

CALIFORNIA STATE UNIVERSITY, FULLERTON

Computer Engineering

EGCP 401 – Engineering Economics & Professionalism

(Fall 2020)

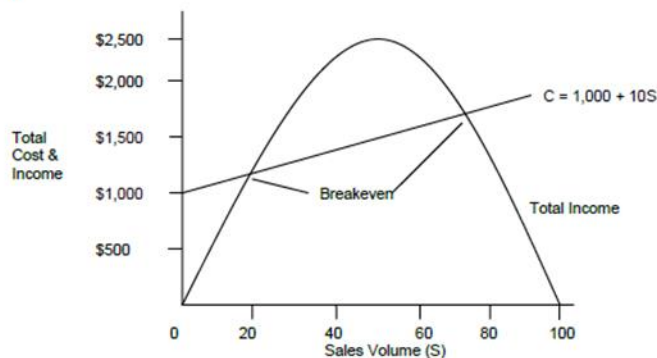
Homework no 2 (Due date: 09/18/2020)

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 $\$1,000+10S$.

- Graph the sales volume (S) from 0 to 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.
- Determine the breakeven point (lowest sales volume at which total sales income just equals total production cost).
- Determine the sales volume (S) at which the firm's profit is a maximum.

2-23

a)



- b) For breakeven, set Profit = 0
 $-S^2 + \$90S - \$1,000 = \$0$

$$S = \frac{-b \pm (b^2 - 4ac)^{1/2}}{2a} = \frac{-\$90 \pm (\$90^2 - (4)(-1)(-1,000))^{1/2}}{-2} = 12.98, 77.02$$

- c) For maximum profit
 $dP/dS = -\$2S + \$90 = \$0$
 $S = 45$ units

Answers: Breakeven at 13 and 77 units. Maximum profit at 45 units.

Alternative Solution: Trial & Error

Price	Sales Volume	Total Income	Total Cost	Profit
\$20	80	\$1,600	\$1,800	-\$200
\$23	77	\$1,771	\$1,770	\$0 (Breakeven)
\$30	70	\$2,100	\$1,700	\$400
\$50	50	\$2,500	\$1,500	\$1,000
\$55	45	\$2,475	\$1,450	\$1,025
\$60	40	\$2,400	\$1,400	\$1,000
\$80	20	\$1,600	\$1,200	\$400
\$87	13	\$1,131	\$1,130	\$0 (Breakeven)
\$90	10	\$900	\$1,100	-\$200

Q2-34 A pump has failed in a facility that will be completely replaced in 3 years. A brass pump costing \$6,000 installed will last 3 years. However, a used stainless steel pump that should last should last 3 more years has been sitting in the maintenance shop for a year. The pump cost \$13,000 new. The accountant say the pump is worth \$7000 now. The maintenance supervisor says that it will cost an extra \$500 to reconfigure the pump for the new use and that he could sell it used (as is) for \$4000.

- a) What is the book cost of the stainless steel pump?
- b) What is the opportunity cost of the stainless steel pump?
- c) How much cheaper or more expensive would it be to use the stainless steel pump rather than a new brass pump?

2-34

- a) \$7000 The book cost results strictly from depreciation and can be more or less than the market value.
- b) \$4000 The pump could be sold for this amount. If the pump is used instead, then it would be viewed as an opportunity foregone.
- c) $\$6000 - 4000 - 500 = \1500 cheaper than buying the brass pump.

Q2-47 SungSam, Inc. is designing a new digital camcorder that is projected to have the following per-unit costs to manufacture:

Cost Categories	Unit Costs
Material costs	\$63
Labor costs	\$24
Overhead costs	\$110
Total unit cost	\$197

SungSam adds 30% to its manufacturing cost for corporate profit

- a) What unit profit would SungSam realize on each camcorder?
- b) What is the overall cost to produce a batch of 10,000 camcorders?
- c) What would SungSam's profit be on the batch of 10,000 if historical data show that 1% of product will be scrapped in manufacturing, 3% of finished product will go unsold, and 2% of sold product will be returned for refund?
- d) How much can SungSam afford to pay for a contract that would lock in a 50% reduction in the uni material cost previously given? If SungSam does sign the contract, the price will not change.

2-47

- a) Unit Profit = \$197 (0.30) = \$59 or
 = Unit Sales Price - Unit Cost
 = \$197 (1.3) - \$197 = \$256 - \$197 = \$59
 - b) Overall Batch Cost = \$197 (10,000) = \$1,970,000
 - c) Of the 10,000 batch:
 - 1. (10,000) (0.01) = 100 are scrapped in mfg.
 - 2. (10,000 - 100) (0.03) = 297 of finished product go unsold
 - 3. (9,900 - 297) (0.02) = 192 of sold product are returned
 - Total = 589 of original batch are not sold for profit

Total Batch Revenue = (10,000 - 589) \$256 = \$2,409,216
 Overall Batch Profit = \$2,409,216 - \$1,970,000 = \$439,216
 - d) Unit Cost = \$63 (0.50) + \$24 + \$110 = \$165.50
 Batch Cost with Contract = 10,000 (\$165.50) = \$1,655,000
 Difference in Batch Cost:
 = BC without contract- BC with contract = \$1,970,000 - \$1,655,000
 = \$315,000
- SungSam can afford to pay up to \$315,000 for the contract.

