.mean())
#################################################################
print('################################')
print('## Test Data Values- Mean')
print('################################')
print(TestData)
print('################################')
print('## Data Profile')
print('################################')
print('Rows:',TestData.shape[0])
print('Columns:',TestData.shape[1])
print('################################')
#################################################################
sFileName=sFileDir + '/' + sOutputFileNameA
TestData.to_csv(sFileName,index=False)

#################################################################
## This is the important action! The rest of this code snippet
## Only supports this action.
#################################################################
TestData=RawData.fillna(RawData.median())
#################################################################
print('################################')
print('## Test Data Values - Median')
print('################################')
print(TestData)
print('################################')
print('## Data Profile')
print('################################')
print('Rows:',TestData.shape[0])
print('Columns:',TestData.shape[1])
print('################################')
#################################################################
sFileName=sFileDir + '/' + sOutputFileNameB
TestData.to_csv(sFileName,index=False)
#################################################################
#################################################################
TestData=RawData.fillna(RawData.mode())
#################################################################
print('################################')
print('## Test Data Values - Mode')
print('################################')
print(TestData)
print('################################')
```

```
print('## Data Profile')
print('################################')
print('Rows:',TestData.shape[0])
print('Columns:',TestData.shape[1])
print('################################')
#################################################################
sFileName=sFileDir + '/' + sOutputFileNameC
TestData.to_csv(sFileName,index=False)
#################################################################
#################################################################
TestData=RawData.fillna(RawData.min())
#################################################################
print('################################')
print('## Test Data Values - Minumum')
print('################################')
print(TestData) print('################################')
print('## Data Profile')
print('################################')
print('Rows:',TestData.shape[0])
print('Columns:',TestData.shape[1])
print('################################')
#################################################################
sFileName=sFileDir + '/' + sOutputFileNameD
TestData.to_csv(sFileName,index=False)
#################################################################
#################################################################
TestData=RawData.fillna(RawData.max())
#################################################################
print('################################')
print('## Test Data Values - Maximum')
print('################################')
print(TestData)
print('################################')
print('##DataProfile')
print('################################')
print('Rows:',TestData.shape[0])
print('Columns:',TestData.shape[1])
print('################################')
#################################################################
sFileName=sFileDir + '/' + sOutputFileNameE
TestData.to_csv(sFileName,index=False)
#################################################################
#################################################################
print('################################')
print('### Done!! ####################')
```

Output:

```
In [7]: runfile('C:/VKHCG/01-Vermeulen/02-Assess/Assess-Good-Bad-05.py',
wdir='C:/VKHCG/01-Vermeulen/02-Assess')

################################
Working Base : C:/VKHCG  using  win32
################################
Loading : C:/VKHCG/01-Vermeulen/00-RawData/Good-or-Bad.csv
################################
## Raw Data Values
################################
      ID FieldA  FieldB FieldC  FieldD  FieldE    FieldF  FieldG
0    1.0   Good  Better   Best  1024.0     NaN   10241.0       1
1    2.0   Good     NaN   Best   512.0     NaN    5121.0       2
2    3.0   Good  Better    NaN   256.0     NaN     256.0       3
3    4.0   Good  Better   Best     NaN     NaN     211.0       4
4    5.0   Good  Better    NaN    64.0     NaN    6411.0       5
5    6.0   Good     NaN   Best    32.0     NaN      32.0       6
6    7.0    NaN  Better   Best    16.0     NaN    1611.0       7
7    8.0    NaN     NaN   Best     8.0     NaN    8111.0       8
8    9.0    NaN     NaN    NaN     4.0     NaN      41.0       9
9   10.0      A       B      C     2.0     NaN   21111.0      10
10   NaN    NaN     NaN    NaN     NaN     NaN       NaN      11
11  10.0   Good  Better   Best  1024.0     NaN  102411.0      12
12  10.0   Good     NaN   Best   512.0     NaN     512.0      13
13  10.0   Good  Better    NaN   256.0     NaN    1256.0      14
14  10.0   Good  Better   Best     NaN     NaN       NaN      15
15  10.0   Good  Better    NaN    64.0     NaN     164.0      16
16  10.0   Good     NaN   Best    32.0     NaN     322.0      17
17  10.0    NaN  Better   Best    16.0     NaN     163.0      18
18  10.0    NaN     NaN   Best     8.0     NaN     844.0      19
19  10.0    NaN     NaN    NaN     4.0     NaN    4555.0      20
20  10.0      A       B      C     2.0     NaN     111.0      21
################################
## Data Profile
```

Practical 6
Processing Data
Hubs, Links, Satellite

```
#################################################################
# -*- coding: utf-8 -*-
#################################################################
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!! ############################################')
#####################################################################
```

Output:

