BADM 505 – FIRM ANALYSIS AND STRATEGY

PROBLEM SET THREE QUESTIONS

---

1. You have just leased a new nut grinding machine that has the capacity to produce 100 nuts per day. The daily lease cost on the machine is $405. The market price for one nut is $120. When running the machine, you observe that daily total costs are: TC(Q) = 405 + 20Q + 5Q2, where Q is the number of nuts produced.

a. You have decided to minimize total costs. How much should you produce? What are the total economic profits?

Derivative of tc(q) = 10Q + 20
Q = -2 which is not possible in this case, the minimum integer value for Q (number of nuts) = 1
TC(Q=1) = 405+20(1)+5(1)^2 = $430
Profits = TR – TC = 120 – 430 = -310$

b. You are convinced of the importance of getting as much market share as you can with his existing machine. How much do you produce? What are the total economic profits?

Running at full capacity of 100 nuts per day, TC = 405+20(100)+5(100)^2 = $52,405, TR = 100*120 = $12,000
Profits = TR – TC = 12,000 – 52,405 = -$40,405

c. You now decide to minimize the average total cost of production. How much do you produce? What are the total economic profits?

ATC = TC/Q = 405/Q + 20 + 5Q
MC = derivative (TC) = 20+10Q
at minimum => ATC = MC
Solving for Q: gives Q=9
Profits = 120*9-990 = $90

d. You finally recognize the importance of maximizing profits. How much do you produce? What are the total economic profits? (Hint: price is marginal revenue in this case)

MC = 20+10Q
setting 20+10Q = 120; we get Q = 10 units
profits = 120*10 – (405+200+500) = $95

2. You have decided to leave the hurried life of corporate America, and move to the state of Maine to follow your lifelong dream of lobstering. Congratulations! It turns out that lobstering is a perfectly competitive industry in the state of Maine, so there is there is free entry and exit in the long run. The total daily cost for an individual lobster boat is $TC(q) = 8 + 2q2$, where q is the daily lobster catch (measured in pounds of lobster). There are currently 200 lobster boats in operation. Daily lobster demand is $QD(P) = 416 - 2P$.

a. What is the price of lobster in the short run equilibrium?

p = MC(q) => p = 4q => q = p/4

for 200 lobster, summation of them Qs(p) = 200(p/4) = 50p

Qd(p) = Qs(p)

416 – 2p = 50p

p = 8 dollars

b. How many pounds of lobster are caught (and eaten!) in the short-run equilibrium?

q = p/4 = 2 pounds

c. How much profit does each lobster boat earn?

profits = Tr – TC = 16 – (8+2*4) = 0

d. Suppose that the daily lobster demand suddenly increases to $QD(P) = 624 - 2P$. In the short run, there are still only 200 lobster boats. What impact does the increase in demand have on the price per pound of lobster?

50p = 624 – 2p => p = 12 dollars and q = p/4 = 3 pounds

No impact

e. How much profit does each lobster boat now earn in the short-run equilibrium?

Profit = 0

f. Given your answer to part e, what will be the number of lobster boats in the long run?

For long run

4q = (8+2q2)/q

q = 2

Long run equilibrium price: MC(q) = 4q = 8 dollars

market quantity: Qd(p) = 624 – 2*8 = 608

number of firms => n = 608/2 = 304

3. The market for pencils is easy to enter, but entry takes time. In the short run, the number of firms (and plants) in the industry is fixed. Production occurs in standard sized plants with each plant having an annual total cost of $TC = 400 + q2$ (this includes a normal return on the plant's capital). Currently, no firm owns more than one plant. Pencils are a completely homogenous good and pencils is a perfectly competitive industry.

a. You own one plant among more than a hundred in the industry. Currently, the price of a pencil is P = 100. How many pencils do you produce each year? What price do you charge? What are your annual profits?

MC(q) = 2q = 100
q = 50
P = 100
Profit = 0

b. The demand in the market is Q = 50000 - 200P. As stated in part a, the price is P = 100. If the market is in short-run equilibrium (meaning each firm is maximizing its profits given that the number of plants is fixed in the short run), how many firms are in the market?

Q(p=100) = 50000 – 200P = 30,000
q = 50
Number of firms = 30,000/50 = 600 firms

c. What is the short run industry supply function?
MC(q) = 2q or q = p/2 and for 600 firms = 600 (p/2) = 300p

d. Explain why this market is not in long-run equilibrium. Derive the long-run equilibrium in this market. What is the equilibrium price? What is the equilibrium quantity sold by each firm? How many firms are in the market?

For long run:

2q = (400+q2)/q
q = 20
p = 40
quantity demanded = 50,000 – 200*40 = 42,000
no of firms = 42000/20 = 2100

e. What is the new short run industry supply function?

Short term average costs will not change

f. Now you find a way to produce pencils more cheaply. Your total cost function is now TC = 200 + $q2/2$. Your technology is unique and cannot be reproduced by others or replicated by you. In the long run, does this discovery increase your profits? Does it lower the market price? Does in change the number of firms in the market?

MC(q) = Q, ATC = TC/q = 200/q + q/2

$Q^2/2 = 200$
Q = 20
P =20
quantity demanded = 50,000 – 200*20 = 46,000
no of firms = 46,000/20 = 2300
Profits = 0 (long run competitive)