Assignment 1 Solutions

EECE/CPEN 481

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Selected problems listed below are based on textbook problems or directly drawn from the textbook (Engineering Economic Analysis: Fourth Canadian Edition).

Problems are drawn mainly from material in Chapters 1 and 3.

1. Based on Problem 1-36
2. Based on Problem 1-46
3. Based on Problem 1-73
4. Based on problem 3-16
5. Based on Problem 3-64 (2x value)

Solutions shown in blue type.

1. Based on Problem 1-36

If you rent a car you can (1) return it with a full gas tank, (2) return it without filling it and pay $1.80/litre, or (3) accept a fixed price of $60 for gas, no matter how much you use. The local price is $1.50/litre for gasoline, and you expect this car to get 8.5L/100 km. The car has a 75-litre tank. How much would each option cost (rounded to nearest cent), and which option is the best, if you expect to drive:

(a) 250 km?
(b) 400 km?
(c) 800 km?
(d) How do your answers change if stopping at the filling station takes 15 minutes and your time is worth $30/hour?

	Distance Driven (KM)		
	250	400	800
Gas consumed (L)			
Option 1: Return fully refueled			
Option 2: Have them refuel it			
Option 3: Fixed charge for fuel			

Solution:

The best approach is to construct a matrix showing the payoff for each strategy for each possible distance driven. Note that even the longest distance driven, 800 km, will require only 68 liters of gas, which is within the capacity of the tank.

	Distance Driven (KM)		
	250	400	800
Gas consumed (L)	21.25	34.00	68.00
Option 1: Return fully refueled	**31.88**	**51.00**	102.00
Option 2: Have them refuel	38.25	61.20	122.40
Option 3: Fixed charge for fuel	60.00	60.00	**60.00**

Best option at each driving distance is marked in bold in table above.

If we charge for the time required to fill up the gas tank, we add a new line to the matrix. This changes the best option in some situations.

	Distance Driven (KM)		
	250	400	800
Gas consumed (L)	21.25	34.00	68.00
Return Full (original option, for reference)	31.88	51.00	102.00
Option 1: Return Full, charge for time	39.38	**58.50**	109.50
Option 2: Have them refuel it	**38.25**	61.20	122.40
Option 3: Fixed charge for fuel	60.00	60.00	**60.00**

Best option at each driving distance is marked in bold in table above.

2. Based on Problem 1-46

A new machine comes with 200 free service hours over the first year. Additional time costs $120 per hour. What are the average and marginal costs per hour for the following quantities of service hours?
(a) 250
(b) 350
(c) 500

Solution:
(a) 250 hours
   Average cost = (50)($120) / 250 = $24
   Marginal cost = $120

(b) 350 hours
   Average cost = (150)($120) / 350 = $51
   Marginal cost = $120

(c) 500 hours
   Average cost = (300)($120) / 500 = $72
   Marginal cost = $120

3. Problem 1-73

Your boss is the director of reporting for the Athens County Construction Agency (ACAA). It has been his job to track the cost of construction in Athens County. Twenty-five years ago he created the ACCA Cost Index to track these costs. Costs during the first year of the index were $120 per square meter of constructed space. (The index value was set at 100 for that first year.) This past year, a survey of contractors revealed that costs were $720 per square meter.

   a) What index number will your boss publish in his report for that same year?
   b) If the index value was 500 ten years ago, what would the cost per square meter have been ten years ago?

Solution:

I_{TODAY} = ($720/$120) (100) = 600
$C_{LAST\ YEAR}$ = $120 (500/100) = $600 per square meter

4. Based on Problem 3-16

You will receive an inheritance of $150,000, but you don't know when. The interest rate for the time value of money (the discount rate) is 3.0%. How much is the inheritance worth now, rounded to the nearest dollar, if it will be received:

    (a) In 5 years?
    (b) In 10 years?
    (c) In 20 years?
    (d) In 50 years?

Solution:

Use $P = F\ (P/F,\ i,\ n) = F\ (1 + i)^{-n}$
$= \$150{,}000\ (1 + 0.03)^{-n}$.

(a)	$n = 5$	$P = \$129{,}391$
(b)	$n = 10$	$P = \$111{,}614$
(c)	$n = 20$	$P = \$83{,}051$
(d)	$n = 50$	$P = \$34{,}216$

5. Problem 3-64

A nation recently loaned $1 billion (which is $1,000 million) to another foreign nation that needed to borrow money. The loan will pay 2% interest, but no money will be paid back until 30 years from now, when the original loan and all the compounded interest will be paid back. One of the nation's leaders objected to the purchase, arguing that the correct interest rate for a loan like this should be 3.5%. The result of loaning the funds at too low of a repayment rate, she said, was a large inappropriate gift to the foreign country without appropriate approval. Assuming the leader's math is correct, how much will the foreign country have saved in interest when it repays the loan? Round your answer to the nearest million dollars.

Solution:

Repayment at 2% $= \$1$ billion $(F/P, 2\%, 30)$
    $= \$1$ billion (1.811)
    $= \$1{,}811$ million

Repayment at 3.5% $= \$1$ billion $(1 + 0.035)^{30}$
    $= \$2{,}807$ million

Saving to foreign country $=$ difference between these
$= \$995$ million