1. Consider a small country (Belgium) with the following demand and supply curves for cloth:

Supply = $2P_c$; Demand = $100 - 2P_c$

Assume Belgium can import cloth at a given world price of $P_c = 10$. Further, assume that Belgium imposes a tariff of $t$ per unit of import.

a) Show how: domestic price, consumption and production change as $t$ increases. Also, calculate how consumer surplus, producer surplus, and government tariff revenue change as $t$ increases. What happens to overall Belgian welfare as $t$ increases?

(i) If $t > 15$, what happens to the level of trade?

b) Compare the domestic equilibrium when $t=10$ to the case where there is no tariff, but there is an import quota of 20 units. What happens to the tariff revenue? Which policy is better for the country?

c) Find the import quota $L$ that corresponds to each tariff $t$. In what sense do the tariff and quota have the same effect?

2. Consider a world of two countries (US, China) with the following demand and supply curves:

US: Demand = $120 - 2P_{cUS}$; Supply = $P_{cUS}$ where $P_{cUS}$ is the price of cloth in US;

China: Demand = $80 - 2P_c$; Supply = $3P_c$ where $P_c$ is the price of cloth in China;

a) Assuming free trade (no tariffs), find the equilibrium price and quantities traded.

b) First, show how a US tariff of 10 affects the volume of trade, prices in China and the US, and welfare in each country. Who pays for the US tax? Explain.

(i) What would happen if the US replaced the tariff with an import quota of 26.25?

c) Now, consider the effect of a US tariff of $t$ on cloth imports (where $t$ can be any number). Show how prices in each country change as the tariff changes.

(i) How does the tariff affect China’s welfare (sum of consumer and producer surplus)?
(ii) How does the tariff affect US welfare? (sum of consumer and producer surplus and government tariff revenue)? Could the US gain from this tariff? If so, explain why.
(iii) Find the tariff that maximizes US welfare (if you can’t do this using calculus, try using a spreadsheet to calculate the optimal tariff).
(iv) Suppose the U.S. import tariff were eliminated, but a Chinese export tariff of equal size were implemented. How would this affect the level of trade, US prices, and US welfare? Explain.

3. Use the model of problem 1 to compare the effects of production subsidies and import tariffs. In particular, let the demand and supply curves, and the world price, be the same as in problem 1. Suppose the objective of the government is to increase domestic production (supply) to 40 units.

   a) Find how this goal can be achieved with a tariff, find the impact on domestic prices, consumption, and find the overall welfare loss from the policy.

   b) Find how this goal can be achieved with a production subsidy, find the impact on consumption and find the overall welfare loss from this policy.

   c) Which of the two policies achieves the goal more efficiently? Provide an economic explanation for this result.

4. (Import and export tariffs/subsidies). Consider the "general equilibrium" model from Problem Set 3, Question 1. Assume a small country with the following production functions and preferences (utility function):

   \[ Q_f = 3\sqrt{L_f}; \quad Q_c = 9L_c; \quad L_f + L_c = 100 \]

   \[ U = D_c + 20D_f - \left( \frac{D_f^2}{2} \right) \]

   As shown in the answers to that problem set, the supply and demand curves are given by:

   Supply: \[ Q_f^* = \left( \frac{P_f}{2P_c} \right); \quad Q_c^* = 900 - \left( \frac{P_f^2}{4P_c^2} \right) \quad \text{provided:} \quad \left( \frac{P_f}{P_c} \right) \leq 60 \]

   Demand: \[ D_f = 20 - \left( \frac{P_f}{P_c} \right); \quad D_c = \left( \frac{I - P_f \left( 20 - \left( \frac{P_f}{P_c} \right) \right)}{P_c} \right); \quad \left( \frac{P_f}{P_c} \right) \leq 20 \]

   where \( I \) denotes income. Further, the autarky relative price is given by: \( \left( \frac{P_f}{P_c} \right) = \left( \frac{40}{3} \right) \)

   Suppose the world prices are such that: \( P_c^w = 1, \quad P_f^w = 5 \) (of course, only relative prices matter). Thus, under free trade the country would import good \( F \).

   a) Show how an import tariff of 20% (of the world price of good \( F \)) affects domestic prices, and domestic production and consumption of each good.

   b) Show how an export tariff of 20% (of the domestic price of \( C \)) affects domestic prices, and domestic production and consumption of each good. Compare to (a). Is there a difference (in real terms) between the import tariff and the export tariff?

   c) Finally, suppose the country imposes an import tariff of 20% (of the world price of \( F \)) and an export subsidy of 20% (of the world price of \( C \)). What is the overall impact of this policy? Does
it make sense to use both import tariffs and export subsidies? What are the real and nominal effects of such policies?