

Task 1 – 40%

Part A

Imagine a market where the good of interest is alcohol.

The compensated demand curve is $Q_d = -\frac{500}{3}P + \frac{25000}{3}$ with Q_d the number of liters demanded and P the price per liter.

The supply curve is $Q_s = 500P$ with Q_s the number of liters produced.

The government is considering a \$10 unit tax on each liter of alcohol sold. The tax is levied on consumers.

1. Compute the equilibrium on the market before the \$10 unit tax is implemented.
2. Compute the equilibrium after the \$10 unit tax is implemented.
3. Explain in detail why a deadweight loss is occurring due to the tax. Draw a graph with the supply and demand curves and explain where we visualize the deadweight loss. No need to calculate the deadweight loss.

Part B

This part B of the task is independent of the part A. We are still studying the alcohol market.

Imagine there are four consumers on the alcohol market: type A, type B, type C, and type D. Before the tax is introduced, all the consumers have the same consumption of alcohol. Each of them consumes 20 liters of alcohol.

Individuals differ with their income and their compensated price elasticity of demand for alcohol. The table below summarizes these features.

Individual	Income level (in \$)	Compensated price elasticity of demand
Type A	10,000	-0.08
Type B	20,000	-0.16
Type C	50,000	-0.24
Type D	100,000	-0.32

How to read the table:

The individual called "Type A" has an income level of \$10,000 and her compensated price elasticity of demand for alcohol is -0.08.

4. Explain what the price elasticity is and give an example of what it means for one individual (either Type A, Type B, Type C, or Type D).
5. The increase in consumer price after the implementation of the tax in part A was 62.5%. Calculate the new quantity of alcohol consumed by each individual after the \$10 unit tax is implemented.

Use the fact that the price variation between before and after the tax is 62.5%. Which individual is the most impacted by the tax and why is that?

Hint: use the price elasticity definition to find an expression of the change in demand.

6. Calculate the amount of tax paid by the four individuals given their new consumption of alcohol and the \$10 unit tax.
7. Individuals do not have the same income level and do not pay the same amount of tax. Calculate the average tax rate for each individual. Do you think the effect of the tax is fair? Explain why and comment on your answer by using the concept of progressiveness of the tax.

Task 2 – 25%

Assume an individual that has a utility function defined over income I (which can be used to buy consumption goods) and leisure time L . The utility is of the form $U(I, L) = I + 400 \ln(L)$. The hourly wage rate is \$25 and the individual has at her/his disposal 60 hours in total, to be divided into leisure and work over the course of a week.

Imagine that the government implements an income tax of 20%.

1. Calculate the optimum for the individual without the income tax.
2. Calculate the optimum for the individual with the income tax. How did the number of working hours change compare to the situation without the income tax?
3. Explain in detail the effects that are at play here and that are leading to a change of equilibrium. You can illustrate with a graphical representation (this is optional). Given the numerical results, which effect is dominating in this case?

Task 3 – 25%

Consider an economy consisting of two individuals Alex and Bob. The total income in the economy is \$5,000 and is to be split between the two individuals.

The utility of Alex is given by $U_A = 2\sqrt{I_A}$ where I_A is the income allocated to Alex.

The utility of Bob is given by $U_B = 4\sqrt{I_B}$ where I_B is the income allocated to Bob.

1. Assume the total income is allocated equally between the individuals. Find the utility level associated with this income for each individual.
2. What should the income distribution be for the individuals to have the same utility level?
3. Find the income distribution that maximizes social welfare in the case of an additive social welfare function.
4. What other case of social welfare function can you think of? Explain the difference between this social welfare function and the additive social welfare function used in the previous question.
5. Develop one limit of the application of the social welfare function in practice.

Task 4 – 10%

Several countries are gathered to vote on limiting CO₂ emissions in order to fight climate change. They need to vote on the extent of the percentage of decrease of CO₂ emissions that needs to be achieved within 5 years.

There are three possibilities for which the countries can vote:

- No change: percentage of decrease of CO₂ emissions is 0%.
- Small change: percentage of decrease of CO₂ emissions is 20%.
- Large change: percentage of decrease of CO₂ emissions is 40%.

Suppose that the countries are divided into three groups that have different preferences:

- Group 1: global warming skeptics: This group of countries thinks the lowest percentage of decrease is the best. Their ranking from best to worst is no change, small change, large change.
- Group 2: cautious: This group of countries thinks the small change is the best but wants to avoid absolutely the no change. Their ranking from best to worst is small change, large change, no change.
- Group 3: global warming anxious: This group of countries thinks the highest percentage of decrease is the best. Their ranking from best to worst is large change, small change, no change.

1. The vote is done using a majority decision rule. Which of the decrease of CO₂ emissions is going to be decided? Detail the steps on how you obtain this result.
2. Explain what is the voting paradox and which condition is needed for it not to happen. Propose new preferences in the previous context where you get a voting paradox.