**PART A: Taxes and perfectly competitive markets**

We have ignored the government’s role in the economy for a vast majority of the course. Now we will relax this assumption, and allow the government to intervene in the market. The rule of thumb is that,

IF the demand and supply curves incorporate all the benefits and costs within a market, THEN government intervention almost always causes a DEADWEIGHT LOSS.

The questions in PART A deal with perfectly competitive markets with no externalities. Please keep in mind the assumptions that we are making while you are doing the questions. Ask yourself, how will my answers change if supply was perfectly inelastic? If supply was perfectly elastic? If demand was perfectly inelastic? If demand was perfectly elastic?

1. The following market for beer is initially in equilibrium. The government wants to raise tax revenue to compensate for the state’s large budget deficit. The government places a $1 per-unit tax on the market for beer. Assume the tax is on producers. Show graphically the effects of this excise tax. Label the price consumers pay after the tax as \( P_1 \), the price the producers receive after the tax as \( P_2 \), and the quantity of beer purchased after the tax as \( Q' \).
2. Calculate numerical values for P1, P2, and Q’.

3. Calculate before-tax consumer surplus.

4. Calculate after-tax consumer surplus.

5. Calculate loss or gain in consumer surplus after the tax.

6. Calculate before-tax producer surplus.

7. Calculate after-tax producer surplus.

8. Calculate loss or gain in producer surplus after the tax.

9. How much tax revenue is collected?
10. Calculate dead-weight loss before the tax.

11. Calculate dead-weight loss after the tax.

12. Calculate the consumer tax burden.

13. Calculate the producer tax burden.

14. Who has the largest tax burden?
HELP SHEET for PART A

Practical Definitions:

**Pa** is the reservation price for consumers in the market. **Pa** is also the highest price consumers are willing and able to buy.

**Pb** is the lowest price for producers in the market. **Pb** is also the lowest prices producers are willing and able to sell.

**P** is the initial market price equilibrium before taxes.

**Q** is the initial market quantity equilibrium before taxes.

**P1** is the price that consumers pay after taxes.

**P2** is the price that producers receive after taxes.

**Q’** is quantity purchased and sold after taxes.

Formulas:

Tax Size = Pc - Ps

Tax Revenue = (Pc - Ps)(Q1)

Keep in mind that the government cannot tax something that is not sold or purchased. Therefore the government cannot tax up to Q**.

CS = area above price paid by consumers, below demand curve, and up to quantity purchased.

PS = area below price received by producers, above supply curve, and up to quantity sold.
PART B: Taxes and negative externalities

We assumed in PART A that the demand and supply curves incorporate all the benefits and costs within a market. However this is not always true. PART B deals with the same beer market but with a negative externality (i.e. traffic accidents). Here are some rules of thumbs,

- MSC = MPC + MEC (Marginal social cost is sum of the marginal private cost and marginal external cost)
- MSC = P tells me P* and Q* (Social optimum)
- MPC = P tells me Pc and Qc (Market optimum)

The market creates dead-weight loss when left unregulated. The government can intervene and shrink the dead-weight loss. PART B shows the necessity of government in markets with externalities. Please keep in mind the assumptions that we are making while you are doing the questions. Ask yourself, how will my answers change if the government overtaxes? If the market had only one firm (i.e. monopoly)? If marginal external cost was increasing at every level of output? If marginal social cost and marginal private cost had different slopes?

1. The marginal external cost (MEC) of beer is $1 at every level of output (Q). In other words, MEC is constant at every level of Q. Sketch and label the marginal social cost curve (MSC). Label the marginal private cost curve (MPC). Label the socially optimal price (P*) and quantity (Q*). Label the market equilibrium price (Pc) and quantity (Qc).
2. Calculate numerical values for \( P^* \), \( Q^* \), \( P_c \), \( Q_c \).

3. Calculate socially optimal consumer surplus.

4. Calculate market equilibrium consumer surplus.

5. Calculate socially optimal producer surplus.

6. Calculate market equilibrium producer surplus.

7. Calculate total external cost at social optimum.

8. Calculate total external cost at market equilibrium.

10. Propose a per-unit tax that will completely eliminate the dead-weight loss. Be specific.

11. Calculate tax revenue.

12. Calculate the dead-weight loss after the per-unit tax.

13. Are there still traffic accidents after the government intervenes in the market?
HELP SHEET for PART B

Practical Definitions:

- $P^*$ is the socially optimal price.
- $Q^*$ is the socially optimal quantity.
- $P_c$ is the market price.
- $Q_c$ is the market quantity.

### Table

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<th>Social Optimum</th>
<th>Market Equilibrium</th>
<th>Government Tax</th>
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