```
In [33]: runfile('C:/Users/MSCIT/.spyder-py3/temp.py',
wdir='C:/Users/MSCIT/.spyder-py3')


################################
Working Base : C:/VKHCG  using  win32
################################
2018-01-01 00:00:00
2017-12-31 23:00:00
2017-12-31 22:00:00
2017-12-31 21:00:00
2017-12-31 20:00:00
2017-12-31 19:00:00
2017-12-31 18:00:00
2017-12-31 17:00:00
2017-12-31 16:00:00
2017-12-31 15:00:00
Storing : C:/VKHCG/88-DV/datavault.db  Table: Process-Time

Storing : C:/VKHCG/88-DV/datavault.db  Table: Hub-Time
2018-01-01 00:00:00
2017-12-31 23:00:00
2017-12-31 22:00:00
2017-12-31 21:00:00
2017-12-31 20:00:00
2017-12-31 19:00:00
2017-12-31 18:00:00
2017-12-31 17:00:00
2017-12-31 16:00:00
2017-12-31 15:00:00
Storing : C:/VKHCG/88-DV/datavault.db  Table: Process-Time-
Africa-Abidjan

Storing : C:/VKHCG/88-DV/datavault.db  Table: Satellite-
Time-Africa-Abidjan
2018-01-01 00:00:00
2017-12-31 23:00:00
2017-12-31 22:00:00
2017-12-31 21:00:00
2017-12-31 20:00:00
2017-12-31 19:00:00
2017-12-31 18:00:00
2017-12-31 17:00:00
2017-12-31 16:00:00
2017-12-31 15:00:00
```

Practical 7
Transforming Data
Sun Model

```
#####################################################################
# -*- coding: utf-8 -*-
#####################################################################
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
#####################################################################
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'
#####################################################################
sDataBaseDir=Base + '/' + Company + '/04-Transform/SQLite'
if not os.path.exists(sDataBaseDir):
    os.makedirs(sDataBaseDir)
#####################################################################
sDatabaseName=sDataBaseDir + '/Vermeulen.db'
conn1 = sq.connect(sDatabaseName)
#####################################################################
sDataWarehousetDir=Base + '/99-DW'
if not os.path.exists(sDataWarehousetDir):
    os.makedirs(sDataWarehousetDir)
#####################################################################
sDatabaseName=sDataWarehousetDir + '/datawarehouse.db'
conn2 = sq.connect(sDatabaseName)
#####################################################################
print('\n#################################')
print('Time Dimension')
BirthZone = 'Atlantic/Reykjavik'
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)")
```

```
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")
#################################################################
IDTimeNumber=str(uuid.uuid4())
TimeLine=[('TimeID', [IDTimeNumber]),
        ('UTCDate', [BirthDateZoneStr]),
        ('LocalTime', [BirthDateLocal]),
        ('TimeZone', [BirthZone])]
TimeFrame = pd.DataFrame.from_items(TimeLine)
#################################################################
DimTime=TimeFrame
DimTimeIndex=DimTime.set_index(['TimeID'],inplace=False)
#################################################################
sTable = 'Dim-Time'
print('\n#################################')
print('Storing :',sDatabaseName,'\n Table:',sTable)
print('\n#################################')
DimTimeIndex.to_sql(sTable, conn1, if_exists="replace")
DimTimeIndex.to_sql(sTable, conn2, if_exists="replace")
#################################################################
print('\n#################################')
print('Dimension Person')
print('\n#################################')
FirstName = 'Guðmundur'
LastName = 'Gunnarsson'
#################################################################
IDPersonNumber=str(uuid.uuid4())
PersonLine=[('PersonID', [IDPersonNumber]),
            ('FirstName', [FirstName]),
            ('LastName', [LastName]),
            ('Zone', ['UTC']),
            ('DateTimeValue', [BirthDateZoneStr])]
PersonFrame = pd.DataFrame.from_items(PersonLine)
#################################################################
DimPerson=PersonFrame
DimPersonIndex=DimPerson.set_index(['PersonID'],inplace=False)
#################################################################
sTable = 'Dim-Person'
print('\n#################################')
print('Storing :',sDatabaseName,'\n Table:',sTable)
print('\n#################################')
DimPersonIndex.to_sql(sTable, conn1, if_exists="replace")
DimPersonIndex.to_sql(sTable, conn2, if_exists="replace")
#################################################################
print('\n#################################')
```

