Homework 5 (36 Points)

Note. You should write this homework in `R Markdown` and include all codes that you have used to generate your results and graphs.

Problem 1 (4 Points)

When poor families have to increase their consumption of staple foods such as rice or wheat when the price of the staple food increases, they are said to exhibit **Giffen behavior**. Individuals with Giffen behavior have *upward-sloping* demand curves, i.e. the higher the price of the staple food, the more they buy. In the article "The Indiana Jones of Economics," Robert Jensen talks about the difficulty of identifying Giffen behavior from data:

"Remember, we're looking for a positive correlation between price and consumption/demand — higher prices associated with higher quantity demanded, lower prices with lower quantity demanded. So, let's say we see a bunch of towns, and people living in those towns with the highest rice prices consume the most rice. Case closed, right? Not quite. Plain old economics tells us that if people want more of some good, its price goes up. So, we see high rice prices where there is high rice consumption, but did the high consumption cause the high price (economics as usual) or did the high price cause the high consumption (Giffen behavior)?"

Using supply and demand diagrams, explain what Jensen means.

Problem 2 (12 Points)

Suppose your demand for a good – call it good 1 – is

$$q_1 = 1000 - 10p_1 + 5p_2 + 2I$$

, where p_1 is the price of good 1, p_2 is the price of a related good – call it good 2 – and I is your income.

1. Plot the relationship between p_1 and q_1 when $p_2 = 50$ and $I = 100$[1]. (2 Points)
2. Plot the relationship between p_2 and q_1 when $p_1 = 50$ and $I = 100$[2]. (2 Points)
3. Plot the relationship between I and q_1 when $p_1 = 50$ and $p_2 = 50$[3]. (2 Points)
4. In one plot, plot the relationship between p_1 and q_1 under the following 3 scenarios[4]: (2 Points)
   (a) $p_2 = 50, I = 100$
   (b) $p_2 = 10, I = 100$
   (c) $p_2 = 50, I = 200$
5. Is good 1 a normal good or an inferior good to you? (2 Points)
6. Are good 1 and good 2 substitutes, complements, or neither? (2 Points)

[1] For this question, draw p_1 on the $x-$axis and q_1 on the $y-$axis.
[2] For this question, draw p_2 on the $x-$axis and q_1 on the $y-$axis.
[3] For this question, draw I on the $x-$axis and q_1 on the $y-$axis.
[4] For this question, draw q_1 on the $x-$axis and p_1 on the $y-$axis.

Problem 3 (6 Points)

The Consumer Expenditure Survey (CE) is a quarterly survey of American households on their consumption pattern. The Diary Survey, which is a part of the Consumer Expenditure Survey, provides information on the type and amount of diary products that consumers buy. The file `CEdiary_201501.csv` contains data from the 2015Q1 Diary Survey[5,6]. In this exercise, we use this data to look at the relationship between household income and total food expenditure.

1. Draw a scatter plot of household income and total food expenditure. (2 Points)

   To do this,

   - Use the variable FINCBEFX for household income.
   - Use the variable FOODTOT for total food expenditure.
   - Delete observations with zero or negative FINCBEFX or FOODTOT[7].

2. Add a linear best-fit line to the scatter plot. (2 Points)

3. Based on this data, can you conclude whether food is a normal or an inferior good? (2 Points)

[5] You can access more public-use microdata from the Consumer Expenditure Survey here.
[6] See here for a definition of data variables. See here for more information.
[7] This is because these are often missing values: for households that fail to answer survey questions about their income or food expenditure, the respective values are often coded at 0.

Problem 4 (14 Points)

Gasoline and Ethanol are both used as fuel for automobiles. Gasoline is derived from petroleum (crude oil). Corn is the main feedstock used for producing ethanol fuel in the U.S. In this exercise, we look at the relationship between the price of corn and crude oil. The FRED database at the Federal Reserve Bank of St. Louis contains data on global corn prices[8] and West Texas Intermediate (WTI) crude oil prices[9,10].

1. Download *monthly* data on global corn prices and WTI crude oil prices from **Jan. 1986** to **Aug. 2021**. Plot the two time series together. (2 Points)

2. Describe the movement of corn price and crude oil price during this time period. (2 Points)

3. Draw a scatter plot of corn price vs. crude oil price. Add a linear best-fit line to the scatter plot. (2 Points)

4. What is the correlation between the price of corn and crude oil over this time period? (2 Points)

5. Based on the observed pattern in the data, do you think corn and crude oil are *more likely* to be substitutes, complements, or neither? (2 Points)

6. Other than corn and crude oil being substitutes or complements, are there any other explanations for the observed pattern in the data?[11] (2 Points)

7. What are the conditions that need to be satisfied for you to definitely conclude whether corn and crude oil are substitutes, complements, or neither? (2 Points)

[8] The FRED data on global corn prices are obtained from the IMF database on primary commodity prices.

[9] West Texas Intermediate (WTI), also known as Texas light sweet, is a grade of crude oil used as a benchmark in oil pricing.

[10] The FRED data on WTI crude oil spot prices are obtained from the U.S. Energy Information Administration (EIA).

[11] If your answer to question 5 is that corn and crude oil are substitutes because you think that explains the observed data, then this question asks you to imagine if there are any other possibilities in which these two goods are *not* substitutes that may also explain the observed data. Similarly, if you answer that corn and crude oil are complements, then this question asks you to imagine other possibilities.