ECON 457 - A01
Computational Economics*
UVIC - Department of Economics
Spring Term 2023/24

Assignment 1
Due on Brightspace before ***8pm February 5th*** *2024*
Please create and submit a pdf file, making sure that it's readable and unlocked.
The file name has to follow this template: 457_PS1_Surname_Name_StudentNumber.pdf

You can cooperate with other students, but no group submissions will be accepted
If you do cooperate, please list the other students' names in the cover page
No "photocopy answers"will be accepted
No late submissions will be accepted

NOTE: YOU MUST INCLUDE THE ASSIGNMENT COVER PAGE
(Failure to do so will entail a 5-point deduction from the grade received)

Remarks: Your answers have to be submitted in a "report" format. Relying on Jupyter is the easiest option. The codes you developed have to be included as well in the pdf file. Devote some time to give the graphs, plots and tables a format easy to understand. Also the way you present your answers matters for the final grade. Even if a question is mainly technical, ***briefly*** *explain what you are doing, stressing the economic meaning of the various steps whenever possible. Being able to convey your thoughts effectively is an asset also in real life.*

Question 1: Market Equilibrium (50 Marks)

Consider the market for a homogeneous good (say, bananas). The demand function is $q^d(p) = \alpha p^{\varepsilon}$, where $\alpha > 0$ is a constant, and $\varepsilon < 0$ stands for the elasticity of demand. The supply function is $q^s(p) = \beta p^{\eta}$, where $\beta > 0$ is a constant, and $\eta > 0$ stands for the elasticity of supply.

(a) Solve the model analytically and report the formulas for the equilibrium price and quantity.

Write Python codes to analyze this market in the following cases:

(b) Set $\alpha = 0.5$ and $\beta = 2$. Consider the following values for the elasticities: $\varepsilon = -2.0$ and $\eta = 0.5$. Adapt the code we discussed in class to find the numerical solution of the market equilibrium. Compare the values of the numerical solution to the 'true' solution, based on the closed-form formulas you obtained in part a.

(c) Set $\alpha = 0.5$ and $\beta = 2$. Consider the following values for the elasticities: $\varepsilon = \{-2.0; -1.0\}$ and $\eta = 1$. Write a do-loop where at each iteration the excess demand function is plotted. Comment.

(d) Now consider a different demand function, namely $q^d(p) = e^{-2p} - 0.01p$. The supply function is $q^s(p) = p^2$. Plot the excess demand function on the interval $[-2, 2]$ and comment. Adapt the code we discussed in class to find the numerical solution of the market equilibrium (Note: the procedure might fail when using a poor initial guess). Report the solution and comment.

(e) Now consider the following demand function $q^d(p) = e^{-p} - 0.01p$. The supply function is $q^s(p) = p^4$. Plot the excess demand function on the interval $[-2, 2]$ and comment. Would it be a good idea to use $p_0 = -1.5$ as the initial guess? Why or why not? Find the numerical solution of the market equilibrium, report it and comment.

Question 2: Canadian Macroeconomic Data (50 Marks)

The text file *CA_data.txt* contains aggregate data for the Canadian economy on Private Final Consumption Expenditure (C_t), Government Final Consumption Expenditure (G_t), and Gross Fixed Capital Formation (namely, investment I_t). All variables are inflation-adjusted, quarterly, and span the period 1981Q1-2023Q2. The Excel file *CA_data_clean.xls* provides additional information on the data.

Write Python codes to do the following:

(a) Import the data using Pandas. The following command does work (on my office computers):

```
filename = 'CA_data.txt'
df = pd.read_csv(filename, delim_whitespace=True)
```

Do check that the data were imported correctly in your notebook with the command print(df).

(b) Assume that Canada is a closed economy, which allows to define its Gross Domestic Product (GDP) as $Y_t = C_t + G_t + I_t$. Compute Canadian GDP, and plot the four series (Y_t, C_t, G_t, I_t) in a graph with four separate panels (with a 2x2 layout). Comment.

(c) Compute the share of total GDP for each of the three GDP components. Plot the three shares $(Cshare_t, Gshare_t, Ishare_t)$ in the same graph. Comment.

(d) Compute the quarterly growth rate of GDP, using both its exact definition ($g_t^Y = (Y_t - Y_{t-1})/Y_{t-1}$) and its approximate formula ($g_t^{LnY} = Ln(Y_t) - Ln(Y_{t-1})$, where $Ln(Y_t)$ denotes the natural logarithm of Y_t). Compute the percentage deviation of the two growth rate series, and comment on the accuracy of the approximate formula. Plot the two series representing the growth rate of GDP in the same graph.

(e) Using their exact definition, compute the quarterly growth rates of the three GDP components. Plot the growth rates of GDP and its three components in a graph with four separate panels. Report in a table the four averages and standard deviations of the quarterly growth rates. Report in another table the correlations between the growth rates of the four series. Comment on your findings.