PGDM, 2017-19
Fixed Income Securities
DM-513/IB-514
Trimester – V, End-Term Examination: December 2018

Time allowed: 2 Hrs 30 Min
Max Marks: 50

Roll No: _____

Instruction: Students are required to write Roll No on every page of the question paper, writing anything except the Roll No will be treated as **Unfair Means.** All other instructions on the reverse of Admit Card should be followed meticulously.

Sections	No. of Questions to attempt	Marks	Marks
A	3 out of 5 (Short Questions)	5 Marks each	3*5 = 15
B	2 out of 3 (Long Questions)	10 Marks each	2*10 = 20
C	Compulsory Case Study	15 Marks	15
		Total Marks	**50**

A. Please attempt 3 questions out of 5 given below.

A1. An investor has a short position in a 20-year 5% coupon, U.S. treasury bond with a yield to maturity of 6% and par value of $100. Assume discounting occurs on a semiannual basis. calculate DV01.

A2. Use the following information and the bootstrapping methodology. What is the 2-year spot rate?

Price as a percentage of par	annual coupon	annual period	maturity (years)
102.6364	4.25%	1	1
105.3651	4.75%	2	2

A3. You have derived the following spot rate curve and forward rates from the prices of treasury STRIPS. Using the information in the table, calculate the 6-month forward rate on an investment that matures in 2.0 years.

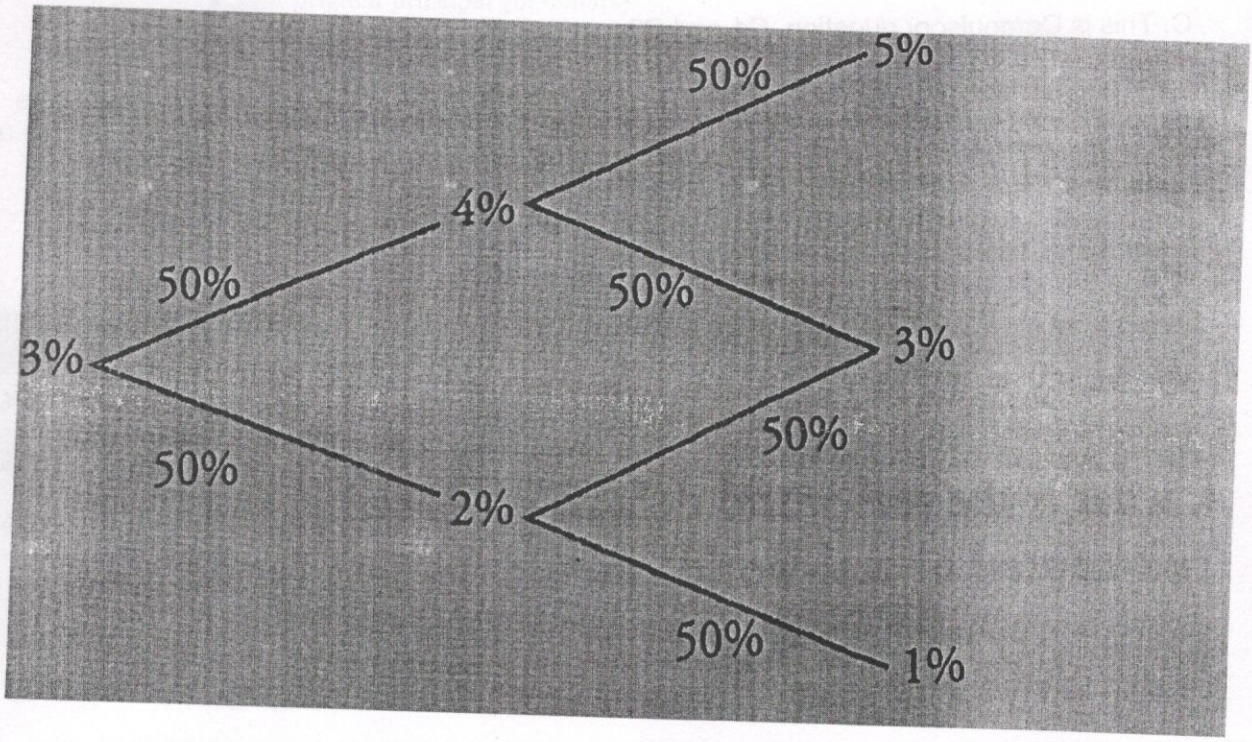
Maturity (Years)	Spot Rate	Forward Rate
0.5	1.50%	1.50%
1.0	2.15%	2.80%
1.5	2.53%	3.295
2.0	2.94%	?

A4. Bond A has an effective duration of 12,13 and a 2-year key rate exposure of $4.04. You would like to hedge it with a security with an effective duration of 2.48 and a 2-year key rate exposure of 0.81 per $100 face value. What amount of face value would be used to hedge the 2-year exposure. (I,II,10)5.

A5. Suppose there is a 15-year option free non callable bond with an annual coupon of 7% trading at par. If interest rates rise by 50 basis point, the estimated price of the bond is 95.586%. If interest rates fall by 50 basis points, the estimated price of the bond is 104.701%. Calculate the convexity of this bond.

