Assignment 3

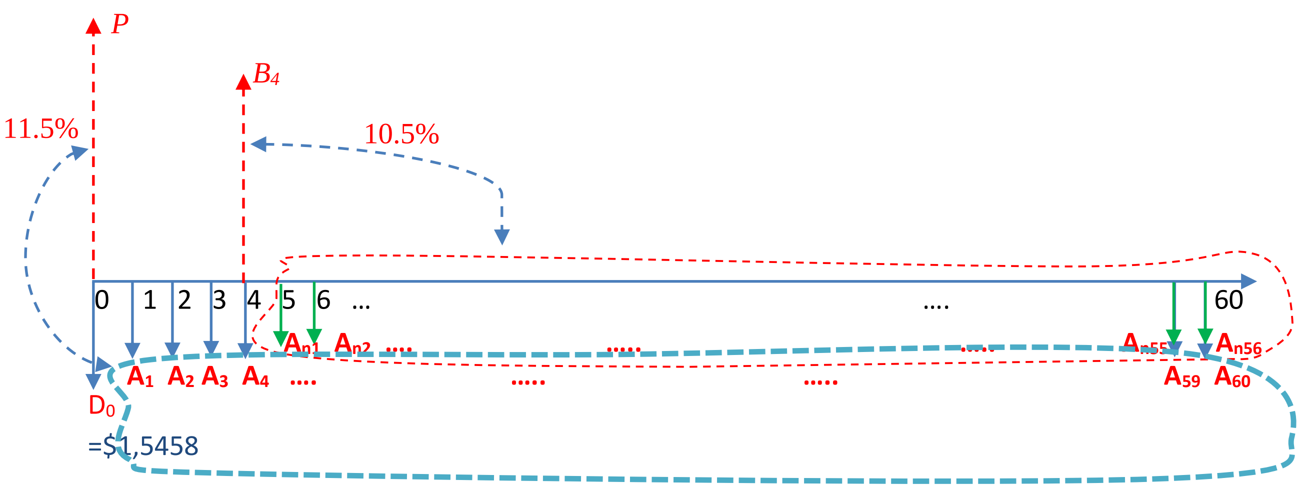
4.65 Kathy Stonewall bought a new car for \$15,458. A dealer's financing was available at an interest rate of 11.5% compounded monthly. Dealer financing required a 10% down payment and 60 equal monthly payments. Because the interest rate was rather high, Kathy checked her credit union for possible financing. The loan officer at the credit union quoted a 9.8% interest rate for a new-car loan and 10.5% for a used car. But to be eligible for the loan, Kathy has to be a member of the union for at least six months. Since she joined the union two months ago, she has to wait four more months to apply for the loan. Consequently, she decided to go ahead with the dealer's financing, and four months later she refinanced the balance through the credit union at an interest rate of 10.5%.

(a) Compute the monthly payment to the dealer.

(b) Compute the monthly payment to the union.

(c) What is the total interest payment on each loan?

Answer [24 marks]:



(a)

Down payment: $D_0 = \$15,458 \times 10\% = \$1,5458$

Amount of dealer financing P = \$15,458×90% = \$13,912

$$i_{monthly} = \frac{11.5\%}{12} = 0.9583\%$$

Which can be treated as the effective rate because the compounding frequency is also monthly

$(A/P, 0.9583\%, 60)$ can be obtained by interpolation as the following:

$$(A/P, 1\%, 60) = 0.0222$$

$$(A/P, 0.75\%, 60) = 0.0208$$

$$(A/P, 0.9583\%, 60) = 0.0208 + (0.9583\% - 0.75\%) \times \frac{0.0222 - 0.0208}{1\% - 0.75\%} = 0.02197$$

$$A = \$13{,}912(A/P, 0.9583\%, 60) = \$305.60$$

(b) When refinancing is opted, the remaining balance will be refinanced over 56 months,

$$B_4 = \$305.96(P/A, 0.9583\%, 56)$$

Alternatively, instead of using factor tables and interpolation, you can use Excel functions to find financial factors:

$$(P/A, 0.9583\%, 56) = \text{PV(0.9583\%, 56, -1)}$$

$$B_4 = \$305.96(P/A, 0.9583\%, 56) = \$13{,}211.54$$

The new effective monthly interest rate: $i_{n-monthly} = \frac{10.5\%}{12} = 0.875\%$

$$A_n = \$13{,}211.54(A/P, 0.875\%, 56) = \$299.43$$

Where $(A/P, 0.875\%, 56)$ = PMT(0.875%, 56, -1) by Excel.

