Assignment 3
Solutions.

True or False. If either supply or demand is perfectly inelastic, a per unit tax on producers will not create any dead weight loss[1]. (3 points, use diagrams for full marks)

For full marks you had to show both cases on diagram, indicating clearly what happens the after the tax: in both cases quantity does not change, but whoever has the perfectly inelastic curve will end up bearing the entire tax burden (the question does not ask for the after tax price, however without telling what happens after the tax you cannot argues about the DWL). Since DWL of taxation is $\frac{1}{2}t(Q^* - Q_t)$ in both cases DWL is zero.

Problem 1. (4 points).
Market demand is $P^D = 15 - .75Q$ and market supply is $P^S = .25Q$.

a) Suppose government imposes a quota of 10 units. Calculate the market price and quantity after the quota is imposed. Use a diagram to show the welfare impact of the quota: who gained and who lost as a result of the quota, show the dead weight loss on the diagram.

b) Now suppose that government introduces a price floor in this market: the price is not allowed to go below 7.5. What will be resulting market price and quantity in this case? Show the impact of this policy on a diagram.

   In both cases P=7.5 and Q=10. If you draw the diagram for the price floor carefully, you will see that price floor will have exactly the same impact as the quota in this particular case: the DWL and changes in CS and PS will be exactly the same. Consumers are hurt in both cases as both policies result in smaller quantity and higher price, which reduces CS. The objective of both policies would be to benefit the producers by keeping the price high thus increasing the producer's surplus. However, for producers it is not a pure gain: part of PS is destroyed by smaller quantity traded in the market (part of the initial PS will be the DWL).

Problem 2. (10 points)
Consider a competitive market with demand given by $P^D = 100 - 2Q$ and supply given by $P^S = 10 + Q$.

a) Find competitive equilibrium price and quantity P^* and Q^*. What are the consumer and producer surplus? $Q* = 30$, $P^* = 40$

b) Suppose government introduces as per unit tax of $t = 15$ on producers. Find the quantity traded in the market after tax Q_t. Find the price paid by consumers P_t and price received by producers after tax P_S. *As we discussed in the lecture, the tax will create discrepancy between the price paid by the consumers and price received by the producers equal to the amount of the per unit tax, therefore in the equilibrium that the market will reach after the tax the following must be true:*

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[1]You need two diagrams: one for inelastic supply and the other one for the inelastic demand.

$P^D = P^S + t$, after substitution of the demand and supply curves and the amount of tax obtain:

$100 - 2Q = 10 + Q + 15$, which solves for $Q = 25$. After tax consumers pay price of 50 and producers receive 35 dollars per unit.

c) Calculate consumer and producer surplus, tax paid by consumers, tax paid by producers, and the total tax revenue to the government, find the dead weight loss associated with the tax. $CS = 625$, $PS = 312.5$, $DWL = 37.5$, $GR = 375$ *(Check: before tax total welfare is $.5 \cdot 90 \cdot 30 = 1,350$, which is equal to the summation of the above.)*
   Although technically the tax is paid by the producers, after tax the price paid by the consumers increases by 10 dollars compared to no tax, therefore, 10 out of 15 dollars of the tax was effectively shifted to the consumers. In total consumers pay $10 \cdot 25 = 250$ dollars. Producers' price received per unit only dropped by 5 dollars, therefore the producers actually contribute only 125 dollars into the GR.

d) Calculate price elasticity of demand and supply in the competitive market equilibrium using point elasticity formula. Now calculate what percentage of tax revenue is paid by the consumers and what percentage is paid by the producers. What can you say about the relationship between the elasticity of supply and demand and the shares of tax paid by consumers and producers? *Recall the formula for price elasticity of demand $E^D = \frac{\Delta Q}{\Delta P} \cdot \frac{P}{Q}$, therefore elasticity for any linear demand curve will be $E^D = \frac{1}{slope} \cdot \frac{P}{Q}$, where P and Q is a combination of price and quantity along the curve. Same formula for the supply. After substitution of the slopes and competitive equilibrium price and quantity obtain $|E^D| = .67$ and $E^S = 1.33$. Consumers pay 67% of the government revenue while producers pay only 33% (even if the tax is collected directly from the producers!). Once we look at the elasticities it becomes clear why. Demand has lower value of elasticity and therefore is inelastic **compared to supply** and as we have shown in class, the side of the market with less elastic curve will bear higher tax burden.*

e) Show your results on a diagram. In particular indicate competitive equilibrium, after tax quantity and prices, after tax consumer and producer surplus, government revenue and the dead weight loss.