```
print('Fact - Person - time')
print('\n###################################')
IDFactNumber=str(uuid.uuid4())
PersonTimeLine=[('IDNumber', [IDFactNumber]),
                ('IDPersonNumber', [IDPersonNumber]),
                ('IDTimeNumber', [IDTimeNumber])]
PersonTimeFrame = pd.DataFrame.from_items(PersonTimeLine)
#####################################################################
FctPersonTime=PersonTimeFrame
FctPersonTimeIndex=FctPersonTime.set_index(['IDNumber'],inplace=False)
#####################################################################
sTable = 'Fact-Person-Time'
print('\n###################################')
print('Storing :',sDatabaseName,'\n Table:',sTable)
print('\n###################################')
FctPersonTimeIndex.to_sql(sTable, conn1, if_exists="replace")
FctPersonTimeIndex.to_sql(sTable, conn2, if_exists="replace")
#####################################################################
```

Output:

```
In [24]: runfile('C:/VKHCG/01-Vermeulen/04-Transform/Transform-
Gunnarsson-Sun-Model.py', wdir='C:/VKHCG/01-Vermeulen/04-
Transform')


################################
Working Base : C:/VKHCG  using  win32
################################

################################
Time Dimension

################################
Storing : C:/VKHCG/99-DW/datawarehouse.db
 Table: Dim-Time

################################
C:/VKHCG/01-Vermeulen/04-Transform/Transform-Gunnarsson-Sun-
Model.py:55: FutureWarning: from_items is deprecated. Please use
DataFrame.from_dict(dict(items), ...) instead.
DataFrame.from_dict(OrderedDict(items)) may be used to preserve
the key order.
  DimTime=TimeFrame

################################
Dimension Person

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

################################
Storing : C:/VKHCG/99-DW/datawarehouse.db
 Table: Dim-Person
################################
C:/VKHCG/01-Vermeulen/04-Transform/Transform-Gunnarsson-Sun-
Model.py:79: FutureWarning: from_items is deprecated. Please use
DataFrame.from_dict(dict(items), ...) instead.
DataFrame.from_dict(OrderedDict(items)) may be used to preserve
the key order.
  DimPerson=PersonFrame

################################
Fact - Person - time

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

################################
Storing : C:/VKHCG/99-DW/datawarehouse.db
 Table: Fact-Person-Time

################################
C:/VKHCG/01-Vermeulen/04-Transform/Transform-Gunnarsson-Sun-
Model.py:98: FutureWarning: from_items is deprecated. Please use
DataFrame.from_dict(dict(items), ...) instead.
DataFrame.from_dict(OrderedDict(items)) may be used to preserve
the key order.
  FctPersonTime=PersonTimeFrame
```

Practical 8A
Organizing Data

A. Horizontal Style

```
#####################################################################
# -*- coding: utf-8 -*-
#####################################################################
import sys
import os
import pandas as pd
import sqlite3 as sq
#####################################################################
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'
#####################################################################
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 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-Horizontal'
print('\n###################################')
print('Storing :',sDatabaseName,'\n Table:',sTable)
print('\n###################################')
DimPersonIndex.to_sql(sTable, conn2, if_exists="replace")
#####################################################################
print('###################################')
sTable = 'Dim-BMI-Horizontal'
print('Loading :',sDatabaseName,' Table:',sTable)
print('###################################')
sSQL="SELECT * FROM [Dim-BMI];"
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:

```
In [20]: runfile('C:/VKHCG/01-Vermeulen/05-Organise/Organize-Horizontal.py', wdir='C:/VKHCG/
01-Vermeulen/05-Organise')

################################
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-Horizontal

################################
################################
Loading : C:/VKHCG/99-DW/datamart.db  Table: Dim-BMI-Horizontal
################################
################################
Full Data Set (Rows): 1080
Full Data Set (Columns): 5
################################
Horizontal Data Set (Rows): 194
Horizontal Data Set (Columns): 5
################################
```

Practical 8B
Vertical style

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

```
In [20]: runfile('C:/VKHCG/01-Vermeulen/05-Organise/Organize-Horizontal.py', wdir='C:/VKHCG/
01-Vermeulen/05-Organise')

################################
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-Horizontal

################################
################################
Loading : C:/VKHCG/99-DW/datamart.db  Table: Dim-BMI-Horizontal
################################
################################
Full Data Set (Rows): 1080
Full Data Set (Columns): 5
################################
Horizontal Data Set (Rows): 194
Horizontal Data Set (Columns): 5
################################
```

Practical 8C
Island Style

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

```
In [38]: runfile('C:/VKHCG/01-Vermeulen/05-Organise/Organize-
Island.py', wdir='C:/VKHCG/01-Vermeulen/05-Organise')


################################
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-Vertical

################################
################################
Loading : C:/VKHCG/99-DW/datamart.db  Table: Dim-BMI-Vertical
################################
################################
Full Data Set (Rows): 1080
Full Data Set (Columns): 5
################################
Horizontal Data Set (Rows): 771
Horizontal Data Set (Columns): 3
################################
```

