

Problem Set #9
Econ. 2106H, J.L. Turner

- 1) Find the **Nash Equilibrium** in this Prisoner's Dilemma:
- There are two prisoners, Paul and Tim
 - There are two strategies: to confess or to deny
 - Numbers in the table represent the number of years in jail Paul and Tim will receive corresponding to the strategies they choose (Paul, Tim)

		Tim	
		Confess	Deny
Paul	Confess	3,3	0,4
	Deny	4,0	2,2

- 2) Find the **Cournot-Nash Equilibrium**.
- There are two firms: A and B
 - There are three strategies of production: produce 3,4, and 6 units
 - Numbers in the table represent the profits for A and B corresponding to the quantities they produce. They are represented as (A,B).

		B		
		3	4	6
A	3	18,18	15,20	9,18
	4	20,15	16,16	8,12
	6	18,9	12,8	0,0

- 3) Consider a market for widgets where the demand curve is $P=53-4Q$
- a) Consider a monopoly with the following cost functions:
- $$TC=5Q$$
- $$MC=5$$
- i) Find the profit maximizing levels of price and quantity for the monopoly if $MR=53-8Q$
 - ii) Calculate the monopoly's profit level
 - iii) Compute the consumer Surplus associated with the price and quantity levels of the monopoly
- b) Consider a duopoly with the following characteristics:
- Firm 1: $TC_1=5Q_1$
 $MC_1=5$
 $MR_1=53-8Q_1-4Q_2$
 - Firm 2: $TC_2=5Q_2$
 $MC_2=5$
 $MR_2=53-8Q_2-4Q_1$
- i) Derive the reaction functions for firm 1 and firm 2
 - ii) Find the Cournot equilibrium levels of price and quantity for each firm in the duopoly
 - iii) Calculate the profit levels for each firm in the duopoly
 - iv) Compute the consumer surplus associated with the price and quantity levels of the duopoly
- c) Suppose the government imposes a perfectly competitive market equilibrium in this market.
- i) What is the market supply curve?
 - ii) Calculate the market equilibrium price and quantity levels
 - iii) Compute the consumer surplus associated with the price and quantity levels of the perfectly competitive market.
- d) Graphically compare the consumer surpluses computed in parts a), b) and c)

4) Consider a market where the demand curve is $P=24-Q$

a) Consider a monopoly with the following cost functions:

$$TC_1 = (1/2)Q_1^2$$

$$MC_1 = Q$$

- i) Find the profit maximizing levels of price and quantity for the monopoly if $MR=24-2Q$
- ii) Calculate the monopoly's profit level
- iii) Compute the consumer surplus associated with the price and quantity levels of the monopoly

b) Consider a duopoly with the following characteristics:

-Firm 1: $TC_1 = (1/2)Q_1^2$

$$MC_1 = Q_1$$

$$MR_1 = 24-2Q_1-Q_2$$

-Firm 2: $TC_2 = (1/2)Q_2^2$

$$MC_2 = Q_2$$

$$MR_2 = 24-2Q_2-Q_1$$

- i) Derive the reaction functions for firm 1 and firm 2.
- ii) Find the Cournot equilibrium levels of price and quantity for each firm in the duopoly
- iii) Calculate the profit levels for each firm in the duopoly
- iv) Compute the consumer surplus associated with the price and quantity levels of the duopoly

c) Consider a perfectly competitive market with 5 firms with the following characteristics:

$$TC_i = (1/2)Q_i^2$$

$$MC_i = Q_i$$

for $i=1,2,3,4,5$

- i) Calculate the equation for market supply
- ii) Calculate the market equilibrium price and quantity levels.
- iii) Calculate the profit levels for each firm in the perfectly competitive market
- iv) Compute the consumer surplus associated with the price and quantity levels of the perfectly competitive market.

d) Graphically compare the consumer surpluses computed in parts a), b) and c)

e) Graphically compare the total welfares of the monopoly, duopoly, and competitive solutions found in parts a), b), and c)