(1) Recall from problem set #4 the demand and supply for my new music CD *Steve Cuellar Sings Abba’s Greatest Disco Hits* given by the following:

\[ Q^d = 200 - 4P \]
\[ Q^s = -50 + 5P \]

Suppose that production of the CD creates a toxic emission and imposes a cost on society given by \( MEC = \frac{Q}{5} \).

(a) Based on your answers in homework #3, what is the competitive equilibrium price and quantity. Show graphically.

\[ P = $30 \]
\[ Q_C = 80. \]

(b) Based on your answers in homework #3, what is the efficient quantity. Show graphically.

\[ Q_E = 57.143 \]

(c) Construct a Pigouvian tax that will internalize the externality and result in the efficient output. Explain.

The tax should be equal to the MEC at the efficient output,

\[ MEC (57.143) = 57.143/5 = $11.43 \]

(d) Impose the Pigouvian tax on sellers and calculate the price paid by consumers, the net price retained by sellers and the tax revenue. Show graphically and explain fully.

\[ Q^D = 200 - 4P^C \]
\[ Q^S = -40 + 4P^N, \text{ where } P^C = P^N + T \text{ or } P^N = P^C - T. \]
\[ 200 - 4P^C = -40 + 4(P^C + T) \]
\[ P^C = 30 + \frac{1}{2} T \implies P^C = $35.71 \]
\[ P^N = 30 - \frac{1}{2} T \implies P^N = $24.29 \]
(e) What is the efficient level of damage resulting from playing the CD? Show graphically and explain fully.

The efficient level of damage is equal to the triangular area \( \frac{1}{2} \times 57.143 \times 11.43 = 326.57 \)

(f) Suppose instead that the Pigouvian tax is levied on consumers and not sellers. Calculate the resulting price paid by consumers, net price retained by sellers and the tax revenue. Show graphically and explain fully.

\[ Q_D = 200 - 4P_C \\
Q_S = -40 + 4P^N \text{, where } P_C = P^N + T \text{ or } P^N = P_C - T. \\
200 - 4P_C = -40 + 4(P_C + T) \\
P_C = 30 + \frac{1}{2}T \\
P^N = 30 - \frac{1}{2}T \\
P_C = $35.71 \\
P^N = $24.29

(g) Do your answers in d and f differ? Explain. The answers are the same. It does not matter who the tax is imposed on, the results to consumers and producers are the same.
Suppose that instead of emitting a toxic fume in production, listening (i.e., consumption) to the CD imposes considerable pain and suffering on those around you. The MEC of consumption is given by \( \text{MEC} = \frac{Q}{5} \).

(h) Show graphically how this changes your answer to a & b above.

(i) Construct a Pigouvian tax that will internalize the externality and result in the efficient output. Explain.

The tax should be equal to the MEC at the efficient output,

\[ \text{MEC} (57.143) = \frac{57.143}{5} = \$11.43 \]

(j) Impose the Pigouvian tax on consumers and calculate the price paid by consumers, the net price retained by sellers and the tax revenue. Show graphically and explain fully.

If consumers pay the tax, then they pay a market price of \( P^N \) to producers and then consumers remit the tax \( T \) to the government.

\[ Q^D = 200 - 4P^C \]
\[ Q^S = -40 + 4P^N, \text{ where } P^C = P^N + T \text{ or } P^N = P^C - T. \]
\[ 200 - 4P^C = -40 + 4(P^C + T) \]
\[ P^C = 30 + \frac{1}{2} T \]
\[ P^N = 30 - \frac{1}{2} T \]
\[ P^C = \$35.71 \]
\[ P^N = \$24.29 \]

(k) What is the efficient level of damage resulting from playing the CD? Show graphically and explain fully.

The efficient level of damage is \( \frac{1}{2} (57.143)(50 - 24.29) = \$734.57 \)
(l) Suppose instead that the Pigouvian tax is levied on producers and not consumers. Calculate the resulting price paid by consumers, net price retained by sellers and the tax revenue. Show graphically and explain fully.

See part d.

(m) Do your answers in k and l differ? Explain.
No, see the answer to g.
Suppose that instead of a tax, a Coasian solution is proposed. Assume the negative externality is in production.

(n) If producers of the CD are granted the property rights to the airwaves, what is the minimum amount needed for them to reduce output to the efficient level? What is the maximum amount that third party participants would be willing to pay to reduce output? Can a Coasian bargaining solution result in the efficient output?

The minimum amount the firm would accept to reduce output to the efficient level is equal to the reduction in profit = \( \frac{1}{2} (80 - 57.143)(35.71 - 24.29) = $130.51 \).

The maximum amount that affected third party participants would be willing to pay to reduce output to the efficient level is equal to the welfare cost they incur which is $313.47.

Clearly, the willingness to pay is greater than the minimum cost required to reduce output so that there is room for a Coasian bargain.

(o) If third party participants are granted the rights to the airwaves, what is the minimum amount they would accept to allow the efficient quantity of output? What is the maximum amount that CD sellers would be willing to pay to produce the CD? Can a Coasian bargaining solution result in the efficient output?

If third party participants are granted property rights to the airwaves, they will not allow any output. To allow for output to be produced, third party participants would have to be paid the MEC of each unit of output. To produce the efficient output, they would have to be paid at least \( \frac{1}{2} (57.143)(11.43) = $326.57 \).

Sellers would be willing to pay up to the amount of their profits from the sales which would be \( \frac{1}{2} (80)(50-10) - \frac{1}{2} (80 - 57.143)(11.43) = $1,469.37 \).

Clearly, the willingness to pay is greater than the minimum cost required to reduce output so that there is room for a Coasian bargain.