Practical 8D
Secure Vault Style

```
#####################################################################
# -*- coding: utf-8 -*-
#####################################################################
import sys
import os
import pandas as pd
import sqlite3 as sq
#####################################################################
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'
#####################################################################
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 \
      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=False)
#################################################################
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:

```
In [47]: runfile('C:/VKHCG/01-Vermeulen/05-Organise/Organize-Secure-
Vault.py', wdir='C:/VKHCG/01-Vermeulen/05-Organise')


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

Practical 9
Reporting Data
A. Create a Network Routing Diagram

```
#####################################################################
import sys
import os
import pandas as pd
import networkx as nx
import matplotlib.pyplot as plt
#####################################################################
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('#################################')
#####################################################################
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_Name'][i]
      Node1=CompanyData['Company_Country_Name'][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('#################################')
#########################################################################
```

Output:

```
In [63]: runfile('C:/VKHCG/01-Vermeulen/05-Organise/Organise-Network-Routing-Company.py', wdir='C:/VKHCG/01-
Vermeulen/05-Organise')

################################
Working Base : C:/VKHCG  using  win32
################################
################################
Loading : C:/VKHCG/01-Vermeulen/02-Assess/01-EDS/02-Python/Assess-Network-Routing-Company.csv
################################
################################
  Company_Country_Code  ...      Company_Country_Name
0                   US  ...  United States of America
1                   US  ...  United States of America
2                   US  ...  United States of America
3                   US  ...  United States of America
4                   US  ...  United States of America

[5 rows x 5 columns]
(150, 5)
Nodes: 6
Edges: 6
################################
Storing : C:/VKHCG/01-Vermeulen/05-Organise/01-EDS/02-Python/Organise-Network-Routing-Company.gml
################################
################################
Storing Graph Image: C:/VKHCG/01-Vermeulen/05-Organise/01-EDS/02-Python/Organise-Network-Routing-Company.png
################################
```

Practical 9B
Directed Acyclic Graph

```
#####################################################################
import networkx as nx
import matplotlib.pyplot as plt
import sys
import os
import pandas as pd
#####################################################################
if sys.platform == 'linux':
   Base=os.path.expanduser('~') + 'VKHCG'
else:
   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("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("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() # display
```

Output:

```
In [16]: runfile('C:/VKHCG/01-Vermeulen/02-Assess/Assess-DAG-
Location.py', wdir='C:/VKHCG/01-Vermeulen/02-Assess')
################################
Working Base : C:/VKHCG  using  win32
################################
################################
Loading : C:/VKHCG/01-Vermeulen/01-Retrieve/01-EDS/02-Python/
Retrieve_Router_Location.csv
################################
Loaded Company : ['Country' 'Place_Name' 'Latitude' 'Longitude']
################################
    Country Place_Name  Latitude  Longitude
0        US   New York   40.7528   -73.9725
1        US   New York   40.7214   -74.0052
2        US   New York   40.7662   -73.9862
3        US   New York   40.7449   -73.9782
4        US   New York   40.7605   -73.9933
5        US   New York   40.7588   -73.9680
6        US   New York   40.7637   -73.9727
7        US   New York   40.7553   -73.9924
8        US   New York   40.7308   -73.9975
9        US   New York   40.7694   -73.9609
10       US   New York   40.7330   -74.0078
11       US   New York   40.7505   -73.9931
12       US   New York   40.7517   -73.9972
13       US   New York   40.7082   -74.0132
14       US   New York   40.7267   -73.9981
15       US   New York   40.7168   -73.9861
16       US   New York   40.7317   -73.9885
17       US   New York   40.7584   -73.9794
18       US   New York   40.7592   -73.9778
19       US   New York   40.7055   -74.0050
20       US   New York   40.6888   -74.0203
21       US   New York   40.7089   -74.0012
22       US   New York   40.7391   -73.9826
```

Practical 9 C
Graphics

CODE

```
import sys
import os
import pandas as pd
import matplotlib as ml
from matplotlib import pyplot as plt
#####################################################################
if sys.platform == 'linux':
    Base=os.path.expanduser('~') + '/VKHCG'
else:
    Base='C:/VKHCG'
print('##################################')
print('Working Base :',Base, ' using ', sys.platform)
print('##################################')
#####################################################################
GBase = Base+'/01-Vermeulen/06-Report/01-EDS/02-Python/'
ml.style.use('ggplot')

data=[
['London',          29.2, 17.4],
['Glasgow',         18.8, 11.3],
['Cape Town',     15.3, 9.0],
['Houston',         22.0, 7.8],
['Perth', 18.0, 23.7],
['San Francisco',             11.4, 33.3]
]
os_new=pd.DataFrame(data)
pd.Index(['Item', 'Value', 'Value Percent', 'Conversions', 'Conversion Percent',
       'URL', 'Stats URL'],
      dtype='object')

os_new.rename(columns = {0 : "Warehouse Location"}, inplace=True)
os_new.rename(columns = {1 : "Profit 2016"}, inplace=True)
os_new.rename(columns = {2 : "Profit 2017"}, inplace=True)

explode = (0, 0, 0, 0, 0, 0.1)
labels=os_new['Warehouse Location']
```

Practical 10: Data Visualization with Power BI.

