

**COURSE 6
MORNING SESSION**

SECTION A – WRITTEN ANSWER

****BEGINNING OF COURSE 6****
MORNING SESSION

1. *(4 points)*

Describe the key features of:

- (i) Asian options
- (ii) Look-back options
- (iii) Interest rate collars
- (iv) Interest rate corridors

2. (7 points) You are given the following:

		Effective Annual Return		
	Probability	Stock ABC	Stock DEF	T-bills
Scenario 1	0.60	25%	5%	4%
Scenario 2	0.40	5%	15%	4%

Mix of Investments			
	Stock ABC	Stock DEF	T-bills
Portfolio I	100%	0%	0%
Portfolio II	75%	0%	25%
Portfolio III	75%	25%	0%

- (a) Calculate the expected rate of return and the standard deviation of each portfolio.
- (b) Assess portfolios I, II and III from the perspective of:
- (i) A risk-neutral investor
 - (ii) A risk-averse investor

3. (5 points)

- a) With respect to short sales of a security:
- (i) Describe the process for executing a short sale.
 - (ii) Outline an investor's motivation for executing such a transaction.
- b) You are given the following:

Date	Corporation Z Share Price
January 1, 2001	60
January 15, 2001	63
January 31, 2001	58

- Corporation Z paid a dividend of 1 on January 15, 2001
 - The maximum price of Corporation Z shares during the month of January 2001 was 63
 - On January 1, 2001, Investor A sold short 100 shares of Corporation Z
 - On January 31, 2001, Investor A covered the short position
 - The initial margin requirement was 50%
 - The maintenance margin requirement was 40%
 - There were no other transaction costs
 - No interest was earned on the balance with the broker
- (i) Outline the transaction on January 1, 2001.
 - (ii) Outline the transaction on January 31, 2001.
 - (iii) Determine whether a margin call was necessary.
 - (iv) Calculate the rate of return to Investor A for January 2001.

Show all work.

4. (10 points) You are given the following information about on-the-run Treasuries:

Term (Years)	Annual Coupon	Yield to Maturity
1	4.00%	4.00%
2	5.25%	5.20%
3	5.50%	5.40%

You are given the following market information about bonds issued by BIG Corporation. The credit spread is relative to Treasuries with the same maturity.

Term (Years)	Credit Spread	Annual Coupon
1	0.20%	5.00%
2	0.50%	5.50%
3	0.60%	6.00%

The following 1-year rates, n-years forward along the lower path calibrate a binomial interest-rate tree where the logarithm of the 1-year rate obeys a binomial distribution with $p = \frac{1}{2}$:

$n = 1$			$n = 2$		
Annual Coupon	Price of 2-yr Bond	r_L	Annual Coupon	Price of 3-yr Bond	r_{LL}
5.50%	99.632	6.369%	6.00%	99.733	5.316%
5.50%	100.000	6.005%	6.00%	100.000	5.071%
5.50%	100.556	5.461%	6.00%	101.622	3.615%

The volatility of the 1-year rate is 13%.

Consider a five-year 6.75% annual coupon BIG Corporation bond that has three years remaining to maturity.

- Determine the current price of the bond using the binomial interest-rate tree model if the bond has no embedded options.
- Determine the current price of the call option if the bond:
 - is callable
 - has a 3.5 year non-callable deferral period
 - has a call premium of 1%
- Describe the features of a bond with an attached warrant.

Show all work.

5. (6 points) With respect to the performance attribution of international investment managers:

(a) Describe the measurement of the following sources of abnormal returns:

- (i) Currency selection
- (ii) Country selection
- (iii) Stock selection
- (iv) Cash/bond selection

(b) You are given the following:

	EAFE Weight	Return on Equity Index	Currency Appreciation	Manager's Weight	Manager's Return
Europe	30%	10%	10%	X	8%
Australia	10%	5%	-10%	Y	7%
Far East	60%	15%	30%	Z	18%

- The manager's currency selection gain: -6.0%
- The manager's country selection gain: -1.5%
- The manager's stock selection gain: +0.8%

Calculate the manager's weights in Europe, Australia and the Far East.

Show all work.

6. (6 points) You are performing an asset adequacy test for a block of immediate annuities. There are three different asset-liability management strategies:

- Immunization
- Contingent immunization
- Dedicated portfolio

- (a) Describe the three strategies.
- (b) Describe the active management modeling considerations of these three strategies.
- (c) Evaluate the advantages and disadvantages of the three strategies for a block of immediate annuities in a changing interest rate environment.