Q2-50 Fifty years ago, Grandma Bell purchased a set of gold-plated dinnerware for \$48, and last year you inherited it. Unfortunately, a fire at your home destroyed the set. Your insurance company is at a loss to define the replacement cost and has asked your help. You do some research and find that the Aurum Flatware Cost Index (AFCI) for gold-plated dinnerware, which was 127 when Grandma Bell bought her set, is at 1989 today. Use the AFCI to update the cost of Bell's set to today's cost to show to the insurance company.

2-50

$$C_A/C_B = I_A/I_B$$

$$C_{50 \text{ YEARS AGO}}/C_{\text{TODAY}} = \text{AFCI}_{50 \text{ YEARS AGO}}/\text{AFCI}_{\text{TODAY}}$$

$$C_{\text{TODAY}} = (1,989/127) (\$48) = \$752$$

Q2-66 New technicians in an oncology department process patients at rates shown below. Steady state occurs at the eighth unit.

Patient Number	1	2	3	4	5	6	7	8
Process Time (min)	84	76	61	54	50	48	45	43

- a) Calculate the learning curve rate for units 1-8.
- b) What is the total time needed to process 11 patients?

2-66

We are given T_1 but we do not know the learning rate, R . We can solve for it using one of the given points:

$$T_2 = T_1 \times 2^{\log(R)/\log(2.0)} \quad 76 = 84 \times 2^{\log(R)/\log(2.0)}$$

$$\log_2(76/84) = \log(R)/\log(2) \quad \log(2) \times \log_2(76/84) = \log(R)$$

$$-0.04347 = \log(R) \quad R = 10^{-0.04347} = 0.9048 = 90.5\%$$

With any real-world data, we will not be able to find a single learning rate that will actually fit all of the data. Another approach is to estimate the learning rate for the available data and average the results. Doing this results in a value of 81.7%

	A	B	C	D	E
1	84 Time to complete first task				
2					
3	N	Target Time	Solve For Learning Rate	Est. Learning Rate	TN (Hours)
4	1	84		81.8%	84
5	2	76	0.9048	81.8%	69
6	3	61	0.8172	81.8%	61
7	4	54	0.8018	81.8%	56
8	5	50	0.7998	81.8%	53
9	6	48	0.8053	81.8%	50
10	7	45	0.8007	81.8%	48
11	8	43	0.8000	81.8%	46
12	9			Steady State	43
13	10				43
14	11				43
15	Average Rate		0.8185	Total Time	596

Applying this learning rate, results in task times above. The total time to process 11 patients will be 596 hours.

Q3-5 Calculate the interest and total amount due at the end of the loan for both simple and compound interest.

	Loan	Years	Rate
(a)	\$ 1000	2	5%
(b)	\$ 1500	5	6%
(c)	\$10,000	10	10%
(d)	\$25,000	15	15%
(e)	\$47,750	20	20%

3-5

Part	i	N	Loan	Simple Interest		Compound Interest	
				Amount Due	Interest Paid	Amount Due	Interest Paid
a	5.0%	2	\$1,000	\$1,100	\$100	\$1,102.50	\$102.50
b	6.0%	5	\$1,500	\$1,950	\$450	\$2,007.34	\$507.34
c	10.0%	10	\$10,000	\$20,000	\$10,000	\$25,937.42	\$15,937.42
d	15.0%	15	\$25,000	\$81,250	\$56,250	\$203,426.54	\$178,426.54
e	20.0%	20	\$47,750	\$238,750	\$191,000	\$1,830,620.40	\$1,782,870.40

Q3-11 A firm borrowed \$5,000,000 for 5 years at 10% per year compound interest. The firm will make no payments until the loan is due, when it will pay off the interest and principle in one lump sum. What is the total payment?

3-11

	A	B	C	D	E	F	G	H	I
46	<i>i</i>	<i>N</i>	<i>PMT</i>	<i>PV</i>	<i>FV</i>	Solve for	Answer	Formula	
47	10.0%	5		\$5,000,000		FV	\$8,052,550	=FV(A47,B47,C47,D47)	

Two possible approaches to solve this problem are as follows:

- 1) $F = \$5,000,000 (F/P, 10\%, 5) = \$5,000,000 (1.611) = \$8,055,000$
- 2) $F = \$5,000,000 (1 + 0.1)^5 = \$5,000,000 (1.611) = \$8,055,000$