A. Importing Data from excel

Step 1: Connect to an excel workbook.

1. Launch Power BI Desktop
2. From the Home ribbon, select Get Data. Excel is one of the Most Common data connections, so you can select if directly from the Get Data menu.
3. If you select the Get Data button directly, you can also select File>Excel and select connect.
4. In the Open File dialog box, select the Product.xlsx file (You need to download this file from http://services.odata.org/V3/Northwind/Northwind.svc/).

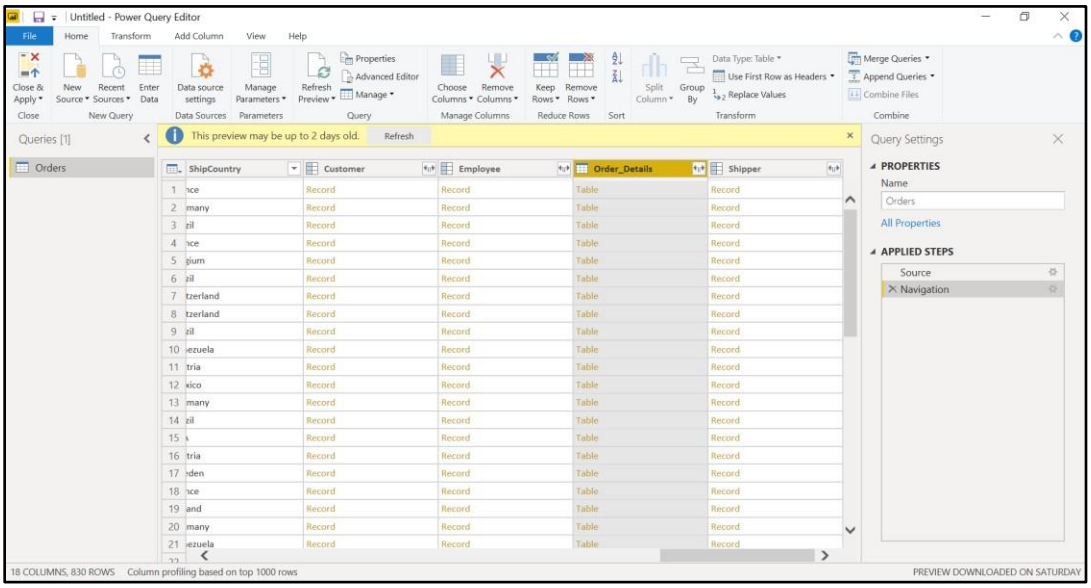
Step 2: We need to remove other columns except ProductID, ProductName, QuantityPerUnit and UnitInStock

Step 3: Change the data type of the UnitsInStock column

For the Excel workbook, products in stock will always be a whole number, so in this step you confirm the UnitsInStock column's datatype is Whole Number.

1. Select the UnitsInStock column.
2. Select the Data Type drop-down button in the Home ribbon.
3. If not already a Whole Number, select Whole Number for data type from the drop down (Data Type: button also displays the data type for the current selection).

Output:



B. Importing data from Odata feed

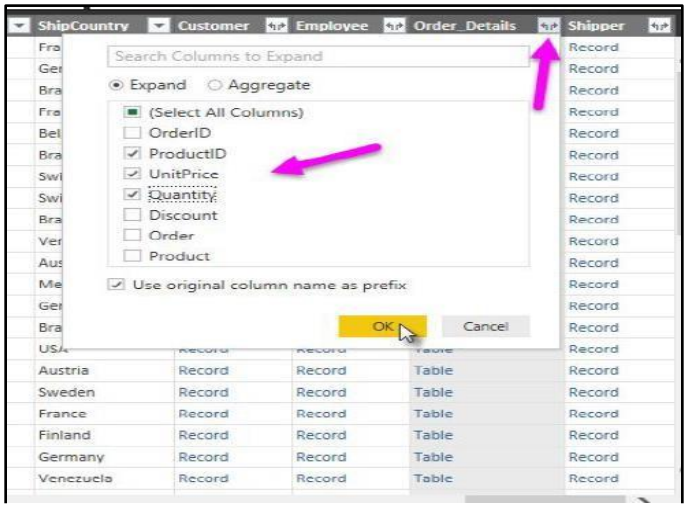
Step 1: Connect to an OData feed

1. From the Home ribbon tab in Query Editor, select Get Data.
2. Browse to the OData Feed data source.
3. In the OData Feed dialog box, paste the URL for the Northwind OData feed.
4. Select OK.
5. Now we need to select the order table from list of table. And then click on Transform Data.