7. (7 points)

- (a) (1 point) Describe the risks to an insurance company of using commercial mortgage-backed securities (CMBS) to support insurance liabilities.
- (b) (3 points) Describe methods of mitigating risks inherent in CMBS.
- (c) (3 points) You are given the following with respect to a portfolio of 10 commercial mortgage loans:
- All are new loans of \$50 million each
 - Eight loans are secured by hotels in New York
 - Two loans are secured by warehouses in Chicago
 - The average loan-to-value ratio is 95%
 - The average debt-service-coverage ratio is 1.1
 - All loans have a yield-maintenance agreement
 - All loans feature a balloon payment in five years
- (i) Evaluate the credit quality of a proposed CMBS which would consist of the above commercial mortgage loan portfolio.
- (ii) Recommend modifications to the commercial mortgage loan portfolio that would increase its attractiveness to the insurance company.

**COURSE 6
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SECTION B – MULTIPLE CHOICE

1. The risk that remains even after extensive diversification of an investment portfolio is:

- (A) Firm-specific risk
- (B) Market risk
- (C) Non-systematic risk
- (D) Political risk
- (E) Unique risk

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2. You are given the following information:

Expected annual return on a risky portfolio:	10%
Standard deviation of annual returns on a risky portfolio:	20%
Risk-free annual rate of return:	5.0%
Annual borrowing rate:	7.5%

Calculate the reward-to-variability ratio of a leveraged position in the risky portfolio.

- (A) 0.100
- (B) 0.125
- (C) 0.167
- (D) 0.250
- (E) 0.500

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3. An arbitrage free securities market model consists of a bank account and one security. The security price today is 100. The security price one year from now will be either 104 or 107. Determine which of the following can be the bank account interest rate.

(A) 0%

(B) 3%

(C) 5%

(D) 8%

(E) 10%

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4. You are given the following information concerning a contingent immunization strategy:

Initial portfolio value:	10,000,000
Minimum target return:	4.0%
Number of years in investment horizon at inception:	10
Immunized yield available at inception:	8.0%

Calculate the difference (x) between the initial portfolio value and the required assets for immunization at inception.

- (A) $x \leq 2,000,000$
- (B) $2,000,000 < x \leq 3,000,000$
- (C) $3,000,000 < x \leq 4,000,000$
- (D) $4,000,000 < x \leq 5,000,000$
- (E) $x > 5,000,000$

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5. You are given the following information for Stock ABC:

Limit-Buy Orders		Limit-Sell Orders	
Price	Number of Shares	Price	Number of Shares
49.75	500	50.25	100
49.50	800	51.50	100
49.25	500	54.75	300

A market-buy order for 150 shares of Stock ABC is placed.

The spread between the bid price and the ask price is zero for this transaction.

Calculate the price at which the market-buy order will be filled.

- (A) 49.75
- (B) 50.25
- (C) 50.67
- (D) 50.88
- (E) 51.50

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6. You are given the following information about a securities exchange:

	Day I	Day II	Day III
Issues traded	3,401	5,587	9,034
Advances	1,373	2,048	5,609
Declines	1,476	2,358	5,906
Advance volume (000)	241,061	524,897	678,095
Decline volume (000)	312,272	489,655	668,901
Total volume (000)	587,215	1,018,629	1,353,333

Using the trin statistic, rank days I, II, III from most bearish to least bearish.

- (A) I > II > III
- (B) I > III > II
- (C) II > I > III
- (D) II > III > I
- (E) III > II > I

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7. You are given the following information:

- An option market satisfies the condition for put-call parity
- The current underlying security price is 100
- A call option with a strike price of 105 and maturity one year from now has a current price of 4
- A put option with a strike price of 105 and maturity one year from now has a current price of 6

Determine the short-term risk-free interest rate.

- (A) 2.9%
- (B) 3.9%
- (C) 5.9%
- (D) 6.9%
- (E) 15.4%

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- 8-14.** Each of questions 8 through 14 consists of two lists. In the list at the left are two items, lettered X and Y. In the list at the right are three items, numbered I, II, and III. ONE of the lettered items is related in some way to EXACTLY TWO of the numbered items. Indicate the related items using the following answer code:

	<u>Lettered Item</u>	<u>Is Related to Numbered Items</u>
(A)	X	I and II only
(B)	X	II and III only
(C)	Y	I and II only
(D)	Y	I and III only
(E)	The correct answer is not given by (A), (B), (C) or (D).	

