Group Assignment 3                                    Due date: see Quercus

**Deliverables (to be submitted on Quercus):**

**1. Case Report showing all the graphs required and answering the questions below.**

**2. All Python source code either in a Jupyter Notebook (\*.ipynb) or a Python file (\*.py). *One* file!**

## OECD Trade and GDP Analysis

Use the provided data sets (OECD_Trade.csv and OECD_GDP.csv) to study exports, imports, net exports (defined as Exports – Imports), and GDPs of countries from 2010 to 2018. Follow the tasks below carefully to complete the analysis.

**Hints:**
1. Ensure that all graphs are properly labeled with appropriate titles, axis labels, and legends.
2. Include brief explanations and descriptions for each chart and analysis where required.
3. To position a legend outside a chart, you can use the command:
   `plt.legend(loc='center left', bbox_to_anchor=(1, 0.5))`

## Task 1: Explore and Prepare the Data

i. Briefly explore the provided data sets (OECD_Trade.csv and OECD_GDP.csv).

ii. Describe your findings, such as data completeness, structure, and potential inconsistencies.

iii. Make any necessary adjustments to the data sets (e.g., handling missing values or formatting issues).

## Task 2: Annual Trends and Relationships (2010–2018)

### Task 2A: Analyze Total Annual Trends

Using the provided data, perform the following:

i. Create **one line chart** with two lines:

- Total annual *exports* of all countries combined.
- Total annual *imports* of all countries combined.
  Clearly distinguish the lines with labels and a legend.

ii. Create **a separate line chart** showing the total annual *net exports* (calculated as Exports – Imports) of all countries combined.

iii. Create **another line chart** showing the total annual *GDP* of all countries combined.

iv. Examine the GDP chart for anomalies. If any are detected, propose potential reasons for these discrepancies.

**Task 2B: Investigate Relationships Between Key Measures**

Using the aggregated annual data from Task 2A, perform the following:

i. Create **six scatterplots**, each comparing a unique pair of the measures *exports*, *imports*, *net exports*, and *GDP*. The required pairwise comparisons are: Exports vs. Imports, Exports vs. Net Exports, Exports vs. GDP, Imports vs. Net Exports, Imports vs. GDP, Net Exports vs. GDP.

Clearly label each scatterplot to indicate the measures being compared.

ii. Briefly describe any patterns, correlations, or anomalies observed in the scatterplots.

**Task 3: Visualize Exports and Imports by Country**

Using the provided data, perform the following:

i. Create the following three charts to show the total annual *exports* for each country for each year from 2010 to 2018:

- A **stacked area chart**.
- A **stacked bar chart**.
- A **normalized stacked bar chart**.

ii. Repeat the above for *imports*.

**Bonus:** Assign a different color to each individual country in the charts.

**Task 4: Analyze Net Exports by Country**

Create the following charts to analyze *net exports* (calculated as Exports − Imports) for each country:

i. An **unstacked bar chart** showing the total annual *net exports* for each country from 2010 to 2018.
ii. A **stacked bar chart** showing the same data.

**Task 5: Rank Analysis for Canadian Export Partners**

Using the provided data, perform the following:

i. Create a **line chart** showing the ranks of the top 10 export partners of Canada for each year from 2010 to 2018. *Hint:* The method `pandas.DataFrame.rank()` may be helpful here.

ii. Identify the rank of Japan in exports among major Canadian trading partners for each year.

iii. Determine when China overtakes the United Kingdom to become Canada's second-largest export partner.