Step 2: Expand the Order_Details table.

	Customer	Employee	Order_Details.ProductID	Order_Details.UnitPrice	Order_Details.Quantity	Shipper
1	Record	Record	11	14	12	Record
2	Record	Record	42	9.8	10	Record
3	Record	Record	72	34.8	5	Record
4	Record	Record	14	18.6	9	Record
5	Record	Record	51	42.4	40	Record
6	Record	Record	41	7.7	10	Record
7	Record	Record	51	42.4	35	Record
8	Record	Record	65	16.8	15	Record
9	Record	Record	22	16.8	6	Record
10	Record	Record	57	15.6	15	Record
11	Record	Record	65	16.8	20	Record
12	Record	Record	20	64.8	40	Record
13	Record	Record	33	2	25	Record
14	Record	Record	60	27.2	40	Record
15	Record	Record	31	10	20	Record
16	Record	Record	39	14.4	42	Record
17	Record	Record	49	16	40	Record
18	Record	Record	24	3.6	15	Record
19	Record	Record	55	19.2	21	Record
20	Record	Record	74	8	21	Record
21	Record	Record	2	15.2	20	Record

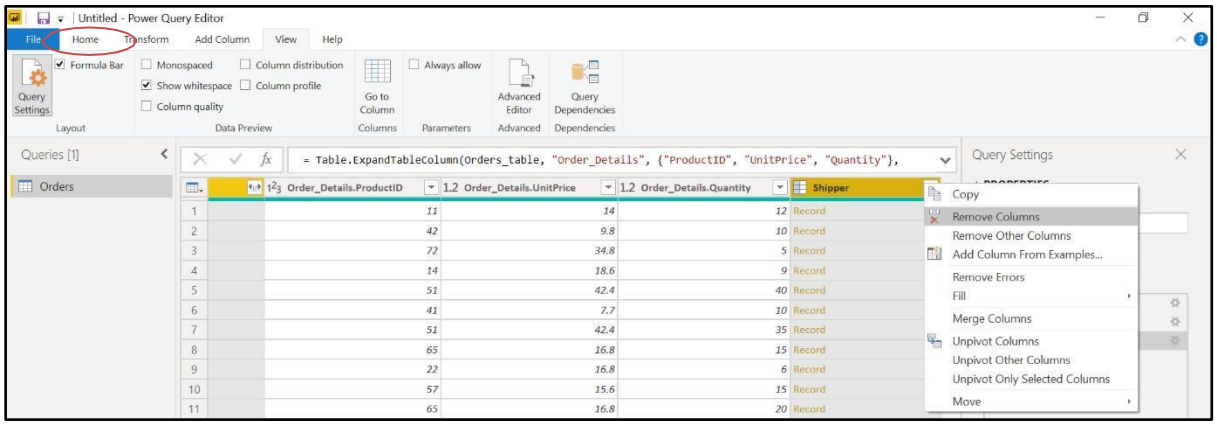
1. As per above picture drag the bottom scroll to the end and you will find the Order_Details column containing the tables.
2. Click on the expand symbol and then mark the checkbox as shown below



Step 3: Remove other columns to only display columns of interest

Remove all columns except OrderDate, ShipCity, ShipCountry, Order_Details.ProductID, Order_Details.UnitPrice, and Order_Details.Quantity columns.