(c) Interest payments to the dealer

The total financed amount after down payment: \$13,912

The total payment made by the end of the 4th month: \$305.96×4

The credit union's amount paid up to the dealer: \$13,211.54

$$I_{\text{dealer}} = \$305.96 \times 4 - (\$13{,}912 - \$13{,}211.54) = \$523.38$$

Interest payments to the credit union:

$$I_{\text{union}} = \$299.43 \times 56 - \$13{,}211.54 = \$3{,}556.54$$

∴ Total interest payments = \$4,079.92

4.70 The Jimmy Corporation issued a new series of bonds on January 1, 1996. The bonds were sold at par ($1000), have a 12% coupon rate, and mature in 30 years, on December 31, 2025. Coupon interest payments are made semiannually (on June 30 and December 31).

(a) What was the yield to maturity (YTM) of the bond on January 1, 1996?

(b) Assuming that the level of interest rates had fallen to 9%, what was the price of the bond on January 1, 2001, five years later?

(c) On July 1, 2001, the bonds sold for $922.38. What was the YTM at that date? What was the current yield at that date?

Answer [36 marks]:

Given: Par value = $1,000, coupon rate = 12%, paid as $60 semiannually, N = 60 semiannual periods

(a) Find YTM (Conceptually, it is the IRR of the cash flows; or the effective annual interest rate, i_a)

$$
\begin{aligned}
\$1,000 &= \$60(P/A, i, 60) + \$1,000(P/F, i, 60) \\
i &= 6\% \text{ semiannually} \\
i_a &= 12.36\% \text{ per year}
\end{aligned}
$$

(b) Find the bond price after five years with r = 9%: i = 4.5% semiannually, N = 2(30 – 5) = 50 semiannual periods.

$$
\begin{aligned}
P &= \$60(P/A, 4.5\%, 50) + \$1,000(P/F, 4.5\%, 50) \\
&= \$1,296.72
\end{aligned}
$$

(c)

- Sale price after 5½ years later = $922.38, The IRR for the original buyer, i.e. the current seller:

$1000=$60 *(P/A, i,11)* + $922.38 *(P/F, i, 11)*

Semi-annual YTM: $i_{semi\text{-}annual}$= *5.4668%*

So: the annual yield for the original investor is: i_a= (1+ $i_{semi\text{-}annual}$)^2-1=11.23%

Use tabular discounting series method							
For the seller of the bonds at July 1, 2001							
YTM (semi-annual)	5.4668%	YTM (annual)	11.23%				
Period		Coupon Int		PV	Face Value	Purchase Price	NPV
0					1000	1000	1000
1		$60		56.9			
2		$60		53.9		Price	922.38
3		$60		51.1			
4		$60		48.5		Delta	0.000
5		$60		46			
6		$60		43.6			
7		$60		41.3			
8		$60		39.2			
9		$60		37.2			
10		$60		35.2			
11		$60		33.4			

- the YTM for the new investors:

$$\begin{aligned} \$922.38 &= \$60(P/A,i,49) + \$1{,}000(P/F,i,49) \\ i &= 6.5308\% \text{ semiannually} \\ i_a &= 13.488\% \end{aligned}$$

- Current yield at sale = $60/$922.38 = 6.53% semiannually
- Nominal current yield = 6.53% × 2 = 13.06% per year
- Effective current yield = 13.48% per year

4.78 Suppose you purchased a corporate bond with a 10-year maturity, a \$1000 par value, a 10% coupon rate, and semiannual interest payments. All this means that you receive a \$50 interest payment at the end of each six-month period for 10 years (20 times). Then, when the bond matures, you will receive the principal amount (the face value) in a lump sum. Three years after the bonds were purchased, the going rate of interest on new bonds fell to 6% (or 6% compounded semiannually). What is the current market value (P) of the bond (three years after its purchase)?

