

Multiple Choice – Circle the correct answer – 3 points each – 30 points total

1. A coupon bond pays annual interest, has a par value of \$1,000, matures in 12 years, has a coupon rate of 8.7%, and has a yield to maturity of 7.9%. The current yield on this bond is _____.
 - A. 8.39%
 - B. 8.43%
 - C. 8.83%
 - D. 8.56%
 - E. None of the above

2. An inverted yield curve implies that:
 - A. Long-term interest rates are lower than short-term interest rates.
 - B. Long-term interest rates are higher than short-term interest rates.
 - C. Long-term interest rates are the same as short-term interest rates.
 - D. Intermediate term interest rates are higher than either short- or long-term interest rates.
 - E. None of these is correct.

3. A hedge ratio of 0.85 implies that a hedged portfolio should consist of:
 - A. long 0.85 calls for each short stock.
 - B. short 0.85 calls for each long stock.
 - C. long 0.85 shares for each short call
 - D. long 0.85 shares for each long call.
 - E. short 0.85 calls for each short stock.

4. Suppose you feel a certain stock will appreciate in value. Which of the following option strategies will create a profit for you?
 - I. Buy a call.
 - II. Buy a put.
 - III. Sell a call.
 - IV. Sell a put.
 - A. II and III only.
 - B. I only.
 - C. II and IV only.
 - D. I and IV only.
 - E. IV only.

5. Which of the following is/are correct?

	Sign of Input Effect	
	Call	Put
I. The strike price.	-	+
II. The time to expiration.	+	-
III. The volatility of the underlying	+	+
IV. The risk-free rate.	+	-

- A. I and II only
- B. I and III only
- C. II and III only
- D. II and IV only
- E. I, III, and IV

6. All else the same, which of the following put options will have the highest price?

- A. Stock price = \$50, Strike price = \$45
- B. Stock price = \$50, Strike price = \$50
- C. Stock price = \$55, Strike price = \$45
- D. Stock price = \$55, Strike price = \$50
- E. Insufficient information.

7. Delta is defined as:

- A. the change in value of an option for a dollar change in the price of the underlying asset.
- B. the percentage change in the value of an option for a one percent change in interest rates.
- C. the change in the price of an option for a one percent change in the volatility of the underlying asset.
- D. the change in value of the underlying asset for a dollar change in the price of the option.
- E. the change in price of an option for a one-day decrease in maturity.

8. Which of the following is not true?

- A. All else constant, the duration of a bond increases with time to maturity.
- B. For a given maturity the duration of a zero coupon bond increase with yield to maturity.
- C. All else constant, the duration of a bond is higher when the coupon rate is lower.
- D. Duration is a better measure of price sensitivity to interest rate changes than maturity.
- E. All of the above are true.

9. To exploit an expected decrease in interest rates, an investor would most likely:

- A. sell Treasury bond futures.
- B. sell Treasury bill futures.
- C. buy S&P index futures.
- D. buy Treasury bill futures.
- E. buy wheat futures.

10. An inverted yield curve implies that:

- A. Long-term interest rates are lower than short-term interest rates.
- B. Long-term interest rates are higher than short-term interest rates.
- C. Long-term interest rates are the same as short-term interest rates.
- D. Intermediate term interest rates are higher than either short- or long-term interest rates.
- E. None of these is correct.

PARTIAL CREDIT PROBLEMS – SHOW ALL WORK!!!

Problem 1 (11 points) You are managing a pension plan that is due to pay \$11 million a year for 15 years with the first payment one year from today and \$8 million a year for 10 years with the first payment 5 years from today. You can use a zero coupon bond with 4 years to maturity and a 20 year coupon bond with a duration of 12.31 years to immunize your portfolio. The interest rate is 7 percent for all maturities. How many zero coupon bonds will you have to purchase? Assume annual cash flows and compounding in your calculations.

Problem 2 (10 points) You want to buy a Back Spread with Calls. This involves selling a call at X_1 and buying two calls at X_2 . Assume $X_1 = \$160$ and $X_2 = \$170$. Graph the strategy for all possible stock prices between \$140 and \$190. What is/are the breakeven price(s)?

