Assignment 8

100 Points (Due: 5:00PM Wednesday April 13th)

Assessment Goals: (Bonds, Multiple rate of returns, EXCEL use of what if analysis, Report quality). Show your work. Use 2 decimals for dollar values and 4 decimals for factors if needed. Use formulas, tables, and EXCEL as you wish.

PROBLEM 1: (30 points)
Six years ago, Make-Home construction company issued $10 million worth of debenture bonds ($10,000 face value) with a coupon rate of 8% per year, payable quarterly. Market interest rates dropped, and the company called the bonds (i.e., paid them off in advance) at a 10% premium on the face value. Therefore, it cost the company $11 million to retire the bonds. What quarterly rate of return did an investor make who purchased a $10,000 bond six years ago and held it until it was called? What annual rate of return did an investor make who purchased a $10,000 bond for $8500, 4 years ago and held it until it was called?

Solution:

Face value = V = $10,000
Coupon rate = b = 8% = 0.08
No. of payment periods per year = c = 4
Dividend = I = Vb/c = $10000 (0.08) / 4 = $200

The investor, invested $10,000 for a bond, received $200 per quarter for 6 years, and sold the bond back to the company for $11,000. To find the rate of return we need to make sure that the periods considered are appropriate. Since payments occur every quarter, we can have considered our periods to be quarters. That is 4 periods in a year and 24 periods for 6 years. So, the cash flow consists of an investment of 10,000 at 0, earnings of 200 per period for 24 periods starting at 1 and ending at 24, and an income of 11,000 at period 24 from the sale of bond. To find the rate of return (which will be per period) we find the present worth and set it equal to 0.

ROR equation: PW = - 10,000 + 200 (P/A, i, 24) + 11,000 (P/F, i, 24) = 0

We can solve by trial and error, but because we are not restricted, we can use EXCEL. Using IRR function, interest rate is calculated to be 4.84% per quarter.

Period	NCF
0	-10000
1	200
2	200
3	200
4	200
5	200
6	200
7	200
8	200
9	200
10	200
11	200
12	200
13	200
14	200
15	200
16	200
17	200
18	200
19	200
20	200
21	200
22	200
23	200
24	11200
ROR	**2.316%**

To find the annual rate of return, we need to find the effective rate of return.

Note that the nominal rate of return (if no compounding is considered) is:

4 (2.316%) = 9.26%

To find the effective interest rate per year:

$(1 + 0.02316)^4 – 1 = 9.59\%$

PROBLEM 2: (40 points)

Accurate3D is an innovative company that manufactures many types of high tolerance industrial parts for aerospace industry. The company's cash flow (in millions) for one of its product divisions is as shown below. Determine:

(a) the number of possible i* values through rule and by plotting PW vs interest rate, and

(b) all rate of return values between 0% and 100%.

(c) Calculate the external rate of return using the return on invested capital (ROIC) approach with an investment rate of 15% per year.

Year	Expenses ($ Mil)	Revenue ($ Mil)
0	-22	0
1	-20	27
2	-19	24
3	-24	36
4	-38	52
5	-28	18
6	-30	15
7	-10	24

Solution:

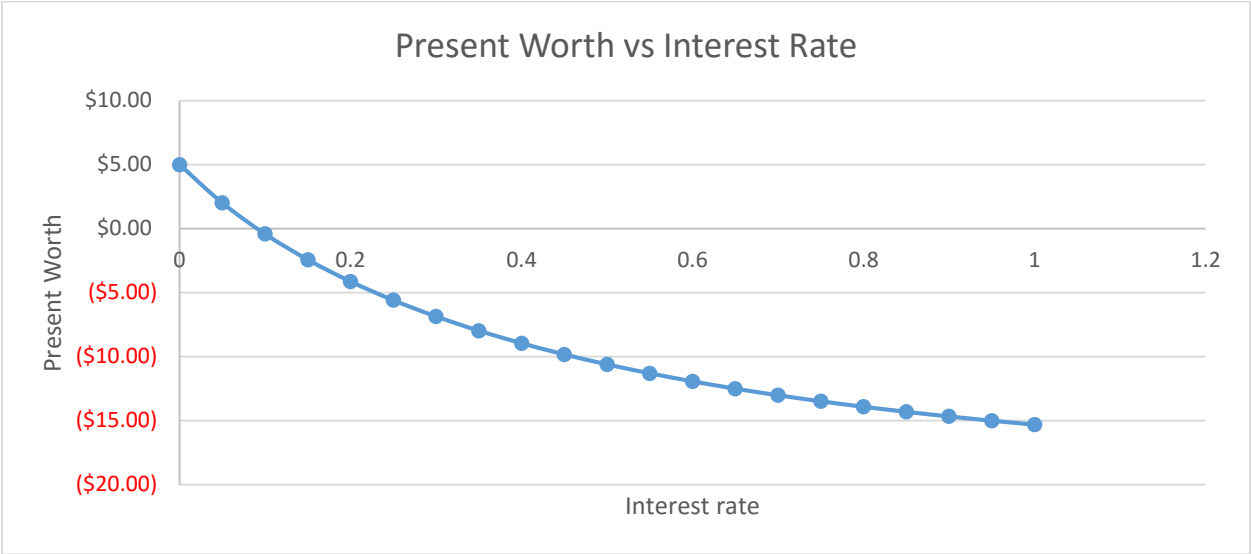
Net cash flow for the project is given below:

Year	Expenses ($ Mil)	Revenue ($ Mil)	NCF	Cumulative Cash flow
0	-22	0	-22	-22
1	-20	27	+7	-15
2	-19	24	+5	-10
3	-24	36	+12	+2
4	-38	52	+14	+16
5	-28	18	-10	+6
6	-30	15	-15	-9
7	-10	24	+14	+5

Test #1: There are 3 sign changes in the NCF series indicating a possible maximum of three roots to the polynomial equation or i* values for the ROR equation.

Test #2: Cumulative cash flow sign test (Norstrom's criterion), states that only one sign change in a series of cumulative cash flows which starts negatively indicates that there is one positive root to the polynomial relation. Which matches our problem.

Using EXCEL we can plot the present worth of the cash flow for different interest rates.



As expected the graph indicates that there is only one positive rate of return, one in the range of 0-20 percent. Using IRR function ROR is found to be 9.06%.

Year	NCF
0	-22
1	7
2	5
3	12
4	14
5	-10
6	-15
7	14
Rate of Return	9.065%

3. The use of the external rate of return (EROR) using the return on invested capital (ROIC) approach requires the project to have multiple rate of returns. As

demonstrated in part 2, this problem has only one rate of return, so there is no need for any additional steps to reduce multiple rate of returns to one.

PROBLEM 3: (30 points)
A car dealer currently offers financing on a $20,000 car at 4% APR compounding monthly for 3 years to be repaid through equal monthly installments. As a promotional case he is thinking of offering some non-conventional financing plans. Two plans that he considers are:

ArithPlan: 3.5% APR compounding monthly for 3 years to be repaid through monthly installments that begin at $300 the first month, increasing by an arithmetic gradient each month for 12 months, then staying at the same month 12 value for another 12 months and then decreasing by the same gradient value to the end of the 36 instalment with the same $300 value.

GeoPlan: 3% APR compounding monthly for 3 years to be repaid through monthly installments that begin at $300 the first month, increasing by an arithmetic gradient each month for 12 months, then staying at the same month 12 value for another 12 months and then decreasing by the same gradient value to the end of the 36 instalment with the same $300 value.

However, not being an IE, he does not know how find G value for the ArithPlan or g value for Geo plan. Your job is to plot the cash flows for the three cases and find and explain your strategy for finding those gradient values.

Solution:

Car dealers' intention is to recover the price of the car and different payment schemes he is providing should all provide the same present worth equivalent to the price of the car. Note that compounding is monthly and payments are monthly too. Thus, periods are months and per month interest rates are i/12.

Installments on the current plan:
A = 20,000 (A/P, 0.04/12, 36) = 20000 (0.0295) = $590/month

ArithPlan:

Since, we do not know G, all payments from the second month to 35th month have an unknown value of G in them.

Payment at month 1 = 300 =A of first gradient series
Payment at month 2 = 300 + 1 G
Payment at month 3 = 300 + 2 G
…
…
Payment at month 12 = 300 + 11 G
Payment at months 12 through 24 = 300 + 11 G = A for annuity
Payment at month 25 = 300 + 11 G -1 G
Payment at month 26 = 300 + 11 G -2 G
…
…
Payment at month 36 = 300 + 11 G – 11 G = 300

To find G, we can write the present worth of the cash flow and solve for G, as all factors and values are known except G. We can also use GOALSEEK analysis from EXCEL. My worksheet. Is presented in the next page. Note that we want the present worth of the cash flow to be $20,000 (Goal) by changing the values of G. So, a trial G is assumed and based on that the cash flow is written and its present worth is calculated using the NPV function. Then GOALSEEK is launched pointing to the two cells, one that has the G value and one that has the present worth that we want to become 20000 by changing the G values.
G = 40.80
Similarly, for GeoPlan:
g = 9.28%