B. Please attempt 2 questions out of given 3 given below.

B1. The following decision tree of expected 1-year rates is for a 2-year zero-coupon bond with a face value of $1. Suppose that investors are risk averse and require a risk premium of 30 basis points for each year of interest rate risk. What is the price for a 2-year zero-coupon bond with a face value of $1 using the expected 1-year returns in the decision tree?



B2. Table below shows selected T-bond prices for semiannual coupon $100 face value bonds . Prices are from 5/14/06 with t+1 settlement. Generate the discount factors for the dates indicated.

Bond	Coupon	Maturity	Price
1	4.25%	11/15/06	101-16
2	7.25%	5/15/07	105-31+
3	2.00%	11/15/07	101-07

4	12.00%	5/15/08	120-30
5	5.75%	11/15/08	110-13+

B3. An investor has a short position in a 20-year 5% coupon, U.S. treasury bond with a yield to maturity of 6% and par value of $100. Assume discounting occurs on a semiannual basis. Using a 30-year, 5% coupon, U.S Treasury bond yielding 5% with a DV01 of 0.1544 to hedge the interest rate risk in the 20-year bond, which action should be taken. (I,I,90), 10.

C. This is Compulsory question. C1 and C2 carries 10 and 5 marks respectively.

C1. Cooper industries (Cooper) is the pay-fixed counterparts in an interest rate swap. The swap is based on the 6-month Hong Kong Interbank Offered Rate (HIBOR). Cooper pays a fixed rate of 7% semiannually. A swap payment has just been made. The swap has a remaining life of 18 months, with pay dates at 6,12 and 18 months. Continuously compounded spot HIBOR rates are as below. Please calculate the value of swap using forward rate agreement (FRA) methodology.

6 Month HIBOR	**6.5%**
12 Month HIBOR	6.8%
18 Month HIBOR	7.5%
24- Month HIBOR	7.7%

C2. Assume a 3-year bond with a face value of $100 pays a 3.5% coupon on a semiannual basis. What is the price of the bond according to the following spot rates?

Maturity (Years)	Spot rates (%)
0.5	2.20%
1.0	2.25%
1.5	2.30%
2.0	2.35%
2.5	2.40%
3.0	2.45%

Formulas

1. To determine the future value of any sum of money invested today the following equation is used.

   $P_n = P_0(1+r)^n$

   Where:

   - n= number of periods
   - P_n=future value n periods from now (in dollars)
   - P_0= original principal (in dollars)
   - r= interest rate per period (in decimal form)

2. Future Value of an ordinary annuity $P_n = A[\frac{(1+r)^n-1}{r}]$

3. Present Value formula $PV = P_n[\frac{1}{(1+r)^n}]$

4. Present value of a series of future values PV=$\sum_{t=1}^{n} \frac{P_t}{(1+r)^t}$

5. Present value of an ordinary annuity PV=$A[\frac{1-\frac{1}{(1+r)^n}}{r}]$

6. Pricing a Bond-Formula

   In general the price of a bond can be computed using the following formula P=$\sum_{i=1}^{n} \frac{C}{(1+r)^t} + \frac{M}{(1+r)^n}$ Where,

   - P=price (in dollars)
   - n=number of periods
   - C=semiannual coupon payment
   - r=periodic interest rate
   - M= Maturity value
   - t= time period when the payment is to be received.

   or Since, the semiannual coupon payments are equivalent to an ordinary annuity, applying the formula for the present value of an ordinary annuity gives the present value of the coupon payments,

   P=$C[\frac{1-\frac{1}{(1+r)^n}}{r}] + \frac{M}{(1+r)^n}$

7. Pricing a Bond-Zero Coupon Bond P=$\frac{M}{(1+r)^n}$

8. Yield or internal rate of return on any investment

   $P = \sum_{t=1}^{N} \frac{CF_t}{(1+y)^t}$

   where

   - CF_t= Cash flow in year t

- P= Price of the investment
- N= Number of years

9. Yield - Special case (Investment with only one future cash flow
   P= $\frac{CF_n}{(1+y)^n}$

10. Annualizing Yields
    effective annual yield= $(1 + periodicinterestrate)^m - 1$
    - where, m is the frequency of payments per year.

11. Current Yield
    current yield= $\frac{annual-dollar-coupon-interest}{price}$

12. Macaulay Duration Macaulay duration= $\frac{\frac{1C}{1+y}+\frac{2C}{(1+y)^2}+....+\frac{nC}{(1+y)^n}+\frac{nM}{(1+y)^n}}{P}$

    where,
    - P= price of the bond
    - C= semiannual coupon interest (in dollars)
    - y= one-half the yield to maturity or required yield.
    - n= number of semiannual periods (number of years*2)
    - M= maturity value (in dollars)
    - the term in brackets is the weighted average average term to maturity of the cash flows from the bond, where the weights are the present value of the cash flow.

13. Modified Duration
    Modified Duration=[Macaulay Duration/(1+ $\frac{YTM}{n}$)]

14. dollar duration=-(modified duration)P