Chris Nutter

EGCP 401

CALIFORNIA STATE UNIVERSITY, FULLERTON

Computer Engineering

EGCP 401 – Engineering Economics & Professionalism
(Spring 2021)
Homework no 1 (Due date: 02/10/2021)

Q1-10 A food processor is considering the development of a new product. Depending on the quality of raw material, he can expect different yields process-wise, and the quality of the final products will vary considerably. The product development department has identified three alternatives, which it has produced on a pilot scale. The marketing department has used those samples for surveys to estimate potential sales and pricing strategies. The three alternatives, which would use existing equipment, but different process conditions and specifications, are summarized as follows. Indicate which alternative seems to be the best according to the estimated data, if the objective is to maximize total profit per year.

	Alternative		
	1	2	3
Pounds of raw material A per unit of product	0.05	0.07	0.075
Pounds of raw material B per unit of product	0.19	0.18	0.26
Pounds of raw material C per unit of product	0.14	0.12	0.17
Other processing costs ($/unit product)	$0.16	$0.24	$0.23
Expected wholesale price ($/unit product)	0.95	1.05	1.25
Projected volume of sales (units of product)	1,000,000	1,250,000	800,000
Cost of raw material A $3.45/lb			
Cost of raw material B $1.07/lb			
Cost of raw material C $1.88/lb			

Alternate B yields highest profit

Q1-13 A new warehouse is being planned, and 3 locations are being compared. Factors being considered include local labor cost, taxes, and access to interstate highways. These are summarized in table follows:

Factor	Location 1	Location 2	Location 3	Factor weight
Labor cost	7	6	5	35%
Taxes	8	7	6	25%
Highway access	3	5	8	40%

5.65 5.65 6.45

Which location should be selected?

Location A because it has lowest taxes

Q1-25 A farmer must decide what combination of seed, water, fertilizer, and pest control will be most profitable and environmentally conscious for the coming year. The local agricultural college did a study of this farmer's situation and prepared the following table.

Q1 - 10)

	Volume	$/unit	Revenue
1.	1000000	x 0.95	= 950,000

#	lbs of material	lbs cost raw
1,000,000	x 0.05	x 3.45
+		
1,000,000	x 0.19	x 1.07
+		
1,000,000	x 0.14	x 1.88
+		
1,000,000	x 0.16	
=	$799,000	

A

$950,000 - $799000 = $ 151,000

	Volume	$/unit	Revenue
2.	1250000	x 1.05	= 1,312,500

#	lbs of material	lbs cost raw
1,250,000	x 0.07	x 3.45
+		
1,250,000	x 0.18	x 1.07
+		
1,250,000	x 0.12	x 1.88
+		
1,250,000	x 0.24	
=		

$1,124,625

B

$1,312,500 - $1,124,625 = $ 187,875

3.

	Volume		$/unit		Revenue
	800,000	×	1.25	=	1,000,000

		lbs of material		lbs cost raw
	800,000	× 0.075	×	3.45
+				
	800,000	× 0.26	×	1.07
+				
	800,000	× 0.17	×	1.88
+				
	800,000	× 0.23		
=				$ 869,240

C

$1,000,000 − $ 869,240 = $ 130,760

Plan	Direct Cost/Acre	Extra-market Cost/Acre	Income/Acre
A	$750	$150	$1200
B	$800	$450	$1400
C	$1000	$250	$1500
D	$1300	$200	$1650

The last page of the college's study was torn off, and hence the farmer is not sure which plan the agricultural college recommends. Which plan should the farmer adopt considering:

a) Only the direct cost,
b) Both the direct and extra-market costs?

B has highest profit
A has highest profit

Q1-57 Cathy Gwynn for a class project is analyzing a "Quick Shop" grocery store. The store emphasizes quick service, a limited assortment of grocery items, and higher prices. Cathy wants to see if the store hours (currently 0600 to 0100) can be changed to make the store more profitable.

Time Period	Daily Sales in the Time Period
0600-0700	$40
0700-0800	$70
0800-0900	$120
0900-1200	$400
1200-1500	$450
1500-1800	$500
1800-2000	$600
2000-2200	$200
2200-2300	$50
2300-~~2400~~ 0000	$85
2400-0100	$40

P = profit NP = no profit

(40 x .65) + 23 = 49 $ NP
(70 x .65) + 23 = 68.50 $ P
(120 x .65) + 23 = 101 $ P
(400 x .65) + (23 x 3) = 329 $ P
(450 x .65) + (23 x 3) = 361.5 $ P
(500 x .65) + (23 x 3) = 394 P
(600 x .65) + (23 x 2) = 436 P
(200 x .65) + (23 x 2) = 176 P
(50 x .65) + (23) = 55.5 NP
(85 x .65) + (23) = 78.25 P
(40 x .65) + (23) = 49 NP

The cost of the groceries sold averages 65% of sales. The incremental cost to keep the store open, including the clerk's wage and other operating costs, is $23 per hour. To maximize profit, when should the store be opened, and when should it be closed?

The Store should open at 0700 and close at 2200 hours, to have No loss in profit, but to maximize profit, close at 2400 hours.

