Carleton University
Department of Civil and Environmental Engineering
Engineering Economics (ECOR3800 A)

ASSIGNMENT # 1

Due date: Tuesday May 21st before 2:00 pm

Drop off location: Filing cabinet near the entrance to the Civil and Environmental. Engineering wing of Mackenzie engineering building.

Question 1 (20 marks)

a. Using 10% simple interest per year, how much interest will be owed on a loan of $1000 at the end of two years?

Solution:

Simple interest = PIN

P is the loan amount I is the interest rate N is the duration of the loan, using number of periods

Solution = $200

b. If a sum of $25000 is borrowed for six months at 8.00% simple interest per year, what is the total amount due (principal and interest) at the end of six months?

Solution:

PIN = 25000* 0.08* 0.5 = 1000 dollars

Total = P + I = 25000+ 1000 = 26000 dollars

c. Simple interest of $190.67 is owed on a loan of $550 after four years and four months. What is the annual interest rate?

Solution:

Simple interest = PIN

190.7 = 550 * 4.33* I, I = 8%

d. How much will be in a bank account at the end of five years if $150000 is invested today at 6% interest per annum, compounded yearly?

Solution:

F = P (1+i) N

= 150000 (1+0.06)5

= $ 200733 at the end of five years

Question 2 (10 marks)

You have a bank deposit now worth $16000. How long will it take for your deposit to be worth more than $24000 if:

a. The account pays 4% actual interest every half-year, and is compounded?

Solution:

$F = P *(1+i)^N$

$24000 = 16000(1+2*0.04)^N$

$1.5 = 1.08^N$

N = 5.3 years

b. The account pays 4% nominal interest, compounded semi-annually?

Solution:

Compounded semi-annually, m = 2

Effective interest rate = $(1+i/m)^m - 1$

= (1+0.04/2)2 -1 =

0.0404 = 4.04%

$24000 = 16000 *(1+0.0404)^N$

$1.5 = (1.0404)^N$

N = 10.3 years

Question 3 (10 marks)

a. Max has $Q at the present time. In 5 years, Q will be $4500 if it is invested at 8.5%, compounded annually. Determine the present value of Q.

Solution:

P = F (1+ i)-N

$= 4500 (1+ 0.085)^{-5}$

= $3134.51 (compounded annually)

b. If Max invested $Q at 8.5%, compounded daily, how much would the value of Q be in 12 years?

Solution:

$i_a = (1+i/m)^m -1$

$= (1+0.085/365)^{365} -1 = 8.87\%$

$F = P (1+i)^N$

$= X (1+0.0887)^{12}$, = 2.77 X dollars

Question 4 (15 marks)

a. You have just won a lottery prize of $1,000,000 collectable in ten yearly instalments of $100,000, starting today. Why is this prize not really $1,000,000? What is it really worth today if money can be invested at 10% annual interest, compounded monthly? Use a spreadsheet to construct a table showing the present worth of each instalment, and the total present worth of the prize.

Solution:

Effective interest rate: $i_a = (1+i/m)^{m} - 1$
$= (1+0.1/12)^{12} - 1 = 0.104713$

Effective interest rate	Annuity amount	Instalment No.	Year	Present Worth
0.104713	100000	1	0	100000
0.104713	100000	2	1	90521
0.104713	100000	3	2	81940
0.104713	100000	4	3	74173
0.104713	100000	5	4	67143
0.104713	100000	6	5	60778
0.104713	100000	7	6	55017
0.104713	100000	8	7	49802
0.104713	100000	9	8	45082
0.104713	100000	10	9	40808

Total present worth of prize = $665269

b. Suppose in part (a) that you have a large mortgage you want to pay off now. You propose an alternative, but equivalent, payment scheme. You would like $300,000 today and the balance of the prize in five years when you intend to purchase a large piece of waterfront property. How much will the payment be after five years? Assume that annual interest is 10%, compounded monthly.

Solution:

P = $665269 dollars

Invested amount = $300,000

Remaining amount = $365, 269

N = 5 years

F = to be calculated

$= F = P(1+i)^{N} =$ $ 600981 dollars

Question 5 (15 marks)

a. Victory Visa, Magnificent Master Card, and Amazing Express are credit card companies that charge different interest on overdue accounts. Victory Visa charges 28% compounded daily, Magnificent Master Card charges 30% compounded weekly, and Amazing Express charges 32% compounded monthly. On the basis of interest rate, which credit card has the best deal?

