INDIAN SCHOOL OF BUSINESS

Business Fundamentals

Practice problem solutions

1. Calculate the present value of a perpetuity that is expected to pay ₹670 of interest every year, assuming an annual return of 7.2 percent.

   (a) $PV = \frac{C}{r} = \frac{670}{0.072} = ₹\,9,305.55$

2. Mahesh borrows ₹12,500 from Suresh and repays ₹21,364 exactly after three years. What is the rate of return earned by Suresh with annual compounding? What is the return earned by Suresh with monthly compounding?

   (a) $PV = \frac{FV_n}{(1+r)^n} \implies 12,500 = \frac{21,364}{(1+r)^3} \implies (1+r)^3 = \frac{21,364}{12,500} \implies r = 20\%$

   (b) $PV = \frac{FV_n}{(1+r)^n} \implies 12,500 = \frac{21,364}{(1+r)^{36}} \implies (1+r)^{36} = \frac{21,364}{12,500} \implies r = 1.53\%$

3. Ramesh is 65 years old. He has accumulated savings of ₹1,000,000. He estimates that he will live another 10 years and wants to spend his entire savings by then. (If he lives longer than that, he figures his son will be happy to take care of him.) Ramesh places his ₹1,000,000 into a saving account with State Bank of Hyderabad ?(now State Bank of India), earning 8 percent annually and sets it up in such a way that he will be making 10 equal annual withdrawals (the first one occurring 1 year from now) such that his account balance will be zero at the end of 10 years. How much will he be able to withdraw each year?

   (a) $PV(\text{Ordinary Annuity}) = \frac{C}{r}\left[1 - \frac{1}{(1+r)^N}\right] \implies ₹1,000,000 = \frac{C}{0.08}\left[1 - \frac{1}{(1+0.08)^{10}}\right] \implies C = ₹149029.49$

4. A rich relative has bequeathed you a growing perpetuity. The first payment will occur in one year and will be $2,000. Each year after that, you will receive a payment on the anniversary of the last payment that is 8% larger than the last payment. This pattern of payments will go on forever. If the interest rate is 13% per year, what is today's value of the bequest??

   (a) $PV(\text{Growing Perpetuity}) = \frac{C_1}{r-g}$

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(b) Here g=8%, r=13%

(c) PV(bequest) $= \dfrac{2000}{0.13 - 0.08} = \$~40{,}000$

5. You are thinking of purchasing a house. The house costs ₹35,00,000. You have ₹5,00,000 in cash that you can use as a down payment on the house, but you need to borrow the rest of the purchase price. The bank is offering a 30 year mortgage (home loan) that requires annual payments and has an interest rate of 6% per year. What will your annual payment be if you sign up for this mortgage?

(a) The Loan amount is ₹35,00,000 - ₹=500,000=₹30,00,000

(b) $PV(\text{Ordinary Annuity}) = \dfrac{C}{r}\left[1 - \dfrac{1}{(1+r)^N}\right]$ Here n=30, r=6%

(c) $\implies$ ₹30,00,000 $= \dfrac{C}{0.06}\left[1 - \dfrac{1}{(1+0.06)^{30}}\right] \implies C = ₹2{,}17{,}946.73$

6. You run an analytics firm. You have just won a contract to build a forensic software for the government that predicts TAX fraud. Building it will require one year and require an investment of ₹10.91 million today and ₹5.00 million in one year. The government will pay you ₹24.00 million upon the completion. Suppose the cash flows and their times of payment are certain, and the riskfree interest rate is 11%. What is the NPV of this opportunity?
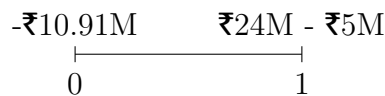
-₹10.91M   ₹24M - ₹5M

0   1

Figure 1: Problem 6 Cash Flows

(a) NPV= -₹10.91 $+ \dfrac{₹19}{1 + 0.11} = \$6.2$ Million

7. You are running a hot Internet company. Analysts predict that its earnings will grow at 40% per year for the next five years. After that, as competition increases, earnings growth is expected to slow to 3% per year and continue at that level forever. Your company has just announced earnings of $2 million. The risk-free rate is 5% and the

expected return on the Market Index is 10%. The returns of similar companies are high when the economy is strong and low when the economy is weak, but the returns vary by only half as much as the market index,

(a) What is the appropriate discount rate for this investment? Since, returns vary by only half as much as the market index, beta=0.5. Hence $r_e = 5\% + 0.5[10\% - 5\%] = 7.5\%$

(b) What is the Present Value of Your Company? Answer: $ 197 Million (see accompanying spreadsheet)