Delhi School of Economics
MICROECONOMIC THEORY
Problem Set 1

1. The demand and supply functions in a market are given by

$$q_d = a - bp$$
$$q_s = cp$$

where a, b, c are positive constants.

(a) Calculate the equilibrium market price and quantity in the absence of any government intervention.

(b) Suppose the government imposes a price floor $\underline{p}$, which is higher than the equilibrium price. Calculate the deadweight loss assuming sellers only produce an amount equal to the quantity demanded at the controlled price.

(c) A producers' lobby can influence the government to set a price floor that maximizes producers' surplus rather than social surplus. What price floor will the lobby recommend?

(d) Suppose instead of directly controlling the price, the government initiates a price support programme. The objective is to purchase a certain quantity x from the market so that the resultant equilibrium price is $\underline{p}$. Calculate x as a function of $\underline{p}$. Also calculate the deadweight loss created by the programme, assuming the quantity procured by the government is not consumed by anyone (it is either costlessly stored or destroyed).

2. Consider the linear demand and supply functions above. Suppose the government imposes a price ceiling $\bar{p}$, which is below the equilibrium price. However, the amount produced by firms at the official controlled price is captured by unscrupulous middlement who sell it to consumers on an illegal but competitive black market. Calculate the black market price, the reduction in consumers' surplus, profits made by the black marketeers and the social deadweight loss.

3. For the linear demand and supply functions above, introduce a sales tax t, which is a fraction of the market price p, i.e., the tax obligation per unit bought and sold is pt.

(a) Show that tax incidence is independent of whether buyers or sellers have to pay the tax.

(b) Calculate the tax burden on both sides of the market, i.e., how much the effective price paid by buyers or received by sellers changes as a function of t.

(c) What value of t maximizes social surplus?

(d) What value of t maximizes tax revenue?

4. The captain of a cricket team must choose the proportion x of his team that should be batsmen, and the proportion y that should be bowlers. We ignore wicket keepers and allrounders, so that $x + y = 1$, and assume that x can be any real number in the $[0, 1]$ interval. The captain's objective is to maximize the run difference between his side and the opposing team. The runs scrored by his own team is given by some function $b(x, \theta)$, while the runs scored by the opponents is another function $f(y)$, where θ is some parameter which represents the opponent's bowling strength (for any given x, the team scores fewer runs when θ is higher). Both functions are twice continuously differentiable in their arguments.

Using the optimization techniques you have learned, try to answer the following question: if the team is playing a stronger bowling side this week compared to last week (θ is higher), should the captain take more batsmen than he did last week or fewer? What assumptions do you need to make on the properties of the run scoring functions to answer this question unambiguously?