- 8.**
- | | | | |
|----|-------------------------------------|------|---|
| X. | Macaulay/modified duration matching | I. | Cannot put a value on existing interest rate exposure. |
| Y. | Cash flow matching | II. | Works well only for small, parallel movements in interest rates. |
| | | III. | Matching is rarely perfect because the yield cost is too high due to restrictions on asset selection. |

- 9.**
- | | | | |
|----|---------------|------|--|
| X. | Common stocks | I. | Volatility of return is often uncorrelated to interest rate volatility. |
| Y. | Bond futures | II. | Useful for correcting asset-liability mismatch positions. |
| | | III. | Are generally not appropriate to support new money liability cash flows. |

- 10.** X. Limit order
Y. Circuit breaker
- I. Sidecar
II. Stop loss
III. Collar
- 11.** X. Seasoned new issue
Y. Initial public offering (IPO)
- I. Best efforts underwriting arrangement more common.
II. Commonly underpriced.
III. Shelf registration applies.
- 12.** X. Variance/covariance approach to optimization
Y. Worst case approach to optimization
- I. Useful for evaluating risk for bond portfolios.
II. Useful for evaluating risk for equity portfolios.
III. Uses linear programming optimization.

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(A)	X	I and II only
(B)	X	II and III only
(C)	Y	I and II only
(D)	Y	I and III only
(E)	The correct answer is not given by (A), (B), (C) or (D).	

13.

X.	Option-pricing model	I.	Requires the study of an assumed asset cash flow.
Y.	Actuarial simulation model	II.	Considers one side of the balance sheet at a time.
		III.	Produces market value results.

14.

X.	Asian option	I.	The payoff of this option is based on the average price of the underlying asset during the life of the option.
Y.	Look-back option	II.	A high-water mark option is an example of this option.
		III.	This option is popular in the US in the foreign currency and interest rate options market place.

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15-21. These questions consist of an assertion in the left-hand column and a reason in the right-hand column. Code your answer to each question by blackening space:

- (A) If both the assertion and the reason are true statements, and the reason is a correct explanation of the assertion.
- (B) If both the assertion and the reason are true statements, but the reason is NOT a correct explanation of the assertion.
- (C) If the assertion is a true statement, but the reason is a false statement.
- (D) If the assertion is a false statement, but the reason is a true statement.
- (E) If both the assertion and the reason are false statements.

<u>ASSERTION</u>		<u>REASON</u>
15. The transaction costs on futures contracts consist of a bid-ask spread only.	BECAUSE	Futures contracts are traded on exchanges.

<u>ASSERTION</u>		<u>REASON</u>
16. A non-convertible bond will often require a yield-to-maturity greater than that offered by a convertible bond.	BECAUSE	A convertible bond is often subordinated debt.

<u>ASSERTION</u>		<u>REASON</u>
17. Mortgages are desirable instruments for dedicated portfolios.	BECAUSE	The Macaulay duration of mortgages accurately reflects the change in market price for a given change in the interest rates.

- | | | | |
|------------|--|---------|---|
| | <u>ASSERTION</u> | | <u>REASON</u> |
| 18. | A callable bond generally has positive convexity. | BECAUSE | An increase in interest rate volatility increases the value of an embedded call option. |
| | <u>ASSERTION</u> | | <u>REASON</u> |
| 19. | An increase in interest rate volatility increases the value of a callable bond. | BECAUSE | An increase in interest rate volatility increases the value of an embedded call option. |
| | <u>ASSERTION</u> | | <u>REASON</u> |
| 20. | For a participating life insurance policy, a dividend scale guarantee of level dividend over 10 years is a major investment risk exposure. | BECAUSE | Dividend scale guarantees are put options granted to the purchaser of a life insurance policy. |
| | <u>ASSERTION</u> | | <u>REASON</u> |
| 21. | According to the Dow Theory, tertiary stock price trends are more important than intermediate trends. | BECAUSE | According to the Dow Theory, intermediate stock price trends are caused by short term deviations of prices. |

22-23. Use the following information for questions 22 and 23.

