ECO 101A: Tutorial # 11

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1. Consider a farmer who is selling his crop to a perfectly competitive market at price P_c. He has a linear marginal cost function. Over-production of farm output causes environmental damage, but it starts after a threshold level of agricultural production (say, Q_T). After the threshold level, damage is proportional to agricultural output.
   a) Represent the situation in a labelled graph.
   b) Find the profit-maximizing output (say, Q_1) and socially optimal output (say, Q_0).
   c) What is the level of social welfare and deadweight loss in this case? Mark various geometric areas with alphabets ('A', 'B' etc.) and express social welfare and deadweight loss in terms of these alphabets.
   d) Show the impact of Pigovian tax on farmer's cost in this diagram.

2. Suppose a competitive refining industry produces one unit of waste for each unit of refined product. The industry disposes of the waste by releasing it into the atmosphere. The inverse demand curve for the refined product (which is also the marginal benefit curve) is $P_d = 24 - Q$, where Q is the quantity consumed when the price consumers pay is P_d. The inverse supply curve (also the marginal private cost curve) for refining is $MPC = 2 + Q$, where MPC is the marginal private cost when the industry produces Q units. The marginal external cost curve is $MEC = 0.5Q$.
   a) What are the equilibrium price and quantity for the refined product when there is no correction for the externality?
   b) How much of the chemical should the market supply at the social optimum?
   c) How large is the deadweight loss from the externality?
   d) Suppose the government imposes an emissions fee of \$T per unit of emissions. How large should the emissions fee be if the market is to produce the socially efficient amount of the refined product?

3. Gotham City has a competitive chocolate industry with the (inverse) supply curve $P_s = 440 + Q$. While the market demand for chocolate is $P_d = 1200 - Q$, there are external benefits that the citizens of Gotham City derive from having a chocolate smell wafting through town. The marginal external benefit schedule is $MEB = 6 - 0.05Q$.
   a) Without government intervention, what would be the equilibrium amount of chocolate produced?
   b) What is the socially optimal amount of chocolate production?
   c) How large is the deadweight loss from the externality?
   d) If the local authority used a subsidy of \$S per unit to encourage the optimal amount of chocolate production, what level should that subsidy be?