SCHOOL OF FINANCE AND APPLIED STATISTICS

FINANCIAL MATHEMATICS
(STAT 2032 / STAT 6046)

TUTORIAL EXERCISES WEEK 10

Question 1

A ten-year zero-coupon bond is issued on 1 February 2000 at a price of $79 per $100 nominal. On 1 February 2002 an investor entered into a forward contract to buy $1000 nominal of the bond in 5 years' time. The price of the bond was $83 per $100 nominal on 1 February 2002 and $92 per $100 nominal on 1 February 2007.

Calculate the profit or loss made by the investor on 1 February 2007 if the risk-free force of interest was 3% pa.

Question 2

(i) A fixed interest stock is redeemable at 106% (ie. 1.06 per unit nominal) in 15 years' time and pays coupons of 9% per annum payable half-yearly in arrears. What price should an investor pay per $100 nominal to obtain a gross redemption yield of 9% per annum?

(ii) Instead of purchasing the stock, the investor decides to agree a forward contract to buy the security in six years' time immediately after the coupon payment then due. Calculate the forward price based on a risk-free rate of return of 6% pa effective and no arbitrage. The current price of the stock is that calculated in part (i).

Question 3

On 30 June 2006 an investor wishes to enter a forward contract to buy 10,000 shares of Company ABC at 30 June 2016. The current share price is $2.50 and the annual dividend payable at 31 December 2006 is expected to be $0.08 per share.

If the risk free force of interest is 5% p.a. and dividends are expected to remain constant, calculate the value of the long forward contract at 30 June 2012 if the share price at that date is $2.90 and dividends have remained constant as expected.

Question 4

If the n year spot rates can be approximated by the function $s_n = 0.09 - 0.03e^{-0.1n}$,

Calculate the following quantities:

a) the one-year forward rate at time 10 years (ie. $f_{10,11}$).

b) the price of $100 nominal of a 10-year zero coupon bond redeemable at par.

c) the 5 year spot rate in 20 years' time

d) the price of $100 nominal of a 10-year zero coupon bond redeemable at par purchased in 5 years' time

Question 5

Zero coupon bonds redeemable at par are available with the following prices for $100 nominal:

Term	Price
4 years	$79
5 years	$74
6 years	$69
7 years	$64

Find the one-year forward rate of interest starting in 5 years' time implied by these prices.

Question 6

Find the price of a 3-year $100 bond, redeemable at par, with annual coupons of 6% per annum, if the 3-year spot rate is 9% per annum and the following annual forward rates of interest apply:

$s_1 = 10\%$ per annum

$f_{2,3} = 7\%$ per annum

where $f_{t,T}$ is the annual rate of interest agreed at time 0 for an investment made from time t until time T.

Past Exam Question – 2005 Final Exam Q2(c)

For discrete time periods (t = 0,1,2,3…..), the forward effective rate per annum can be calculated as follows:

$$f_{t,t+1} = \exp(0.07 + 0.001t^2) - 1$$

Calculate the following (on an effective per annum basis):

i) s_3 (2 marks)

ii) $f_{6,9}$ (2 marks)

iii) $f_{t,t+2}$ (2 marks)