The following two securities have the same current price of 1000 as a Treasury bond maturing one year from now with 6% annual coupons and a face amount of 1000.

- (i) A European call option on 10,000 shares of stock in Company ABC at a strike price of 10 with maturity one year from now, and a probability p_1 of maturing for 10.50. Otherwise, the stock price would be 10 or less.
- (ii) A one-year forward on 2500 bushels of wheat that will enable purchase at 30 per bushel at that date. Analysts expect that the price of wheat will be at 37 with probability p_2 or at 31 with probability p_1 . Otherwise, the price of wheat will be at 28.

22. Calculate the value of p_1 .

- (A) 0.196
- (B) 0.199
- (C) 0.212
- (D) 0.228
- (E) 0.247

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22-23. Use the following information for questions 22 and 23.

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- (ii) A one-year forward on 2500 bushels of wheat that will enable purchase at 30 per bushel at that date. Analysts expect that the price of wheat will be at 37 with probability p_2 or at 31 with probability p_1 . Otherwise, the price of wheat will be at 28.

23. Calculate the value of p_2 .

- (A) 0.196
- (B) 0.199
- (C) 0.212
- (D) 0.228
- (E) 0.247

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24. You are given the following information with respect to a callable bond:

Time	Expected Cash Flows at a 7% Annual Yield
1	8.00
2	7.90
3	107.80

Annual Yield	Bond Price
6%	104.33
7%	102.37
8%	99.76

The current yield is 7%.

Calculate the ratio of the modified duration to the effective duration of this bond.

- (A) 0.80
- (B) 0.86
- (C) 1.00
- (D) 1.16
- (E) 1.25

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- 25.** The current price of a bond is 100. The derivative of the price with respect to the yield to maturity is -700 . The yield to maturity is 8%.

Calculate the Macaulay Duration.

- (A) 7.00
- (B) 7.49
- (C) 7.56
- (D) 7.69
- (E) 8.00

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26. You are given the following multiplicative binomial branching model where the value of the short rate one year from now is either:

- $r_1^u = r_0(1+g)$ or $r_1^d = \frac{r_0}{(1+g)}$, with equal probability
- Volatility is 25%
- The current value of the short rate is 4%

Calculate the value of a 2-year interest rate floor with a 3.5% strike level and a notional amount of 100.

- (A) 0.217
- (B) 0.219
- (C) 0.363
- (D) 0.859
- (E) 0.876

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27. You are given the following data:

	Expected Annual Return	Standard Deviation of Annual Return
Stock I	10%	25%
Stock II	35%	60%

- The correlation coefficient between Stock I and Stock II is -0.2
- The T-bill annual yield is 5%

Calculate the difference between the weights of Stock I and Stock II in the optimal risky portfolio consisting of only these two stocks.

- (A) 0.14
- (B) 0.31
- (C) 0.43
- (D) 0.77
- (E) 0.80

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28. You are given the following with respect to a T-bill:

- Bank discount yield based on the ask price: 5.7%
- Bank discount yield based on the bid price: 5.8%
- Remaining term to maturity: 60 days

Calculate the difference between the asked bond equivalent yield and the bid bond equivalent yield.

- (A) 0.1000%
- (B) 0.1005%
- (C) 0.1014%
- (D) 0.1019%
- (E) 0.1034%

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29. You are given the following:

	Stock I Share Price	Stock II Share Price
Beginning of period	30	70
End of period	40	30

- A price-weighted index (PWI) is constructed using only Stock I and Stock II
- Stock II was split 2 for 1 during the period

Determine the value of PWI at the end of the period.

- (A) 35.0
- (B) 46.4
- (C) 50.0
- (D) 53.8
- (E) 91.0

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30. With respect to multi-period immunization, a portfolio of liabilities has a dispersion of 7. Determine the dispersion of the assets best suited to immunize these liabilities, if all other aspects of the portfolio are equally suitable.

(A) 0

(B) 6

(C) 7

(D) 8

(E) 30

****END OF COURSE 6****
MORNING SESSION

Course 6
May 2001

Multiple-Choice Answer Key

1	B
2	B
3	C
4	C
5	C
6	B
7	A
8	D
9	E
10	D
11	C
12	D
13	B
14	E
15	D
16	B
17	E
18	D
19	D
20	C
21	D
22	C
23	B
24	D
25	C

26	C
27	A
28	E
29	C & D
30	D