CM 1021 Mathematical Methods for Computing I

Exercise Sheet 8

1. (a) A sum of £10,000 is invested in an account that pays 5% per annum simple interest. How much money is in the account after 10 years?

   (b) A sum of £10,000 is invested in an account that pays 5% per annum compound interest. How much money is in the account after 10 years?

   (c) A sum of £10,000 is invested in an account that pays simple interest. What interest rate is required so that the money in the account after 10 years is the same as if the money were invested with 5% compound interest (as in part (b)).

   (d) A sum of £10,000 is invested in an account that pays 5% per annum compounded continuously. How long will it take for the amount in the account to reach £15000?

   (e) If £10,000 is invested, at what interest rate, compounded monthly will the amount in the account total £12500 after 5 years?

2. A sum of £25 per month is paid into a savings account which offers a return of 3% per annum, compounded monthly.

   (a) How much money will be in the account after 10 years?

   (b) What sum should be invested each month in order to accumulate a total of £4000 in the account after 10 years?

   (c) What interest rate is needed if £25 is invested monthly and the total in the account is to reach £4500 after 10 years?

3. In order to buy a house, a person takes out a mortgage of £110,000. The interest rate is fixed at 8% per annum.

   (a) Calculate the monthly payments if the mortgage is to be paid off in 25 years.

   (b) Calculate the total amount of interest paid by the person over the 25 year loan period.

   (c) If the original £110,000 mortgage was paid over a period of 20 years, how much money would have been saved compared with paying over a 25 year period?

   (d) What is the loan outstanding after 15 years?

   (e) If the house initially cost £140,000 and house prices rise at an average 4% per year, how much equity will the person have after 15 years?

4. How long will it take for an investment to triple in value if invested at an annual rate of 3% compounded (a) annually and (b) continuously?

5. What is the APR if the nominal rate of 7% is compounded (a) quarterly and (b) continuously?

6. What is the annual percentage rate if the nominal rate is 12% compounded weekly?

7. Two projects are available for an initial investment of £100,000.

   Project A returns £25,000 at the end of year 2 and £27,500 at the end of years 3,4,5 and 6. At the end of year 7 the scrap value will be £20,000.

   Project B gives a return of £28,000 at the end of years 1,2,3 4 and 5.

   (a) Calculate the NPV and the IRR of each project.

   (b) Which project is the more attractive investment?

   More Challenging Question

8. A prize fund is set up with a single investment of £5000 to provide an annual prize of £500. The fund is invested to earn 7% interest compounded annually. If the first time the prize is awarded is one year after the initial investment is made and subsequent prizes are awarded each year on the same date, for how many years can the prize be awarded before the fund falls below £500?