**Homework Set 2**

**EGR 310**

**Answers**

**2/16/23**

**Problem 1 (5 points)**

$1,000 is borrowed for one year at 1.5% interest charged per month. If the same amount could be borrowed at 18% interest charged at the end of the year, how much could be saved?

What is the nominal and effective rate for each investment alternative. *(Chapter 3)*

**$ with Nominal Rate (no compounding)**

(18% per year)

$1,000 \* 1.18 = $1,180

**$ with Effective rate (with compounding)**

(1.5% per month)

 $1,000 \* (1.015)^12 = $1,196

**Delta:**

$1,196 – $1,180 = $16 saved by borrowing at annual rate of 18%

**Rates:**

18%/yr

nom 18%

eff 18%

1.5%/mo

nom = 1.5% \* 12 = 18%

eff = (1.015)^12 – 1 = 19.6%

**Problem 2 (5 points)**

If you invest $3,000 into an account that compounds 7% continuously, what is the annual effective rate? *(Chapter 3)*

Effective rate = e(.07) – 1 = 7.25% =(1+0.07)-1

The value of e can be found at the end of the Appendix : Continuous Compounding Single Payment Factor

**Problem 3 (10 points)**

You just bought a house for $500,000. You put 20% down and financed the rest over 20 years at 3% nominal interest.

Assuming equal monthly payments over the term of the loan, what are the monthly payments?

 What is the effective rate? *(Chapter 4)*

Down payment = $500,000 \* .2 = $100,000

Finance $500,000 - $100,000 = $400,000

Monthly rate is 3%/12 = 0.25%

Number of periods = 12 months \* 20 years = 240

Monthly payment, X = $400,000\*(A/P, 0.25%, 240) = $400,000 \* (.00555) = $2220.

Effective rate = (1.0025)^12 – 1 = 3.04%

From the Appendix

A/P =Capital Recovery factor. Finding A given P

**Problem 4 (10 points)**

What would you need to invest today in an account that had a nominal rate of 12% compounded quarterly, if you wanted $9,000 in 5 years?

What would be the investment required if the account compounded monthly?

What is the effective rate of each investment? *(Chapter 3)*

Quarterly rate is 12/4 = 3%. N = 5 \* 4 = 20.

 P = 9000\*(P/F, 3%,20) = 9000\* (.5537) = $4,983,

eff rate = (1.03)^4 – 1 = 12.6%

Monthly rate is 12/12 = 1%.

 N = 5 \* 12 = 60.

P = 9,000\*(P/F, 1%,60) = 9000\* (.5504) = $4,954,

eff rate = (1.01)^12 – 1 = 12.7%

From the Appendix

P/F =Percent Worth Factor. Finding P given F

**Problem 5 (10 points)**

Assume we receive $1,200 at the end of each year for 6 years.

What is the equivalent value of the cash flows at time period 0 assuming 5% interest?

What is the equivalent value at the end of time period 6 assuming 5% interest? *(Chapter 4)*

P = A\*(P/A, 5%, 6) = 1,200 \* (5.076) = **$6,091**

F = A\*(F/A, 5%, 6) = 1200 \* (6.802) = **$8,162**

**From the Appendix** :

P/A =Present Worth Factor. Find P given A

F/A =Compound Amount Factor. Find F , given P

**Problem 6 (10 points)**

**Skip this one. Needs reworking.**

1. Assume the following cash flows: *(Chapter 4)*



Assuming an 8% interest rate, what is the value of A required to make the present value of the cash flows equal to 0?

There are multiple ways to solve this using the toolbox. Here is one way:

Find value of inflows at the end of time period 2. Call that X1

X1 = 500\*(F/A, 8%, 2) = 500\*(2.080) = 1040

Find the value of X1 at the end of time period 4. Call that X2

X2 = X1(F/P, 8%, 2) = 1040(1.166) = 1212.64

Find the values of outflow A by using A/P on X2

A = X2(A/P, 8%, 3) = 1212.64(.3880) = $470.50

**Problem 7 (10 points)**

The maintenance on a piece of equipment is $800 at the end of year 1 and increases $200/yr each year until the end of the 4 year life of the equipment.

