DSC540-T302 Data Preparation

Weeks 5 & 6: Data Formats/Data Structures/Data Sources

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Assignment

Activity 5.01: Reading Tabular Data from a Web Page and Creating DataFrames

In this activity, you have been given a Wikipedia page where you have the GDP of all countries listed. You have to create three DataFrames from the three sources mentioned on the page (https://en.wikipedia.org/wiki/List_of_countries_by_GDP_(nominal)).

You will have to do the following:

```
Open the page in a separate Chrome/Firefox tab and use something like
an Inspect Element tool to view the source HTML and understand its
structure.
Read the page using bs4.
Find the table structure you will need to deal with (how many tables
are there?).
Find the right table using bs4.
Separate the source names and their corresponding data.
Get the source names from the list of sources you have created.
Separate the header and data from the data that you separated before
for the first source only, and then create a DataFrame using that.
Repeat the last task for the other two data sources.
```

In [1]:

```
# Load the modules
from bs4 import BeautifulSoup
import numpy as np
import pandas as pd
```

Read the page using bs4.

Since the page / link has a updated content with only one table, wheras the orginal html had 3 tables, the backup copy avalable locally is used

In [2]:

```
# Read the page using bs4.

soup = " "
# Open the html file available in local file system  and load into a soup object
```

```
with open("datasets/List_of_countries_by_GDP.htm", "r", encoding='utf-8', errors='ignc
    soup = BeautifulSoup(fd)
```

In [3]:

```
# Find the table structure you will need to deal with (how many tables are there?).
# Find all tables
tables = soup.find_all('table')

print(" Number of tables in the page is  : " , len(tables) )
```

```
 Number of tables in the page is  :  9
```

Find the right table using bs4.

Inspecting the table structure the GDP values are listed in 3 tables wrapped by a parent table.

The parent table styled using css class **"wikitable"|}**

The 3 tables that hold the GDP values are styles using **'wikitable sortable jquery-tablesorter'** class

In [4]:

```
#  Retrieve the header by parsing the first 3 rows that has the header for 3 tables us
gdp_tables = soup.find("table", {"class": '"wikitable"|}'})
tr_elements = gdp_tables.find_all('tr')
td_elements = tr_elements[0].find_all('td')
tables_hdr = [cell.text.strip() for cell in td_elements]
print(tables_hdr)
```

```
['Per the International Monetary Fund (2017)[1]', 'Per the World Bank (2017)[20]', 'P
er the United Nations (2016)[21][22]']
```

