

MATH 2600/STAT 2600, Theory of Interest

FALL 2014

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Homework Sheet 2

Due: Thursday 2nd October: 11:30 AM

1. Mrs. Hall makes a loan of \$35,000 at $j_{12} = 4\%$. The loan is repaid over 5 years with equal monthly payments. When Mrs. Hall receives each payment, she immediately deposits it in an account which receives $j_{12} = 3\%$ interest. What yield does she make on her investment at the end of the 5 years?
2. Mr. Izzard invests \$500 a month at $j_{12} = 4\%$ into a fund for his retirement.
 - (a) How much is in the fund when he retires 14 years 3 months from the first investment in the fund?
 - (b) If he needs to accumulate \$150,000 before retiring, how long does he have to delay his retirement?
3. Mrs. Jacobs wants to save up \$100,000 for her son's education. She starts a savings account, which pays interest at $j_{12} = 4\%$. She plans to make monthly contributions into the account from now until her son starts university in 9 years 5 months time.
 - (a) How much should she pay into the account each month in order to meet her savings goal?
 - (b) If she can only afford to contribute \$650 each month, what interest rate does she need to receive on her savings?
4. Mr. Keith borrows \$50,000 from a bank at $j_{12} = 8\%$. He plans to pay this off with monthly payments over the next 4 years.
 - (a) What are the monthly payments?
 - (b) After 2 years, the bank sells the loan to another bank, which wants to receive $j_{12} = 6.7\%$. How much does that bank pay for the loan?
5. A company is investing into its pension plan. It makes monthly payments of \$300,000 into an account that pays $j_{12} = 6\%$, starting in January 2003. In January 2006, interest rates drop to $j_{12} = 5\%$. In September 2007, one employee retires, and the company decreases the net monthly payments starting with the September payment to \$280,000. How much is in the account when the pension plan is audited immediately following the payment in March 2010?
6. Mr. and Mrs. Lewis are retiring. They have saved up \$1,600,000, from which they want to live for the next 35 years. They want to take out monthly withdrawals, which will increase every month in line with inflation at an annual rate of 2%. (That is, the withdrawals form a geometric

progression, with each payment 2% more than the one twelve months earlier.) If their money is invested at $j_{12} = 5\%$, how much should the first withdrawal be?

7. Mr. Monroe donates \$5,000,000 to his old university. He states that the donation should be used to fund an annual scholarship of \$10,000 for each of 12 students. At what interest rate does the money need to be invested to provide this scholarship forever.
8. Mr. Neville deposits \$1,200 every quarter into an account which pays interest at $j_{12} = 4\%$. How much is in the account when he makes the 17th deposit?
9. Mrs. Owen is saving up to go on holiday. Every day she puts \$25 into an account which pays interest at $j_1 = 4\%$. How long does she have to wait before she has saved up \$6,500 for her holiday?
10. Dr. Parker takes out a loan for \$14,000 at $j_{12} = 6\%$. He wants to repay the loan with an increasing arithmetic progression of payments. He would like the first payment in one month's time to be \$100, and he would like the loan to be payed off after three years. By how much should the payments increase each month?
11. The stock of company ABC currently pays a dividend of \$0.70 every quarter. Every year the company increases the dividend by 3%. What is a fair price for the stock at $j_{12} = 8\%$?
12. A company buys a machine for \$90,000. The machine is expected to last for 6 years, after which it will have a salvage value of \$12,000. Prepare a depreciation schedule using:
 - (a) The sum of digits method.
 - (b) The constant percentage method
 - (c) The straight line method
 - (d) The compound interest method, with cost of capital $j_1 = 5\%$.
13. A company is deciding between two printers. The first printer costs \$1,600, lasts for 3 years, after which it has a resale value of \$200, and has ink and maintainance costs of \$130 in the first year, and increasing by \$20 every subsequent year. The second printer costs \$4,300, lasts for 4 years, with a resale value of \$300, and has ink and maintainance costs of \$80 in the first year, and increasing by \$10 in each subsequent year.
 - (a) If the cost of capital is $j_1 = 8\%$, which printer has lower total capitalised cost?
 - (b) Suppose the first printer will print 1,000 pages in a day, but the second printer will print 1,200 pages in a day. Which printer has the lower total capitalised cost per page?

(c) [bonus] At what cost of capital would the two printers have the same total capitalised cost per page?