Solution:

$i_a = (1+i/m)^m - 1$

1) Victory Visa 28% compounded daily
   Compounded daily, m = 365
   Effective interest rate = (1+ 0.28/365) ^365 -1 = 0.323 = 32.3%

2) Victory Visa 30% compounded weekly
   Compounded weekly, m = 52
   Effective interest rate = (1+ 0.3/52) ^52 -1 = 0.3487 = 34.87%

3) Victory Visa 32% compounded monthly
   Compounded weekly, m = 12
   Effective interest rate = (1+ 0.32/12) ^12 -1 = 0.3714 = 37.14%

Victory Visa has the lowest effective interest rate and the best deal

b. The Bank of SVFA advertises savings account interest at 4.5% compounded weekly and chequing account interest at 6% compounded monthly. What are the effective interest rates for the two types of accounts?

Solution:

Compounded weekly, m = 52
Compounded weekly, m = 12

Effective interest rate = i_a = {(1 +0.045/52) ^ 52} -1 = 4.6%
Effective interest rate = i_a = [(1+0.06/12) ^ 12] – 1 = 6.17%

Question 6 (10 marks)

a. Victor paid $1500 a month for 20 years to pay off the mortgage on his house. If his down payment was $15000 and the interest rate was 6% compounded monthly, how much did the house cost?

Solution:

Amount is given in months so I = 6/12 = 0.5%
Compounded monthly, N = 240

$P = 1500\,[\{(1+0.005)^{240} - 1\}/0.0617(1+0.005)^{240}] = 69790$ dollars
Original cost of the house = Down payment + Mortgage
= 209370 + 15000 = $224370

b. Sarah wants to save up for a car. How much must she put in her bank account each month to save $15,000 in two years if the bank pays 5% interest compounded monthly?

Solution:

$i_a = (1+i/m)^{m} - 1$; $i_a = (1+0.05/12)^{12} - 1 = 0.05116$
$i = i_a = 5.116\%$, N =2,
$A = F\,[\,i / \{(1+i)^N - 1\}] = \$15000 * 0.4878 = \$7317$ /annum = $609.7 / month

Question 7 (10 marks)

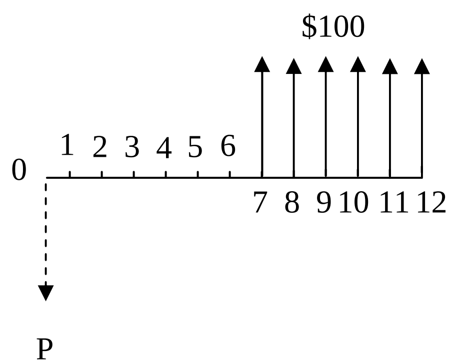
a. If you make the following series of deposits at an interest rate of 10%, compounded annually, what would be the total balance at the end of 10 years? (Support your answer with C.F.D.)

End of Period	Amount of Deposit
0	$800
1-9	$1500
10	0

Solution:

i-) $F = P\,(1+i)^N = 800\,(1+0.1)^9 = 2074$ dollars
ii-) $F = (A\,(1+i)^N - 1))\,/I = (1500\,(1+0.1)^9 - 1))\,/0.1 = 20369$ dollars
For additional year
iii-) F = P (1+i) = 20369 (1.1) = 22406 dollars
Total balance = i + iii = 2074 + 22406 = **24481 dollars**

b. Compute the equivalent present worth of the following cash flow series at period 0, *i* = 6%.



Solution:

i = 6%

Equivalent present worth = ?

P = 100 x [P/A, i, N]*[P/F,i,N]

P = 100 x [P/A, 6%%, 6] x [P/F,6%,6]

= $347

Question 8 (10 marks)

a. What is the sinking fund factor (uniform series)?

Solution:

Sinking funding factor (uniform series) provides the calculation of annuity (A) resulting in a given future amount "F"

b. A couple is planning to finance their 5- years –old daughter's university education. They established a university funds that earns 10%, compounded annually. What annual deposit must be made from the daughter's 5th birthday (now) to her 16th birthday to meet the future university expenses shown in the following table .Assume that today is her 5th birthday?

Birthday	Deposit	Withdrawal
5-16	A	
17		
18		25,000
19		27,000
20		29,000
21		31,000

Solution:

$$P = A(P/A,10\%,4) + G(A/G,10\%,4)X(P/A,10\%,4)$$

P = 25000((1.1)^4 -1)/0.1(1.1)^4) + 2000 ((1/0.1)-(4/((1.1)^4 -1)) x ((1.1)4 –1))/ ((0.1 x (1.1)^4)

P_{17} = $87971

Using the Sinking Fund Factor equation

A = F [i/ (I +N)^N -1)]

A = 87971 (0.1/ (1.1^{12} -1))

A = $4124