Calls for September 15, 2017

^ Strike	Contract Name	Last Price	Bid	Ask	Change	% Change	Volume	Open Interest	Implied Volatility
140.00	IBM170915C00140000	20.00	19.25	21.15	0.00	0.00%	10	10	17.75%
150.00	IBM170915C00150000	11.60	11.30	11.95	0.00	0.00%	8	16	13.84%
155.00	IBM170915C00155000	8.25	8.05	8.30	0.00	0.00%	1	54	13.48%
160.00	IBM170915C00160000	5.25	5.20	5.35	0.00	0.00%	25	242	13.20%
165.00	IBM170915C00165000	3.04	3.05	3.20	-0.16	-5.00%	15	623	13.04%
170.00	IBM170915C00170000	1.69	1.66	1.72	-0.02	-1.17%	17	347	12.78%
175.00	IBM170915C00175000	0.85	0.80	0.91	0.04	4.94%	6	127	12.90%
180.00	IBM170915C00180000	0.41	0.39	0.49	-0.02	-4.65%	180	168	13.26%

Problem 3 (11 points) You have found the following interest rates for zero coupon bonds:

<u>Maturity</u>	<u>EAR</u>
3 month	4.17%
6 month	4.69%
9 month	4.98%
1 year	5.35%

What are the three month forward rates in three months, six months, and nine months when expressed as EARs?

Problem 4 (10 points) There is a stock that trades for \$74. What is the price of an American put option with a strike price of \$70 if the expected return of the stock is 12 percent, the volatility is 65 percent, and the risk free rate is 5 percent if the option has three months until expiration? Use one-month steps.

Problem 5 (10 points) You are short 30 gasoline futures contracts, established at an initial settle price of \$1.548 per gallon, where each contract represents 42,000 gallons. Your initial margin to establish the position is \$7,425 per contract, and the maintenance margin is \$6,500 per contract. Over the subsequent four trading days, gasoline settles at \$1.493, \$1.578, \$1.593, and \$1.647, respectively. Compute the balance in your margin account at the end of each of the four trading days, and compute your total profit or loss at the end of the trading period. Assume that a margin call requires you to fund your account back to the initial margin requirement.

Problem 6 (6 points) Under the liquidity preference theory, if inflation is expected to be falling over the next few years, long-term interest rates will be lower than short-term interest rates. True/False/Uncertain? Explain.

Problem 7 (4 points) What is the most important thing you learned in this class? Why? (This is four points so answer seriously – An answer of nothing receives nothing.)

Multiple Choice

- | | |
|------|-------|
| 1. E | 6. B |
| 2. A | 7. A |
| 3. C | 8. B |
| 4. D | 9. D |
| 5. E | 10. A |

Problem #1

The duration for the annuity beginning in one year is:

$$D_1 = \frac{1+.07}{.07} - \frac{15}{(1+.07)^{15}-1} = 6.758 \text{ years}$$

The duration for the annuity beginning in five years is:

$$D_2 = \frac{1+.07}{.07} - \frac{10}{(1+.07)^{10}-1} = 4.946 + 4 = 8.946 \text{ years}$$

The present value and weights are:

$PV_1 = \$100,187,054.06$	weight = .7003
$PV_2 = \$42,866,053.83$	weight = .2997
Total = \$143,053,107.89	

The duration of the portfolio is:

$$D = .7003(6.758) + .2997(8.946) = 7.414 \text{ years}$$

The weight of the bonds in the dedicated portfolio will be:

$$\begin{aligned} 7.414 &= x_{\text{zero}}(4) + x_{\text{coupon}}(12.31) \\ 7.414 &= x_{\text{zero}}(4) + (1 - x_{\text{zero}})(12.31) \\ 7.414 - 12.31 &= x_{\text{zero}}(4) - x_{\text{zero}}(12.31) \\ x_{\text{zero}} &= .5892 \end{aligned}$$

$$\text{Zero dollar value} = .5892(\$143,053,107.89)$$

$$\text{Zero dollar value} = \$84,284,880.65$$

$$\text{Zero price} = \$1,000/(1 + .07)^4 = \$762.90$$

$$\text{Number of zeros} = \$84,284,880.65 / \$762.90$$

$$\text{Number of zeros} = 110,480.29$$

Problem #2



You will sell the option for \$5.20 and buy 2 at \$1.72 for a net cash flow of \$1.86. The breakeven points are \$163.18 and \$176.86.