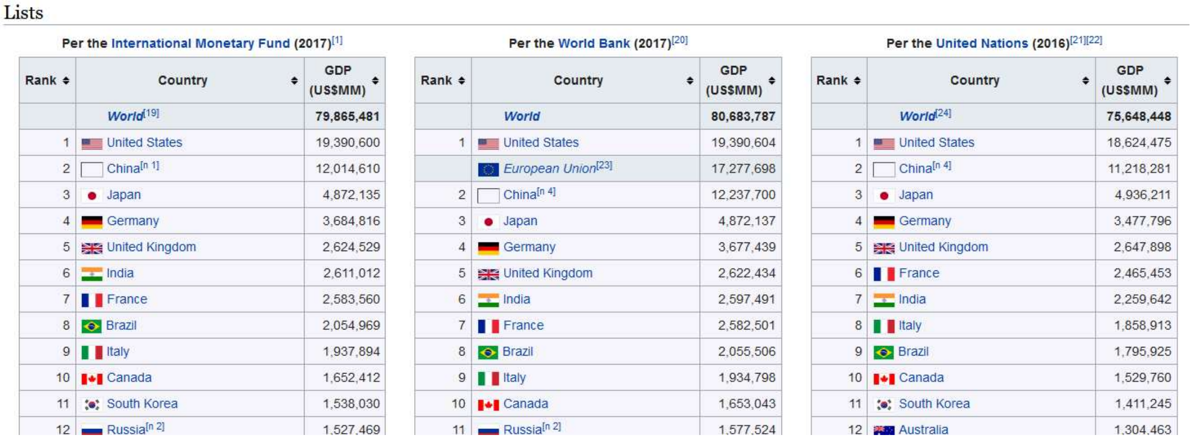
In [5]:

```
# Retrieve all the tags in the table that was styled using class value 'wikitable sort
# This returns all the 3 tables that has the gdp values
tables =  soup.find_all('table', class_='wikitable sortable jquery-tablesorter')

# Declare a list to hold the 3 tables data in a dataframe for later printing
table_content_df_lst = []

# Extract and print table data
# Iterate through the tables soup object ( 3 tables are available)
for index, table in enumerate(tables, start=1):
    # Reteieve all the TR tags
    rows = table.find_all('tr')

    # Declare a list to hold all the row data of the table
    temp_lst = []

    for row in rows:
        # filter all the TH, TD, THEAD and TBODY tags
        cells = row.find_all(['th','td','thead','tbody'])

        # strip other values and retrieve only the tag text values
        row_data = [cell.text.strip() for cell in cells]

        # based on the web page inspection ,   two tables has a character and numbers
        # indentify the index of the character and assign the values following the cha
        spl_car_indx = str(row_data[2]).find("♠")
        if( spl_car_indx != -1):
            row_data[2] = str(row_data[2])[spl_car_indx+1:].strip()
```

```python
        temp_lst.append(row_data)

    # Once all the rows in the tables are process,  create a data frame using the list
    # the first record is the header and rest are all values
    # Add the Dataframe to the list
    table_content_df_lst.append(pd.DataFrame(temp_lst[1:], columns=temp_lst[0]))


# Iterate the list and retrieve the dataframe that holds the table data
for idx , df in enumerate(table_content_df_lst):

    # strip and super script reference values in the header
    sub_scrt_idx = tables_hdr[idx].find('[')
    print("Table : ", tables_hdr[idx][:sub_scrt_idx])

    # print the dataframe top 5 records
    print(df.head())
    print("\n\n")
```

```
Table :  Per the International Monetary Fund (2017)
  Rank        Country  GDP(US$MM)
0          World[19]  79,865,481
1     1  United States  19,390,600
2     2      China[n 1]  12,014,610
3     3          Japan   4,872,135
4     4        Germany   3,684,816



Table :  Per the World Bank (2017)
  Rank             Country  GDP(US$MM)
0                    World  80,683,787
1     1       United States  19,390,604
2       European Union[23]  17,277,698
3     2          China[n 4]  12,237,700
4     3               Japan   4,872,137



Table :  Per the United Nations (2016)
  Rank        Country  GDP(US$MM)
0          World[24]  75,648,448
1     1  United States  18,624,475
2     2      China[n 4]  11,218,281
3     3          Japan   4,936,211
4     4        Germany   3,477,796
```

Screen shot of the tables in web page



Lists

Per the International Monetary Fund (2017)[1]

Rank	Country	GDP (US$MM)
	World[19]	**79,865,481**
1	United States	19,390,600
2	China[n 1]	12,014,610
3	Japan	4,872,135
4	Germany	3,684,816
5	United Kingdom	2,624,529
6	India	2,611,012
7	France	2,583,560
8	Brazil	2,054,969
9	Italy	1,937,894
10	Canada	1,652,412
11	South Korea	1,538,030
12	Russia[n 2]	1,527,469

Per the World Bank (2017)[20]

Rank	Country	GDP (US$MM)
	World	**80,683,787**
1	United States	19,390,604
	European Union[23]	17,277,698
2	China[n 4]	12,237,700
3	Japan	4,872,137
4	Germany	3,677,439
5	United Kingdom	2,622,434
6	India	2,597,491
7	France	2,582,501
8	Brazil	2,055,506
9	Italy	1,934,798
10	Canada	1,653,043
11	Russia[n 2]	1,577,524

Per the United Nations (2016)[21][22]

Rank	Country	GDP (US$MM)
	World[24]	**75,648,448**
1	United States	18,624,475
2	China[n 4]	11,218,281
3	Japan	4,936,211
4	Germany	3,477,796
5	United Kingdom	2,647,898
6	France	2,465,453
7	India	2,259,642
8	Italy	1,858,913
9	Brazil	1,795,925
10	Canada	1,529,760
11	South Korea	1,411,245
12	Australia	1,304,463

Activity 6.01: Handling Outliers and Missing Data

In this activity, we will identify and get rid of outliers. Here, we have a CSV file. The goal here is to clean the data by using the knowledge that we have learned about so far and come up with a nicely formatted DataFrame. Identify the type of outliers and their effect on the data and clean the messy data.

