100 Thanks -mel

UCLA - ENG 110 Midterm

Mel Bulu- Taciroglu

NAME: Akshat Khaitan ID#:______________________

1. (25 points) A company producing in a perfectly competitive industry has the following cost structure:

TFC = 20
TVC(Q) = 50 Q^2

Assume that there are 100 identical companies operating in this industry.

a) **(10 points)** What is the market price if the industry demand is given by P = 2480 - 30Q?

$MC = 100 Q_j = P \Rightarrow Q_j = \frac{P}{100}$; $Q_i = 100 Q_j \Rightarrow Q_i = P$

By demand = supply

$2480 - 30 Q_i^* = Q_i^* \Rightarrow 2480 = 31 Q_i^* \Rightarrow Q_i^* = 80$

$P = 2480 - 30 Q_i^* = 2480 - 30 \times 80 = 2480 - 2400 = 80$ (Ans)

b) **(5 points)** What is the profit obtained by each firm?

$\pi(Q_j^*)$ = Total Revenue − Total Cost

$(Q_i)^* = 80$ ∴ $Q_j^* = Q_i^*/100 = 0.8$

$\pi(Q_j^*) = 80 \times 0.8 - (20 + 50 \times 0.8 \times 0.8) = 64 - 52 = 12$ (Ans)

c) **(10 points)** How will this industry change in the long run? Will there be any entry? If so, let the total number of firms after the entry be x. Write the equation that will solve for x. DO NOT solve the equation as it involves higher order polynomials.

(For ease of calculation assume that any company that enters this industry will have the exact same scale and cost structure as others.)

Yes, there will be entry of firms until the point where each firm make zero economic profit (in the long run).

If there are x firms in the market:

$MC = 100 Q_j = P \Rightarrow Q_j = \frac{P}{100}$) $Q_i = x Q_j \Rightarrow Q_i = \frac{xP}{100} \Rightarrow P = \frac{100 Q_i}{x}$

Demand = Supply $\Rightarrow \frac{100 Q_i^*}{x} = 2480 - 30 Q_i^* \Rightarrow Q_i^* = \frac{2480x}{100+30x} \Rightarrow P = 2480 - 30 \ldots$

$\Rightarrow P = 2480 - 30\left[\frac{2480x}{100+30x}\right]$; $Q_j^* = \frac{Q_i^*}{x}$ & $\pi(Q_j) = 0$ in the long run for firms

$∴ \pi(Q_j^*) = \left[2480 - 30\left(\frac{2480x}{100+30x}\right)\right] \cdot \frac{2480x}{(100+30x)x} - 20 - 50\left[\frac{2480x}{(100+30x)x}\right]^2 = 0$

$\Rightarrow \left[\frac{2480 \cdot 100}{100+30x}\right] \cdot \frac{2480}{100+30x} - 20 - 50\left[\frac{2480}{100+30x}\right]^2 = 0$ (Ans)

10

2. (25 points) There are two firms, A and B, producing a homogenous product, X.
Total quantity demanded (by the entire market) at each price is given in the following table for product X. Ignoring the production costs, and assuming that each firm simultaneously decides how many units to produce, what will be the price in equilibrium?

(Assume that each firm prefers to produce less when the revenue obtained is the same at different quantities.)

Price	Total Quantity Demanded
1	132
2	120
3	108
4	96
5	84
6	72
7	60
8	48
9	36
10	24
11	12
12	0

From the partially filled table (showing the game with different choices) shown below, it is clear that each firm will produce 48 units.

Then, the price will be 4. (since total quantity demanded: 96)

This nash equilibrium exists because when each firm is producing 48 units, there are both making 192 (revenue) each, and have no incentive to deviate

Firm B →

Firm A ↓

Q	0	12	24	36	48	60	72	84	96	108	120	132
0	0,0											
12	132,0	120,120	108,216	96,288								
24	240,0	216,108	192,192	168,252								
36	324,0		252,168	216,216	180,240							
48				240,180	192,192*	144,180						
60					180,144	120,120	60,72					
72						72,60	0,0					
84								0,0				
96									0,0			
120											0,0	
132												0,0

* Nash equilibrium

3. (10 points) A monopolist that produces a non-perishable product has the following cost structure per year where all costs are due at the time of the production.

TFC = 400
TVC(Q) = 8 Q^2 + 12Q

The market demand is currently P = 300-30Q per year.

The demand will change every year so as to have 10% higher price at each quantity.

That is, if today (beginning of year 1) monopolist sells 2 units, it will be able to charge 300-30*2 = $240 per unit. Price will be $240*1.1 = 264 at the end of this year (same as beginning of next year), and, at the end of next year (same as beginning of the following year), it will be 240*1.1*1.1 = $290.4 etc.

Just like the price, the costs are increasing at 10% per year as well.

Assume that the production and sales can take place only at the beginning or end of any given year, not necessarily at the same time. Each year's production has to be sold by the end of that year. That is, year 1's production cannot be sold in year 2 or 3.