Assuming you could invest at 6% compounding annually, what amount would you need to invest today to cover all the maintenance costs in the future? *(Chapter 4)*

From the Appendix:

P = $800(P/A, 6%, 4) + $200(P/G, 6%, 4) = 800\*(3.465) + 200\*(4.945) = $3,761

P/G = Gradient Present Worth. Find P, given G

**Problem 8 (10 points)**

Assuming you are earning $60,000/yr and expect a 3% raise every year for the next seven years.

If you invest 10% of your salary each year into a 401K that returns 3% per year, what will the value of the 401K be after 7 years? *(Chapter 4)*

 i = g ->

From the Appendix

Present value of geometric gradient = (60,000\*(.10))\*(7\*(1.03)^(-1)) = **$40,777**

Value at the end of period 7 = present value \* (F/P, 3%, 7) = $40,777\*1.230 = **$50,155**

The arithmetic gradient is applicable where the period-by period change in cash receipt or payment is a constant amount(i).

The geometric gradient occurs where the period-by-period change in cash receipts or payment is at the uniform rate (g).

F/P = Compound Amount factor. Find F, given P.

**Problem 9 (10 points)**

Use Present Worth Analysis to determine which investment is best (which has the lowest present cost). Assume a 4% interest rate. *(Chapter 5)*

|  |  |  |
| --- | --- | --- |
| Year | Alt A | Alt B |
| 0 | -$4,000 | -$2,000 |
| 1 | -$500 | -$500 |
| 2 | -$500 | -$800 |
| 3 | -$500 | -$1,100 |
| 4 | -$500 | -$1,400 |
| 5 | -$500 | -$1,700 |
| 6 | -$500 | -$2,000 |

A = -$4,000 - $500 \* (P/A, 4%, 6) = -$4,000 - $500 \* (5.242) = $4,000-2,621= **-$6,621**

B = -$2,000 - $300 \* (P/G, 4%, 6) = -$2,000 - $300 \* (12.506) =- $2,000 -3.751.80 = **-$5,751**.**8**

Investment B has lower cost.

**Problem 10 (10 points)**

To maintain a gravesite requires $600/yr perpetually. What amount needs to be invested today at 5% interest to provide $600/yr perpetually? *(Chapter 5)*

$600/.05 = $12000

**Problem 11 (10 points)**

Use Net Present Worth Analyses to determine the best of the following 3 mutually exclusive investments. Assume a useful life of 8 years and interest rate of 7%: *(Chapter 5)*

|  |  |  |  |
| --- | --- | --- | --- |
|   | **Alt A** | **Alt B** | **Alt C** |
| **Initial Investment** | $10,000 | $12,000 | $15,000 |
| **O&M Costs** | $800 | $500 | $800 |
| **Annual Benefit** | $2,200 | $2,400 | $3,000 |
| **Salvage Value** | $3,000 | $4,000 | $5,000 |

From the Appendix:

A: -10,000 + (2,200 – 800) \* (P/A, 7%, 8) + 3,000 \* (P/F, 7%, 8) = -10,000 + (1,400)\*(5.971) + 3,000\*(.582) =NPV= $105.4

B: -12,000 + (2,400 – 500) \* (P/A, 7%, 8) + 4,000 \* (P/F, 7%, 8) = -12,000 + (1,900)\*(5.971) + 4,000\*(.582) =NPV= **$1,672.9**

C: -15,000 + (3,000 – 800) \* (P/A, 7%, 8) + 5,000 \* (P/F, 7%, 8) = -15,000 + (2,200)\*(5.971) + 5,000\*(.582) =NPV= $1,046.2

**Pick B because it has the largest NPV.**