The dataset that we have used here can be found in the visit_data.csv file. This file contains data generated by a random data generator, and it contains people's names, their gender, email_id, ip_address, and the number of visits they made to a particular web page.

The steps that will help you solve this activity are as follows:

```
Read the visit_data.csv file.
Check for duplicates.
Check whether any essential column contains NaN.
Get rid of the outliers.
Report the size difference.
Create a box plot to check for outliers.
Get rid of any outliers
```

Read the visit_data.csv file.

In [6]:

```
# Read the visit_data.csv file.
vis_dat_df = pd.read_csv('visit_data.csv')
vis_dat_df.head()
```

Out[6]:

	id	first_name	last_name	email	gender	ip_address	visit
0	1	Sonny	Dahl	sdahl0@mysql.com	Male	135.36.96.183	1225.0
1	2	NaN	NaN	dhoovart1@hud.gov	NaN	237.165.194.143	919.0
2	3	Gar	Armal	garmal2@technorati.com	NaN	166.43.137.224	271.0
3	4	Chiarra	Nulty	cnulty3@newyorker.com	NaN	139.98.137.108	1002.0
4	5	NaN	NaN	sleaver4@elegantthemes.com	NaN	46.117.117.27	2434.0

```
In [7]: print('The file has ', len(vis_dat_df), ' records')
```

```
The file has  1000  records
```

Check for duplicates.

```
In [8]: duplicate_data = vis_dat_df.duplicated()
```

```
In [9]: print('there are ', duplicate_data.sum(), ' duplicate records in the data file ')
```

```
there are  0  duplicate records in the data file
```

```
In [10]: # Iterate the columns and print the duplicate values
         for col_nm in vis_dat_df.columns:
             print('Total number rows that are duplicated for column ', col_nm ,  ' is ', vis_c
```

```
Total number rows that are duplicated for column  id  is  0
Total number rows that are duplicated for column  first_name  is  320
Total number rows that are duplicated for column  last_name  is  299
Total number rows that are duplicated for column  email  is  0
Total number rows that are duplicated for column  gender  is  997
Total number rows that are duplicated for column  ip_address  is  0
Total number rows that are duplicated for column  visit  is  164
```

Check whether any essential column contains NaN

```
In [11]: # print the nan counts in each column
         vis_dat_df.isna().sum()
```

```
Out[11]: id              0
         first_name    296
         last_name     296
         email           0
         gender        505
         ip_address      0
         visit          26
         dtype: int64
```

Purpose of the data is to collect the number of visits , if it is null or no data, then it does not serve the purpose, hence removing those outliers

```
In [12]: # drop the records that has NAN values in visits column or feature
         vis_data_df_cleaned = vis_dat_df.dropna(subset=['visit'])
```

Report the size difference.

