1 – (12 points) An annuity consists of annual payments of $100 starting at t=5 and ending at t=30 inclusive. If i=4%, find the total value of this annuity at t=20.

2 – (12 points) Find the present value of an annuity due consisting of $1,000 every six months for 20 years if the nominal rate of interest is 12% compounded monthly.

3 – (18 points) The annual effective rate of interest is 10%. Deposits of $100 are placed in a fund at the beginning of each quarter for 5 years. The fund is being accumulated in order to be able to withdraw a certain amount every quarter forever. If the first withdrawal takes place at the end of the 10th year, find the amount of each withdrawal.

4 – (18 points) A benefactor leaves an inheritance to four charities A, B, C, and D. The total inheritance is a series of level payments at the end of each year forever. A will receive the first 10 payments, B will receive the second 10 payments, C will receive the next 20 payments, and D will receive all payments thereafter. The present value of D’s share is 1/16 of the present value of the total inheritance.

 a) Show that v10=1/2

 b) Find the ratio of the present value of C’s share to the present value of A’s share.

5 – (14 points + Bonus 5 points)

a) (9 points) A fund of $45,000 is to be accumulated by means of deposits of $3,000 at the end of every year for as long as necessary. If the fund earns an effective rate of interest of 8%, find how many regular deposits will be necessary.

b) (5 points) Determine the size of the final deposit to be made, if needed, one year after the last regular deposit.

 c) (Bonus: 5 points) Give an explanation for the result obtained in part b.

6 – (12 points) To accumulate $8,000 at the end of 3n years, deposits of $1,000 are made at the end of each of the first n years and $200 at the end of the next 2n years. The annual effective rate of interest is i. You are given (1+i)n=2. Determine i.

7 – (14 points) Frank takes out a loan on January 1, 2007. He will repay the loan by means of an annuity consisting of 10 payments of $1,000 to be made every six months, with the first of these payments to be made on January 1, 2009. The nominal interest rate compounded semi-annually is 8% for the first five years (2007 – 2011 inclusive), and 4% compounded semi-annually thereafter. Find the present value of the loan on January 1, 2007.