Q1-62 A firm is planning to manufacture a new product. As the selling price is increased, the quality that can be sold decreases. Numerically the sales department estimates:

$$P = \$475 - 0.25Q$$

Where P= selling price per unit

Q = quantity sold per year

On the other hand, management estimates that the average unit cost of manufacturing and selling the product will decrease as the quantity sold increases. They estimate

$$C = \$48Q + \$22{,}500$$

$159,505 Profit

Q1 - 25)

A) Direct

A 1200 - 750 = 450

B 1400 - 800 = 600

C 1500 - 1000 = 500

D 1650 - 1300 = 350

B) Extra

1200 - (750+150) = 300

1400 - (800+450) = 150

1500 - (1000+250) = 250

1650 - (1300+200) = 150

Q1 - 62)

Revenue

$P \times Q = (475 - 0.25Q) \times Q$

$= 475Q - 0.25Q^2$

Marginal (derivative) $= \frac{dP}{dQ}(475Q - 0.25Q^2)$

$= 475 - 0.50Q$

Cost $= 48Q + 22{,}500$

Marginal $= \frac{dP}{dQ}(48Q + 22500)$

$= 48$

$475 - 0.50Q = 48$

$-0.50Q = -409$

$.50Q = 409$

$Q = \frac{409}{0.5}$

$Q = 818$

Profit =

$(475 - 0.25Q \times Q) - 48Q + 22500$

$\downarrow$

$475Q - 0.25Q^2 - 48Q + 22500$

$475(818) - 0.25(818)^2 - 48(818) + 22500$

$159,505$ Profit

Where C= cost to produce and sell Q per year

The firm's management wishes to maximize profit. What quantity should the decision makers plan to produce and sell each year and what profit will be earned?

Q2-6 CleanTech Manufactures equipment to mitigate the environmental effects of waste

a) If Product A has fixed expenses of $15,000 per year and each unit of product has a $0.20 variable cost, and Product B has fixed expenses of $5,000 per year and a $0.50 variable cost, at what number of units of annual production will A have the same overall cost as B?
b) As a manager at CleanTech what other data would you need to evaluate these two products?

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Q2-23 A firm believes a product's sales volume (S) depends on its unit selling price (P) as S=100-P. The production cost (C) is $1,000+10S.

a) Graph the sales volume (S) from 0 10 100 on the x axis, total cost and total income from $0 to $2500 on the y axis, C=$1000+10S, and plot the curve of total income. Mark the breakeven points on the graph.
b) Determine the breakeven point (lowest sales volume at which total sales income just equals total production cost).
c) Determine the sales volume (S) at which the firm's profit is a maximum.

q_2-6)

a)

$5000 + 0.50x = 10000 + 0.20x$

$0.30x = 10000$

$x = \frac{10000}{.30}$

Round up for units

$x = 33333.33^{\wedge}$

$x = 33334$ units

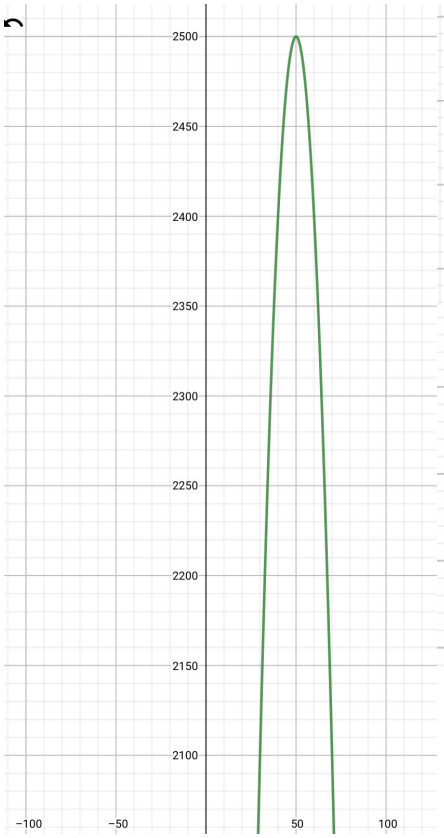
b) The Manager should evaluate the profit of each product specifically and the lifespan of each product.

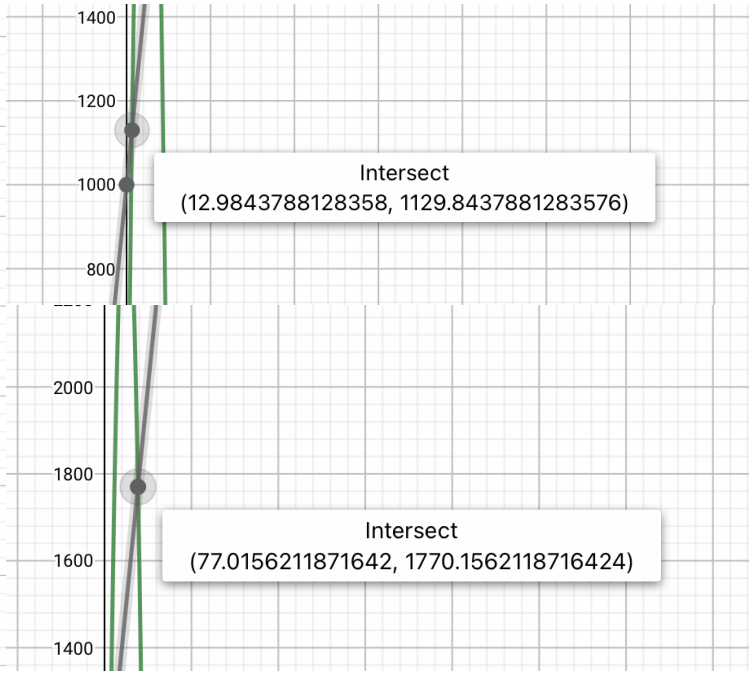
Q2-23)

a) $C = 1000 + 10s$

$P = 100 - s$

$P \times s = (100 - s)(s) = 100s - s^2$





$S = 12.98438$

$S = 77.01562$

B) 12.98 is needed to break even.

C) $(100s - s^2) - (1000 + 10s) = -s^2 + 90s - 1000$

$$\frac{dP}{ds}\left(-s^2+90s-1000\right) = -2s+90$$

$$= 2s = 90$$

$$s = 45$$

Sales profit is maximum at 45.