Problem #3

The APRs and effective quarterly rates are:

<u>Maturity</u>	<u>EAR</u>	<u>APR</u>	<u>Quarterly</u>
3 month	4.17%	4.11%	1.03%
6 month	4.69%	4.61%	1.15%
9 month	4.98%	4.89%	1.22%
1 year	5.35%	5.25%	1.31%

In three months:

$$1.0115^2 = [(1.0103)(1 + f_{3,3})]$$

$$\left(\frac{(1.0115)^2}{(1.0103)} \right) - 1 = f_{3,3}$$

$$f_{3,3} = .01278 \times 4 = 5.114\%$$

$$\text{EAR} = 5.213\%$$

In six months:

$$1.0122^3 = [(1.0115)^2(1 + f_{3,6})]$$

$$\left(\frac{(1.0122)^3}{(1.0115)^2} \right) - 1 = f_{3,6}$$

$$f_{3,6} = .01363 \times 4 = 5.450\%$$

$$\text{EAR} = 5.562\%$$

In nine months:

$$1.0131^4 = [(1.0122)^3(1 + f_{3,9})]$$

$$\left(\frac{(1.0131)^4}{(1.0122)^3} \right) - 1 = f_{3,9}$$

$$f_{3,9} = .01579 \times 4 = 6.317\%$$

$$\text{EAR} = 6.468\%$$

Problem #4

E(R)	0.12
$S_0 =$	74
$\sigma =$	0.65
X =	70
$R_f =$	0.05

Expiration	3 mths
Steps	1 mths

$u = e^{\sigma\sqrt{T}} =$	1.2063977
$d = e^{-\sigma\sqrt{T}} =$	0.828914
$p = (e^{\mu\Delta t} - d) / (u - d) =$	0.4798516
$1-p =$	0.5201484

$$S_G = 129.93$$

$$f_G = 0.00$$

$$S_D = 107.70$$

$$f_D = 0.00$$

$$S_B = 89.27$$

$$f_B = 2.32$$

$$S_H = 89.27$$

$$f_H = 0.00$$

$$S_0 = 74.00$$

$$f_A = 7.36$$

$$S_E = 74.00$$

$$f_E = 4.49$$

$$S_C = 61.34$$

$$f_C = 12.07$$

$$S_I = 61.34$$

$$f_I = 8.66$$

$$S_F = 50.85$$

$$f_F = 19.15$$

$$S_J = 42.15$$

$$f_J = 27.85$$

Problem #5

Initial margin account	\$222,750
Maintenance margin	\$195,000
Initial value of position	\$1,950,480

Day 1:

New position value	\$1,881,180
Gain/Loss	\$69,300
Margin account balance	\$292,050
Margin deposit	\$0
New margin account balance	<input type="text" value="\$292,050"/>

Day 2:

New position value	\$1,988,280
Gain/Loss	\$(107,100)
Margin account balance	\$184,950
Margin deposit	\$37,800
New margin account balance	<input type="text" value="\$222,750"/>

Day 3:

New position value	\$2,007,180
Gain/Loss	\$(18,900)
Margin account balance	\$203,850
Margin deposit	\$0
New margin account balance	<input type="text" value="\$203,850"/>

Day 4:

New position value	\$2,075,220
Gain/Loss	\$(68,040)
Margin account balance	\$135,810
Margin deposit	\$86,940
New margin account balance	<input type="text" value="\$222,750"/>

Total	<input type="text" value="-\$124,740"/>
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Problem #6

Uncertain. Expectations of lower inflation will usually lead to lower nominal interest rates. Nevertheless, if the liquidity premium is sufficiently great, long-term yields may exceed short-term yields *despite* expectations of falling short rates.