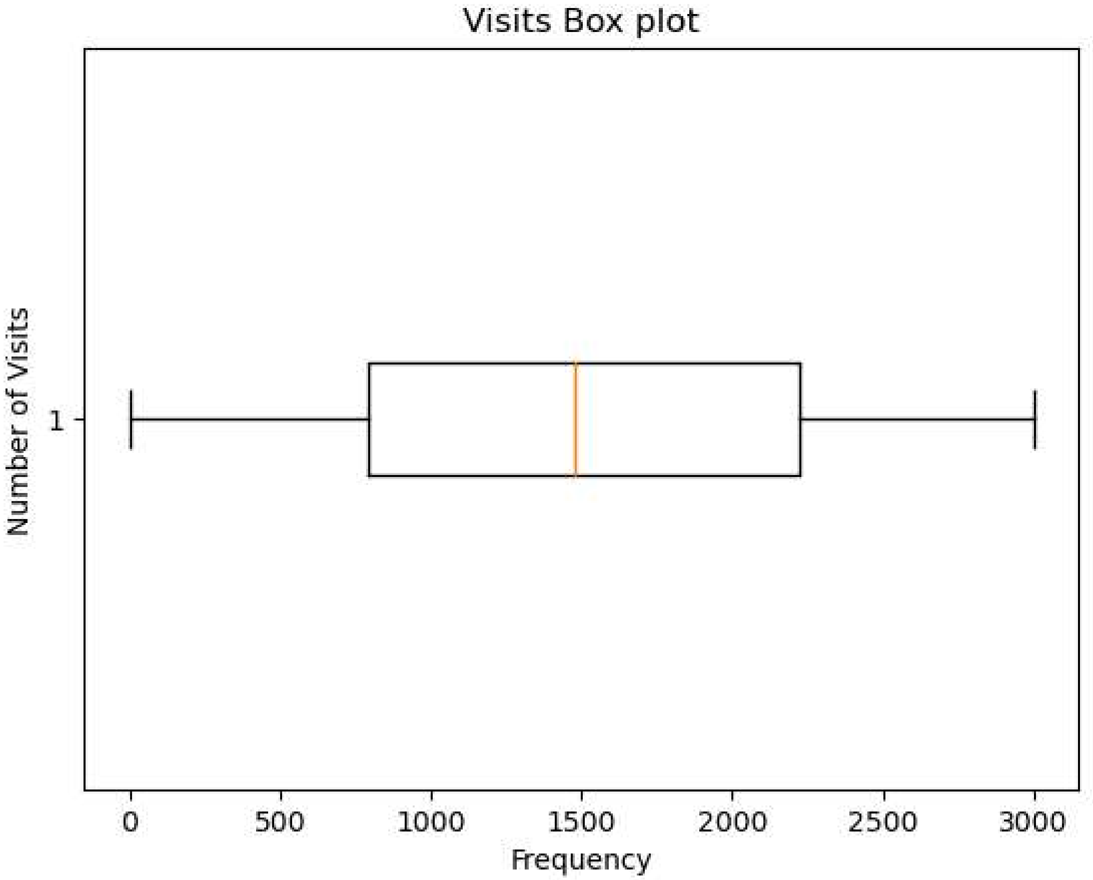
```
In [13]: # Print the net record count after dropping records
         print('The key column cleaned up  file has ', len(vis_data_df_cleaned), ' records')
         print('number of records deleted are ', (1000- len(vis_data_df_cleaned)))
```

```
The key column cleaned up  file has  974  records
number of records deleted are  26
```

Create a box plot to check for outliers.

```
In [14]: # Create a box plot to visually view the quantiles , Inter Quantile Range,  Lower Quan
         # and Upper Quantile (right most)
```

```
import matplotlib.pyplot as plt
plt.boxplot(vis_data_df_cleaned['visit'], vert=False, meanline=True)
plt.ylabel('Number of Visits')
plt.xlabel('Frequency')
plt.title('Visits Box plot')
plt.show()
```



In [15]:
```
# From the box plot the outliers are on 1st and 4th quantile
# print the quantile values
print('Quantile values')
print(vis_data_df_cleaned['visit'].quantile([ 0,0.25, 0.5, 0.75, 1]))
```

```
Quantile values
0.00       1.00
0.25     794.50
0.50    1477.00
0.75    2224.25
1.00    2998.00
Name: visit, dtype: float64
```

