FINANCIAL MATHEMATICS
(STAT 2032 / STAT 6046)

TUTORIAL EXERCISES WEEK 7

Where possible, you should perform the calculations exactly, however in some cases you will need to use linear interpolation.

Question 1
A bank lends a company $5,000 at a fixed rate of interest of 10% pa. The loan is to be repaid by five level annual payments. Calculate the amount of each repayment and complete the loan schedule for the repayments.

Question 2
A loan of $80,000 is repayable by eight annual payments, starting in one year's time, with interest payable at 4.5% per annum. Payments one to three are half as much as payments four to eight. Calculate the loan outstanding one year before the loan is completely repaid.

Question 3
A loan of $120,000 is repayable by equal quarterly payments for 25 years. The effective rate of interest is 6% per annum. Find the interest portion of the first payment.

Question 4
A loan of $12,000 is repaid by 36 monthly payments starting one month after the loan. The first 12 payments are 395+X each, the next 12 payments are 395 each, and the final 12 payments are 395-X each. If $i^{(12)}=0.12$ find X.

Question 5
A 5-year loan made on July 1, 2009 is amortised with 60 level monthly payments starting August 1, 2009. If interest is at $i^{(12)}=0.12$, find the date on which the outstanding balance first falls below one-half of the original loan amount.

Past Exam Question – 2005 Final Exam Q3(a)
A $20,000 loan is to be repaid by monthly installments payable in arrears over a period of 20 years. Monthly payments for the first 15 years of the loan are to be at the rate of $\$K$ per month, while for the final 5 years payments are to be at the rate of $\$2K$ per month. Interest is charged on the loan at the rate of 8% per annum effective.

i) Calculate the value of K. (3 marks)

ii) Calculate the total interest charged during the 17^{th} year of the loan. (4 marks)

Question 6

This question refers to two projects relating to a small software company that has asked to set up a new computer system for a major client. :

Project A

Project A delegates all the development work to outside companies. The estimated cashflows for Project A are (where brackets indicate expenditure):

Beginning of year 1	contractors' fees	($150,000)
Beginning of year 2	contractors' fees	($250,000)
Beginning of year 3	contractors' fees	($250,000)
End of year 3	sales	$1,000,000

Project B

Project B carries out all the development work in-house by purchasing the necessary equipment and using the company's own staff. The estimated cashflows for Project B are:

Beginning of year 1	new equipment	($325,000)
Throughout year 1	staff costs	($75,000)
Throughout year 2	staff costs	($90,000)
Throughout year 3	staff costs	($120,000)
End of year 3	sales	$1,000,000

The staff costs can be assumed to be paid uniformly throughout the year.

(a) Calculate the net present value for Project A and Project B using a risk discount rate of 10% per annum. Using net present value as a criterion, which project is preferable?

(b) Find the internal rates of return for Project A and Project B, and hence determine which project is more favourable using this criterion.

Question 7

For each of the projects C and D outlined below, calculate:

(a) the internal rate of return.
(b) The range of interest rates at which money can be borrowed in order for the projects to be profitable.
(c) The accumulated profit at the end of 5 years, assuming that the projects are financed by a loan subject to interest at 6.25% and interest is earned at 5%.

Project C

Initial outlay	($100,000)
Proceeds (at the end of 5 years)	$140,000

Project D

Initial outlay	($100,000)
Proceeds (at the end of each of the next 3 years)	$38,850

Question 8

An investment requires an upfront outlay of $50,000 to produce income of $10,000 at the end of each of the first five years and $5,000 at the end of each of the next five years. If an investor is able to reinvest income at 6%p.a. effective, find the internal rate of return on the investment.

Question 9

A speculator borrows $50,000 at an effective interest rate of 8% per annum to finance a project that is expected to generate $7,500 at the end of each year for the next 15 years. Find the discounted payback period for this investment and the accumulated profit if the money invested after the loan is paid back is at a rate of 6%.