

## Assignment 03

### 1. Problem 1

Anna, an engineer, has made a considerable fortune. She wishes to start a scholarship for engineering students at her alma mater. The scholarship will provide a student with an annual stipend of \$15,000 for each of four years, plus an additional \$10,000 during the fourth year to cover job search expenses. Assume that students graduate in four years, and all funds are paid at the beginning of the year (so, the first award will be given at the beginning of Year 1). Assume an interest rate of 3%. Round all answers to the nearest dollar.

- (a) Determine the equivalent uniform annual cost (EUAC) of providing the scholarship.
- (b) Suppose that the payment structure will change slightly: all scholarship payments will take place at the end of the year. The interest rate remains the same. How much money must Anna donate to the university right away, to cover all the necessary payments for the scholarship? Round to the nearest dollar. (Assume her donation is made in year 0.)
- (c) Suppose, under the conditions listed in part (b), that Anna would like to donate an amount of money that will allow the program to continue forever (in perpetuity). How much would she need to donate in year 0 for this to be possible?

(a)

$$\$15,000 + \$10,000(A/F, 3\%, 4) = \$17,390$$

(b)

$$\$15,000(P/A) + \$10,000(P/F, 3\%, 4) = \$64,641$$

(c)

$$\text{EUAC of Part B : } \$64,641(A/P, 3\%, 4) = \$17,390$$

$$P = \frac{A}{i} = \frac{\$17,390}{0.03} = \$579,667$$

## 2. Problem 2

A company must decide whether to buy Machine A or Machine B:

	<b>Machine A</b>	<b>Machine B</b>
Initial Cost	\$15,000	\$22,500
Useful Life, in years	4	10
End-of-useful-life Salvage Value	\$11,000	\$10,000
Annual Maintenance	\$1,000	\$0

At a 10% interest rate, use an annual cash flow analysis to analyze each option. Which machine should be installed?

Machine A

$$\$15,000(A/P, 10\%, 4) - \$11,000(A/F, 10\%, 4) + 1000 = \$3,362$$

Machine B

$$\$22,500(A/P, 10\%, 10) - \$10,000(A/F, 10\%, 10) = \$3,034$$

Machine B should be installed.

## 3. Problem 3

Kareen is buying a \$12,000 car with a \$3,000 down payment, followed by 36 monthly payments of \$350 each. The down payment is paid immediately, and the monthly payments are due at the end of each month.

- (a) What nominal annual interest rate is Kareen paying?
- (b) What effective interest rate?

Round each solution to the hundredths place (xx.xx%).

$$\$12,000 - \$3,000 = 350(P/A, i\%, 36)$$

$$i \approx 1.95\%$$

$$\text{Nominal Rate} : 1.95 \times 12 = 23.40\%$$

$$\text{Effective Rate} : (1 + 0.0195)^{12} - 1 = 26.08\%$$

## 4. Problem 4

Some laboratory equipment sells for \$100,000. The manufacturer offers two options:

- (1) borrow \$70,000 of the cost and repay it with annual payments over four years at 7% interest. Pay the rest with cash right away.
- (2) Pay it all immediately with cash, in which case the manufacturer will lower the price by 5%. with cash right away.

What is the effective annual interest rate you would pay if you pay by financing, rounded to the nearest tenth of a percent?

Annual Payments for Option 1:

$$\$70,000(A/P, 7\%, 4) = \$20,666$$

Year	Option 1	Option 2	Incremental Difference
0	-\$30,000	-\$95,000	-\$65,000
1	-\$20,666	-	\$20,666
2	-\$20,666	-	\$20,666
3	-\$20,666	-	\$20,666
4	-\$20,666	-	\$20,666

IRR of Incremental Analysis:

$$\$65,000 = \$20,666(P/A, i_a\%, 4)$$

$$i_a \approx 10.4\%$$

## 5. Problem 5

Consider three alternatives: A, B, and do nothing. Construct a choice table for these alternatives.

Year	A	B	B-A
0	-\$110	-\$165	-\$55
1	+32	+45	+13
2	+32	+45	+13
3	+32	+45	+13
4	+32	+45	+13
5	+32	+45	+13

Computing the Rate of Returns:

$$ROR_A \rightarrow 110 - 32(P/A, i_a\%, 5) = 0 \rightarrow i_a = 13.95\%$$

$$ROR_B \rightarrow 110 - 32(P/A, i_b\%, 5) = 0 \rightarrow i_b = 11.32\%$$

Doing Incremental Analysis:

$$ROR_{B-A} \rightarrow 110 - 32(P/A, i_{b-a}\%, 5) = 0 \rightarrow i_{b-a} = 5.84\%$$

Choice Table:

	Choice
$0 < \text{rate} \leq 5.84\%$	B
$5.84\% < \text{rate} \leq 13.95\%$	A
$\text{rate} > 13.95$	Do Nothing

## 6. Problem 6

The owner of a corner lot wants to find a use that will yield a desirable return on his investment. After much study and calculation, he decides that the two best alternatives are the following:

	Build Gas Station	Build Soft Ice Cream Stand
First Cost	\$80,000	\$120,000
Annual Property taxes	\$4,000	\$5,000
Annual Income	\$12,000	\$16,000

Neither option is expected to have any salvage value. Both investments are expected to last twenty years. The owner wants a minimum attractive rate of return on his investment of 6%. Use IRR analysis to determine which of the two alternatives you would recommend.

Cash Inflows:

$$\text{Gas Station : } \$12,000 - \$4,000 = \$8,000$$

$$\text{Ice Cream Stand : } \$16,000 - \$5,000 = \$11,000$$

Year	Build Gas Station	Build Soft Ice Cream Stand
0	-\$80,000	-\$120,000
1	+8,000	+11,000
2	+8,000	+11,000
$\vdots$	$\vdots$	$\vdots$
20	+8,000	+11,000

Rate of Returns:

$$IRR_1 : \$80,000 - \$8,000(P/A, i\%, 20) \rightarrow i = 7.75\%$$

$$IRR_2 : \$120,000 - \$11,000(P/A, i\%, 20) \rightarrow i = 6.63\%$$

Building the gas station will be more preferred due to the higher rate of return of investment.