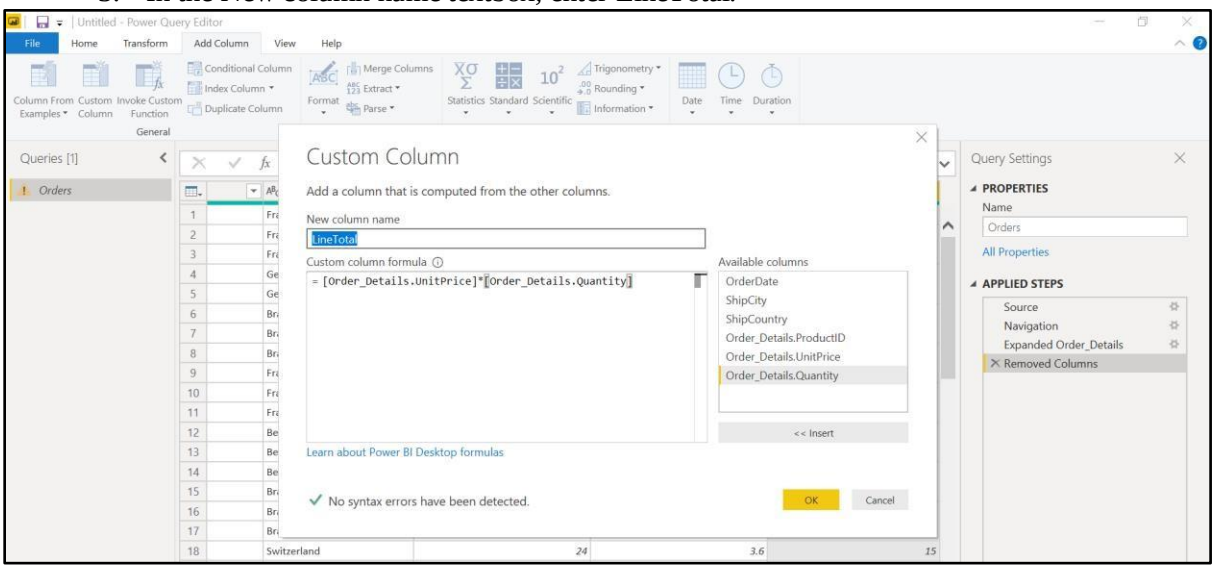
- Check mark the Formula Bar and then perform the below shown steps



Step 4: Calculate the line total for each Order_Details row

Calculate the line total for each Order_Details row:

1. In the Add Column ribbon tab, click Add Custom Column.
2. In the Add Custom Column dialog box, in the Custom Column Formula textbox, enter [Order_Details.UnitPrice] * [Order_Details.Quantity].
3. In the New column name textbox, enter LineTotal.



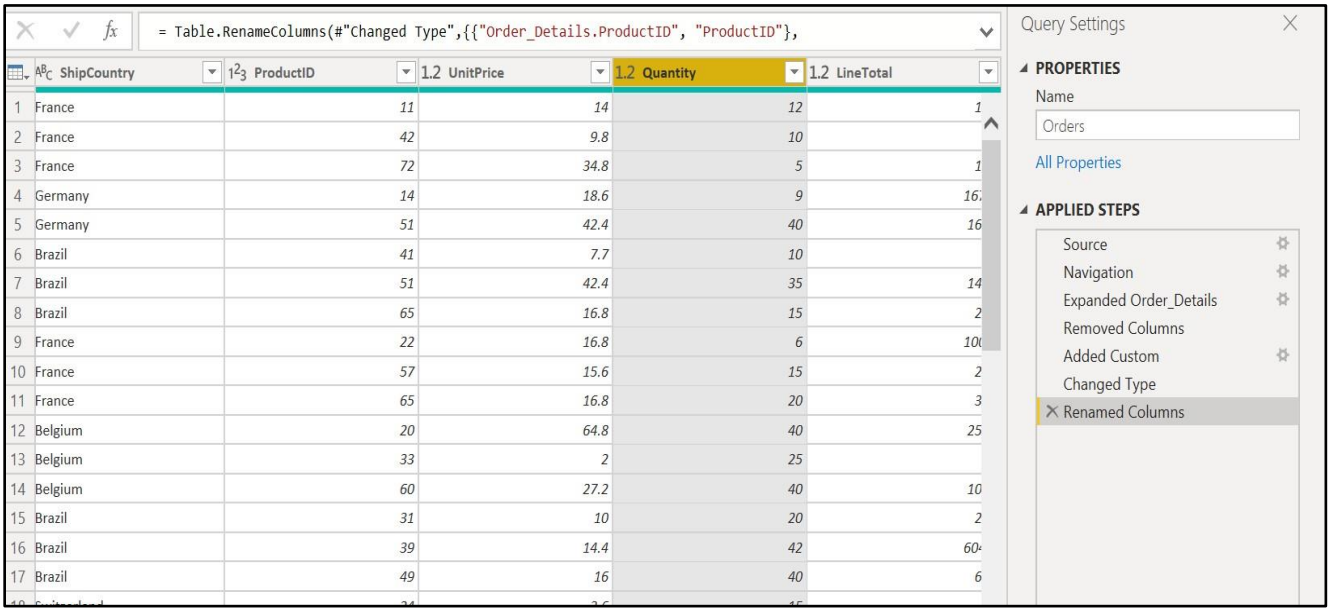
Step 5: Set the datatype of the LineTotal field

1. Right click the LineTotal column.
2. Select Change Type and choose Decimal Number.

Step 6: Rename and reorder columns in the query

1. In Query Editor, drag the LineTotal column to the left, after ShipCountry.

2. Remove the Order_Details. prefix from the Order_Details.ProductID, Order_Details.UnitPrice and Order_Details.Quantity columns, by double-clicking on each column header, and then deleting that text from the column name.