In [16]:
```
min(vis_data_df_cleaned['visit'])
```

Out[16]:
```
1.0
```

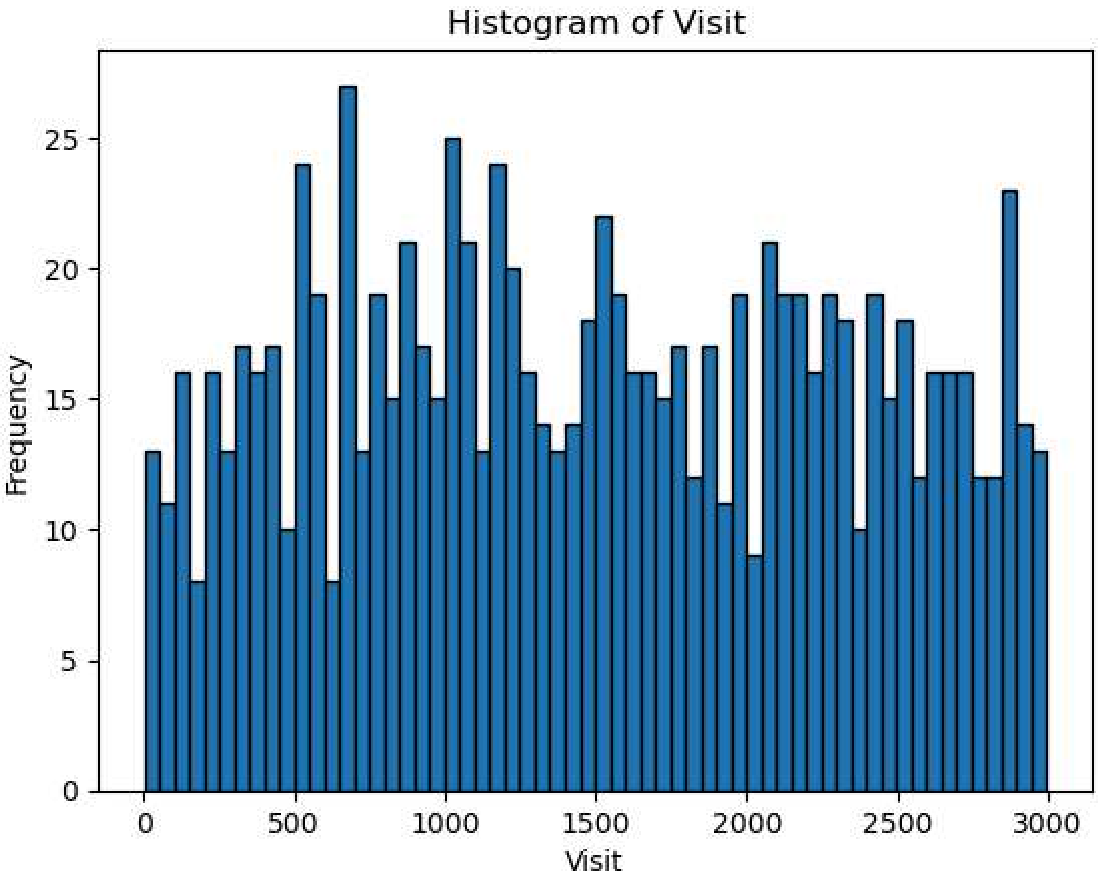
In [17]:
```
max(vis_data_df_cleaned['visit'])
```

Out[17]:
```
2998.0
```

Get rid of any outliers

In [18]:

```python
# Create a histogram
plt.hist(vis_data_df_cleaned['visit'], bins=60, edgecolor='black')  # Adjust the numbe

# Add labels and title
plt.xlabel('Visit')
plt.ylabel('Frequency')
plt.title('Histogram of Visit')

# Show the plot
plt.show()
```



In [19]:

```python
# From the histogram view
# removing values less than 50 and greater than 2850
vis_data_df_final = vis_data_df_cleaned[(vis_data_df_cleaned['visit'] > 50) & (vis_dat
```

In [20]:

```python
vis_data_df_final.head()
```

Out[20]:

	id	first_name	last_name	email	gender	ip_address	visit
0	1	Sonny	Dahl	sdahl0@mysql.com	Male	135.36.96.183	1225.0
1	2	NaN	NaN	dhoovart1@hud.gov	NaN	237.165.194.143	919.0
2	3	Gar	Armal	garmal2@technorati.com	NaN	166.43.137.224	271.0
3	4	Chiarra	Nulty	cnulty3@newyorker.com	NaN	139.98.137.108	1002.0
4	5	NaN	NaN	sleaver4@elegantthemes.com	NaN	46.117.117.27	2434.0

In [21]:

```python
print('Final size of the dataframe after cleaning up the outliers is ', len(vis_data_d
Final size of the dataframe after cleaning up the outliers is  913
```