Ans: Doesn't matter

a) If the monopolist can borrow and lend at 10% per year, when should the production and sale take place in each of the coming **three** years? (Numerical answer required)

In this case, I would be ~~indifferent to~~ when I produce and sell because I'll be able to make 10% regardless.
If I choose to sell at the beginning of the year, P = 300 - 30Q
If I choose to sell at the end, P = (300 - 30Q) 1.1 … next year dollars).
So P = 300 - 30Q in today dollars (same as before) [$PV = \frac{FV}{(1+r)}$]

-1

Similarly, for the cost, TC = 400 + 8Q^2 + 12Q if I produce today
and TC = $\frac{400 + 8Q^2 + 12Q(1.1)}{(1.1)}$ (same as before) if I produce a year from now
Therefore, it doesn't matter when I produce or sell

Ans: produce → end ✓ sell → beginning

b) If the monopolist can borrow and lend at 12% per year, when should production and sale take place in the coming **three** years? (can be verbally answered, no numerical answer is required)

I would produce at the end of the year and sell in the beginning
So that I can lend @ 12% ~~of my money~~ as opposed to the 10% increase in price
that I would get. Similarly I would produce at the end to make sure that I can
✓ make 12% by lending even if I have to bear a 10% extra cost in production

Ans: produce - beginning sell → end

c) If the monopolist can borrow and lend at 8% per year, when should production and sales take place in the coming **three** years? (can be verbally answered, no numerical answer is required)

I would produce in the beginning and sell at the end so that
I can make 10% in the market (due to 10% increase in price) as opposed to lending at 8%. Similarly,
I would produce early to avoid a 10% rise (in cost) as I can only make 8% in the market by lending.

-1

P

4. (20 points) LATAE Inc. operating in a monopolistically competitive market has a demand for its product given by $P = 84-2Q$ per year. The short run is one year and the corresponding total cost is given by $200 + 5\,Q^2$. All costs are due at the beginning of the year and the price is charged upfront, that is, obtained at the beginning of the year as well. LATAE's best alternative opportunity provides 10% per year in the market.

An international corporation approaches LATAE, today, to purchase the company at a price of 1,000.

Should LATAE sell the company today? Yes

What would be your answer if LATAE's best investment opportunity were to be 4% per year? No

Total revenue at $Q = (84-2Q)Q = 84Q - 2Q^2$

Total cost at $Q = 200 + 5Q^2$

For $Q = Q^*$, MR = MC ⇒ $84 - 4Q^* = 10Q^*$ ⇒ $14Q^* = 84$ ⇒ $Q^* = 6$

Profit = TR − TC = $84\times6 - 2\times36 - (200 + 5\times36) = 52$

For a market rate = 10%, perpetuity = $52 + \frac{52}{0.1} = 52 + 520 = 572$

Thus, LATAE SHOULD sell the company today at a price of 1000. (Ans 1) [Since 572 < 1000]

If best investment opportunity (market rate) = 4%,

then perpetuity = $52 + \frac{52}{0.04} = 52 + 1300 = 1352$

Thus, since now the firm valuation (in eternity) > 1000, LATAE should NOT sell the company. (Ans 2)

5. (20 points) You have two investment opportunities:

I: Invest 10% in the market per year

~~II:~~ Invest $50,000 today to get 10,000 every two years beginning a year from today, forever.

choose this → Note: Since, it is payable every 2 years, $r = \frac{1}{(1.1)^2}$ and $\left(a = \frac{10000}{1.1}\right.$ because payment is in next year, market rate = 1.1$\left.\right)$

a) Which opportunity would you choose?

If I get $10000 every 2 years beginning a year from today, forever

Total = $\frac{10000}{1.1} + \frac{10000}{(1.1)^3} + \frac{10000}{(1.1)^5} + \ldots$ → Sum by geometric series = $\frac{10000/1.1}{1 - \left(\frac{1}{1.1^2}\right)}$ $\left[\frac{a}{1-r}\right]$ $\left(a = \frac{10000}{1.1}\right)$

TR = $52380.95 ⇒ NPV = $52380.95 − $50000 = $2380.95 in today dollars.

Since I make economic profit when investing in scheme 2, that is what I would choose. [Economic profit = NPV = $2380.95]. Ans ⇒ choose scheme 2

b) How much extra would you be willing to invest today in order to get paid $10,000 per year beginning a year from today, every year?

If I get $10000 per year beginning a year from today, every year,

$PA = \frac{10000}{0.1} = 100000$ (in today dollars)

(in today dollars)

To get an economic profit = $2380.95, ⇒ I would invest

$100,000 − $2380.95 = 97619.05.

Thus, I would be willing to invest ($97619.05 − $50000) = $47619.05 extra for this deal to get the same economic profit as scheme II.

Ans: extra investment = $47619.05