Australian National University
Research School of Finance, Actuarial Studies and Applied Statistics

STAT2032/6046: Financial Mathematics

Review Questions (Week 1 – Week 3)

WEEK 1

Question 1

At a certain rate of simple interest $1100 will accumulate to $1250 after a certain period of time. Find the accumulated value of $500 at a rate of simple interest three fifths as great over twice as long a period of time.

Question 2

Find the total present value as at 1 June 1999 of payments of $100 on 1 January 2000 and $200 on 1 May 2000, assuming a rate of interest of 10% pa convertible quarterly.

Question 3

    i.   Find the effective annual rate of interest corresponding to:
        a. a nominal rate of 13% convertible half-yearly
        b. a nominal rate of interest of 10% convertible monthly

    ii.   Find the rate of interest convertible monthly corresponding to:
        a. an effective rate of 5% per annum
        b. a nominal rate of 21% convertible five times a year

Question 4

At a certain interest rate the present value of the following two payment patterns are equal:

    i. $150 at the end of 5 years plus $450 at the end of 10 years.
    ii. $400 at the end of 5 years.

At the same interest rate $80 invested now plus $100 invested at the end of 5 years will accumulate to P at the end of 10 years. Calculate P.

Question 5

Fund A accumulates at 6% p.a. effective and Fund B accumulates at 8% p.a. effective. At the end of 18 years the total of the two funds is $3000. At the end of 10 years the amount in Fund A is half that in Fund B. What is the total of the two funds at the end of 7 years?

WEEK 2

Question 6

A rate of interest of 8% pa convertible weekly is equivalent to an annual effective rate of discount of d. Find d.

Question 7

Find the accumulated value of $5.50, assuming a force of interest of 4% per annum, after:

    a. 1 month
    b. 3 years and 12 days

Question 8

$780 is invested for 13 months at $i = 9.00\%$, then the investment is switched to one that pays interest at a force of $\delta = 8.00\%$ for 10 months and then $\delta = 10.00\%$ for five years. What is the final accumulated value?

Question 9

When $i = 8.00\%$ find:

    a. $i^{(1/2)}$
    b. $d^{(5.5)}$
    c. $i^{(4)}$
    d. $d^{(2)}$
    e. δ

WEEK 3

Question 10

Find the present value of an annuity-due (ie. payable at the start of each period) of $300 per annum payable half-yearly for 10 years if $d^{(12)} = 9.00\%$

Question 11

Show that $a_{\overline{n|}}^{(m)} = \dfrac{1}{m} \ddot{a}_{\overline{n|}} \sum\limits_{t=1}^{m} v^{t/m}$

Question 12

If $\overline{a}_{\overline{n|}} = 3$ and $\overline{s}_{\overline{n|}} = 6$, find δ, where $\delta > 0$

Question 13

If $a_{\overline{n|}} = x$ and $a_{\overline{2n|}} = y$, express i as a function of x and y.

Question 14

Show that:

    i. $\ddot{a}_{\overline{n|}} = a_{\overline{n|}} + 1 - v^n$

    ii. $\ddot{s}_{\overline{n|}} = s_{\overline{n|}} - 1 + \left(1+i\right)^n$

Question 15

Find the present value to the nearest dollar on January 1 of an annuity which pays $3000 every 6 months for 9 years. The first payment is due on the next April 1 and the rate of interest is 9% convertible half-yearly.

Question 16

Evaluate the following at $\delta = 1.5\%$

    i. $s_{\overline{5|}}$

    ii. $\ddot{s}_{\overline{10|}}$

    iii. $\overline{s}_{\overline{4.5|}}$

Question 17

Evaluate the following functions at $i = 4.5\%$.

i. $a^{(12)}_{\overline{10|}}$

ii. $\ddot{a}^{(2)}_{\overline{20}}$

iii. $\overline{s}_{\overline{15|}}$

Question 18

Find the present value as at 1 June 2000 of 50 monthly payments each of $200 commencing on 1 January 2001, assuming a rate of interest of 12% pa convertible half yearly.

Question 19

i.   Find the combined present value of an immediate annuity payable monthly in arrears such that payments are $500 pa for the first 5 years and $350 pa for the next 2 years.
ii. Calculate the amount of the level annuity payable continuously for 5 years having the same present value as the payments in (i)
iii. Calculate the accumulated values of the first 4 years' payments at the end of the 4th year for the payments in (i) and (ii).

Assume an interest rate of 24% pa convertible monthly.

Question 20

Find the accumulated value 32 years after the first payment is made of an annuity on which there are 8 payments of $1000 each made at two-year intervals. The nominal rate of interest convertible half-yearly is 7%.