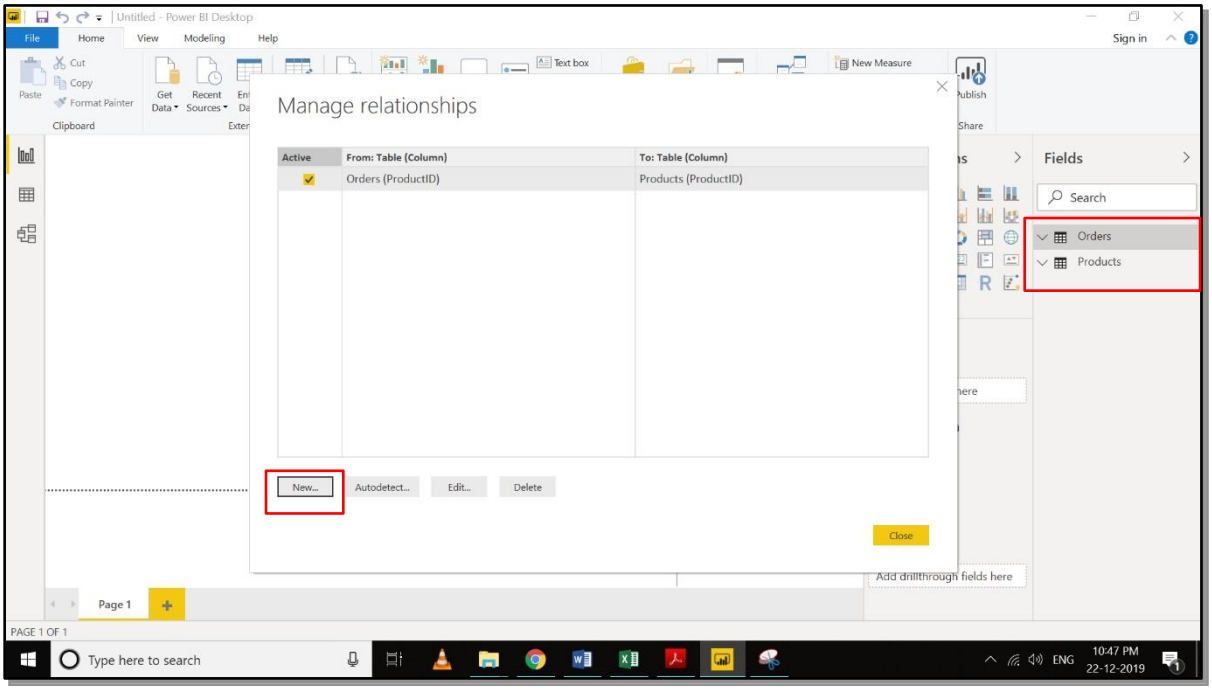
	ShipCountry	ProductID	UnitPrice	Quantity	LineTotal
1	France	11	14	12	1
2	France	42	9.8	10	
3	France	72	34.8	5	1
4	Germany	14	18.6	9	16.
5	Germany	51	42.4	40	16
6	Brazil	41	7.7	10	
7	Brazil	51	42.4	35	14
8	Brazil	65	16.8	15	2
9	France	22	16.8	6	10
10	France	57	15.6	15	2
11	France	65	16.8	20	3
12	Belgium	20	64.8	40	25
13	Belgium	33	2	25	
14	Belgium	60	27.2	40	10
15	Brazil	31	10	20	2
16	Brazil	39	14.4	42	60
17	Brazil	49	16	40	6

	ShipCountry	Order_Details.ProductID
1	France	11
2	France	42
3	France	72
4	Germany	14
5	Germany	51
6	Brazil	41
7	Brazil	51
8	Brazil	65
9	France	22
10	France	57
11	France	65
12	Belgium	20
13	Belgium	33
14	Belgium	60
15	Brazil	31
16	Brazil	39
17	Brazil	49
18	Switzerland	24
19	Switzerland	55

C. Data visualization with Power BI.

For this we need to first load the Products.xlsx table in the Power BI.

1. Go to Get Data and click
2. Select excel and click
3. Now select your Product.xlsx workbook
4. Click Open
5. Now click on Manage Relationships in Home ribbon



6. When we attempt to create the relationship, we see that one already exists! As shown in the Create Relationship dialog (by the shaded columns), the ProductsID fields in each query already have an established relationship.
7. Select Cancel, and then select Relationship view in Power BI Desktop.