Answer [5 marks]:

Given: Par value = \$1,000, coupon rate = 10%, paid as \$50 every six months, N = 20 semiannual periods,

$$\begin{aligned} P &= \$50(P/A,3\%,14) + \$1{,}000(P/F,3\%,14) \\ &= \$1{,}225.91 \end{aligned}$$

5.8 Cable television companies and their equipment suppliers are on the verge of installing new technology that will pack many more channels into cable networks, thereby creating a potential programming revolution with implications for broadcasters, telephone companies, and the consumer electronics industry.

Digital compression uses computer techniques to squeeze 3 to 10 programs into a single channel. A cable system fully using digital compression technology would be able to offer well over 100 channels, compared with about 35 for the traditional cable television system. If the new technology is combined with the increased use of optical fibers, it might be possible to offer as many as 300 channels.

A cable company is considering installing this new technology to increase subscription sales and save on satellite time. The company estimates that the installation will take place over two years. The system is expected to have an eight-year service life and produce the following savings and expenditures:

Digital Compression	
Investment	
Now	\$500,000
First year	\$3,200,000
Second year	\$4,000,000
Annual savings in satellite time	\$2,000,000
Incremental annual revenues due to new subscriptions	\$4,000,000
Incremental annual expenses	\$1,500,000
Incremental annual income taxes	\$1,300,000
Economic service life	8 years
Net salvage value	\$1,200,000

Note that the project has a 2-year investment period, followed by an 8-year service life (a total 10-year life for the project). This implies that the first annual savings will occur at the end of year 3 and the last will occur at the end of year 10. If the firm's MARR is 15%, use the NPW method to justify the economic worth of the project.

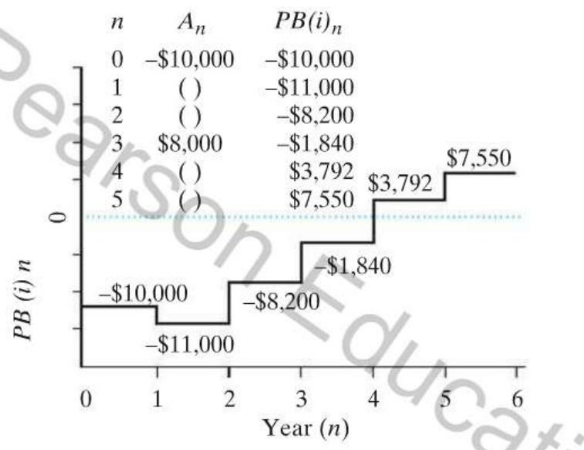
Answer [10 marks]: Units are in thousand

$$
\begin{aligned}
PW(15\%) &= -\$500 - \$3{,}200(P/F,15\%,1) - \$4{,}000(P/F,15\%,2) \\
&\quad + (\$4{,}000 + \$2{,}000 - \$2{,}800)(P/A,15\%,8)(P/F,15\%2) \\
&\quad + \$1{,}200(P/F,15\%,10) \\
&= \$4{,}847.23
\end{aligned}
$$

5.13 Consider the accompanying project balance diagram for a typical investment project with a service life of five years. The numbers in the figure indicate the beginning project balances.

(a) From the project balance diagram, construct the project's original cash flows.

(b) What is the project's conventional payback period (without interest)?



Answer [25 marks]:

(a) First find the interest rate that is used in calculating the project balances. We can set up the following project balance equations:

$$PB(i)_1 = -\$10,000(1+i) + A_1 = -\$11,000$$
$$PB(i)_2 = -\$11,000(1+i) + A_2 = -\$8,200$$
$$PB(i)_3 = -\$8,200(1+i) + \$8,000 = -\$1,840$$
$$PB(i)_4 = -\$1,840(1+i) + A_4 = \$3,792$$
$$PB(i)_5 = \$3,792(1+i) + A_5 = \$7,550$$

From $PB(i)_3$, we can solve for i: $i = 20\%$.

Substituting *i* into other $PB(i)_n$ yields

n	A_n	$PB(i)_n$
0	–$10,000	–$10,000
1	**1,000**	–11,000
2	**5,000**	–8,200
3	8,000	–1,840
4	**6,000**	3,792
5	**3,000**	7,550

(b) Conventional payback period $= 3$ years