ELEC 481

Assignment 3

Submitted to Prof. Jeff Carmichael

May 22, 2020

Jian Gao

Problem 1 (6-7)

Monthly interest rate: 8% / 12 = 0.006667
To be a millionaire: F = $1000,000
Need to save for each month: A = $1000,000 (A/F, 0.6667%, 500) = $249.47

Problem 2 (6-23)

a)

EUAC = A = $2,500 + $5,000 (A/F, 8%, 4) = $2,500 +$5,000 * 0.2219 = $3609.60

b)

P = A/i = $45,120.05

Problem 3 (6-34)

a)

EUAC = A = $5,000 + $35,000 (A/P, 6%, 20) = $5,000 + $35,000 * 0.08718 = $8051.46

b)

Due to the fact that EUAC for the new pipeline is less than the annual cost of the current pipeline of $10,000, the new pipeline should be built.

Problem 4 (6-47)

Machine A:
EUAC = $10,000 (A/P, 10%, 4) + $1,000 - $10,000 (A/F, 10%, 4) = $2000

Machine B:
EUAC = $20,000 (A/P, 10%, 10) - $10,000 (A/F, 10%, 10) = $2627.45

Machine A should be chosen.

Problem 5 (6-68) (See canvas' comment section for the spreadsheet)

a)

Monthly interest rate = 6% / 12 = 0.5%
A = $145,000 (A/P, 0.5%, 360) = $869.35

b)

See the calculation on Excel.
It takes 259 months to pay off the mortgage.

c)

New monthly payment: $869.35 * 1.2 = $1043.22
Thus, this can be done using the similar approach in part b).
It takes 239 months to pay off the mortgage.

Problem 6 (7-12)

According to the problem: $5,000 = $1,500 (P/A, i, 5)
Here, we can use an equation solver or linear interpolation:

$$\text{solve}\left(\frac{x*(1+x)^5}{(1+x)^5-1}=\frac{15}{50},x\right)$$

My calculator gives me a result of 15.24%

When i = 15%, (P/A, i, 5) = 3.3522
When i = 16%, (P/A, i, 5) = 3.1272
Using linear interpolation: i = 15.1%

For the sake of accuracy, we would go with 15.24%.

Problem 7 (7-26)

Quarterly interest: $5,000 * 0.02 = $100
To calculate the rate of return: NPW = 0 = $100 (P/A, i, 14) + $5,000 (P/F, i, 14) - $4,800
Again, we can use either a calculator or the approach of linear interpolation.

$$\text{solve}\left(100*\left(\frac{x*(1+x)^{14}}{(1+x)^{14}-1}\right)^{-1}+\frac{5000}{(1+x)^{14}}=4800,x\right)$$

From the calculator: i = 2.34%

When i = 2.3%, $100 (P/A, i, 14) + $5,000 (P/F, i, 14) = $4,822.18
When i = 2.4%, $100 (P/A, i, 14) + $5,000 (P/F, i, 14) = $4,764.55
Using linear interpolation: i = 2.338%

Thus, the rate of return that she will earn is 2.34%

Problem 8 (7-37)

Using cash, I am supposed to pay: $75,000 * 0.9 = $67,500
Annual payment with financing: $50,000 (A/P, 8%, 4) = $15,096.04

Thus, an equation can be established: $67,500 = $25,000 + $15,096.04 (P/A, i, 4)
(P/A, i, 4) = 2.8153

When i = 15%, (P/A, i, 4) = 2.8550
When i = 16%, (P/A, i, 4) = 2.7982
Using linear interpolation: i = 15.70%

Therefore, 15.70% is the interest rate I would pay with financing.

Problem 9 (7-54)

MARR = 10%

Alternative X--assuming i is the rate of return:
$100 = $35 (P/A, i, 4)
Using linear interpolation or calculator: i = 14.86%

Alternative Y--assuming i is the rate of return:
$50 = $16.5 (P/A, i, 4)
Using linear interpolation or calculator: i = 12.11%

Incremental analysis: (X-Y)
For year 0, the difference is -$50.
For each year from year 1 to 4, the difference is $18.5
Assuming i is the rate of return:
$50 = $18.5 (P/A, i, 4)
Using linear interpolation or calculator: i = 17.76%

Since 17.76%>MARR, alternative X should be chosen.

Problem 10 (7-74)

Alternative A--assuming i is the rate of return:
$100 = $30 (P/A, i, 5)
Using linear interpolation or calculator: i = 15.24%

Alternative B--assuming i is the rate of return:
$150 = $43 (P/A, i, 5)
Using linear interpolation or calculator: i = 13.34%

Incremental analysis: (B-A)
For year 0, the difference is -$50.
For each year from year 1 to 5, the difference is +$13
Assuming i is the rate of return:
$50 = $13 (P/A, i, 5)
Using linear interpolation or calculator: i = 9.43%

Thus, we conclude that:

$0 < MARR \leq 9.43\%$	B should be selected
$9.43\% < MARR \leq 15.24\%$	A should be selected
$15.24\% < MARR \leq 100\%$	DO NOTHING!