**COURSE 6
MORNING SESSION**

SECTION A – WRITTEN ANSWER

1. *(4 points)* Outline the key characteristics of securities regulations and restrictions in effect in the United States.

2. *(6 points)* You are given the following:

	Scenario 1	Scenario 2	Scenario 3
Probability	45%	40%	15%
Stock A Return	30%	2%	-10%
Stock B Return	-8%	15%	5%
Stock C Return	8%	4%	-10%
T-bills Return	3%	3%	3%

An investor has:
- 7,000 invested in Stock A which he cannot sell
- a risk aversion of 4
- 3,000 of additional funds to invest

(a) Calculate the expected return and standard deviation of each available investment.

(b) The investor can invest the additional funds in only one investment.
  (i) Calculate the risk and reward of each investment strategy.
  (ii) Rank each of the investment strategies. Explain your answer.

Show all work.

3. *(9 points)* You are given the following:

- two types of bonds are available with par values of 100:

    (i)   5-year zero coupon callable bonds, callable at 80 after two years of call protection
    (ii) 10-year zero coupon putable bonds, putable to issuer at 40 after three years
    (iii) market prices are given in the table below:

Date	Market Price	
	Callable Bond	Putable Bond
December 31, 2003	70	50
December 31, 2004	100	50
December 31, 2005	90	60
December 31, 2006	70	60

- An investor's strategy is:

    (i)   invest any proceeds received from callable bonds into putable bonds
    (ii) invest any proceeds received from putable bonds into callable bonds

The investor's initial investment on December 31, 2003 was split between one callable bond and one putable bond. Both bonds purchased had two years of protection remaining at time of purchase.

December 31 of each year is the only day for purchasing, calling or putting bonds. Bonds are called or put whenever the opportunity arises.

Today's date is December 31, 2004.

(a)   Contrast put options with call options.

(b)   Describe the risks associated with the embedded options in the initial investment.

(c)   Calculate the holding period return if all bonds are sold on December 31, 2006. Assume no transaction costs.

(d)   Contrast options with futures.

(e)   Describe how futures could be used to improve the holding period return.

Show all work.

4. *(6 points)* You are given the following information about three collateralized mortgage obligations (CMOs):

- CMO A is backed by 7.5% pass-throughs consisting of the following tranches:
  - 3-year sequential-pay
  - 5-year very accurately defined maturity (VADM)
  - 7-year sequential-pay
  - 10-year sequential-pay
  - 17-year Z bond

- CMO B is backed by 7.5% pass-throughs consisting of the following tranches:
  - 3-year planned amortization classes (PAC)
  - 7-year PAC
  - 7-year companion
  - 10-year PAC
  - 16-year PAC
  - 20-year companion

- CMO C is backed by 7.5% pass-throughs consisting of the following tranches:
  - 3-year sequential-pay
  - 7-year sequential-pay
  - 10-year sequential-pay
  - 17-year sequential-pay

U.S. federal authorities are expected to increase interest rates by 50 basis points.

Describe how each structure will be affected by the increase.

5. *(8 points)* You are given the following with respect to two public companies:

- the common shares of each company are currently trading at 30 as of December 31, 2003
- neither company pays shareholder dividends
- there are no taxes or transaction costs
- an industry analyst has projected the possible stock prices over the next two years as a function of the performance of the US economy:

US Economy		Company A		Company B	
2004	2005	December 31, 2004	December 31, 2005	December 31, 2004	December 31, 2005
Expansion	Expansion	32	33	33	36
Expansion	Recession	32	30	33	30
Recession	Expansion	30	29	29	29
Recession	Recession	30	30	29	27

(a)   Determine if the analyst's projections allow for arbitrage.

(b)   Using the analyst's projections, determine the value of a European put option on Company B's stock if the option expires on December 31, 2005, and has an exercise price of 30.

(c)   Determine how an investor could replicate the payoff of a one-year European call option with an exercise price of 31 on Company A's stock using a portfolio of the two companies common shares.

Show all work.

6. *(5 points)* You are given the following:

Bond	Maturity (years)	Annual Coupon Rate (%)	Embedded Options
		Features	
A	10	5%	None
B	10	5%	Put Option
C	10	7%	None
D	10	7%	Call Option
W	20	8%	None
X	20	8%	Put Option
Y	20	10%	None
Z	20	10%	Call Option

(a) Describe how bond features affect interest rate risk.

(b) An investor only buys bonds that have at least two of their features with high sensitivity to interest rate changes. Identify the four bonds that this investor will buy. Explain your answer.

7. *(5 points)*

(a) Describe the advantages of simulation techniques and lattice methods.

(b) Outline the issues that arise when implementing simulation techniques for a mortgage-backed securities portfolio.

(c) Describe how lattice methods are used in a simulation model when evaluating a mortgage-backed securities portfolio.

COURSE 6
MORNING SESSION

SECTION B – MULTIPLE CHOICE

1. You are given the following bond portfolio:

S&P Rating	Percentage of Portfolio
AAA	10%
AA+	10%
BBB+	10%
A+	25%
D	2%
CC	3%
BBB-	15%
BB+	5%
A	20%

Determine the percentage of the portfolio that is investment grade.

(A) 65%

(B) 75%

(C) 90%

(D) 95%

(E) 100%

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2. You are given the following information for a mutual fund:

- net asset value (NAV) at December 31, 2003: 28
- income distribution per share in 2004: 0.4
- assets at December 31, 2004: 620,000
- liabilities at December 31, 2004: 14,600
- shares outstanding: 20,000

No securities were sold throughout the year. There are no capital gain distributions and no fees in the year.

Calculate the effective annual interest rate of return for the mutual fund.

(A)   6.7%

(B)   8.1%

(C)   8.8%

(D)   9.5%

(E)   12.1%

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3. A one-period securities market model is given by $S(0) = \begin{bmatrix} 1 & 1 & 1 \end{bmatrix}$.

$$S(1) = \begin{pmatrix} 2 & 1.6 & 0 \\ 0 & 0.8 & x \\ 0 & 0 & 1 \end{pmatrix}$$

Determine the range of values for x so that this model is arbitrage free.

(A) $x > 4$

(B) $x < 4$

(C) $x > 0$

(D) $x < 0$

(E)   no such x exists

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4. You are given the following:

- expected return of market portfolio: 7.0%
- variance of market portfolio: 10.0%
- variance of Security A: 19.0%
- covariance of Security A and market portfolio: 25.0%
- risk-free rate: 5.0%

Calculate the expected return of Security A using CAPM.

(A)   7.6%

(B)   10.0%

(C)   14.2%

(D)   17.5%

(E)   22.5%

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5-9. Questions 5 through 9 consist of an <u>assertion</u> in the left-hand column and a <u>reason</u> 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 <u>a correct explanation</u> of the assertion.

(B)   If both the assertion and the reason are true statements, but the reason is <u>NOT a correct explanation</u> 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>
5. The original loan-to-value ratio overestimates the measurement of defaults for home mortgages.	BECAUSE	As home mortgages become more seasoned, default rates tend to decline.

<u>ASSERTION</u>		<u>REASON</u>
6. Preferred stock payments are tax-deductible for the issuing corporation.	BECAUSE	Preferred stock payments are treated as dividends.

ASSERTION		REASON
7. An option-adjusted spread (OAS) value by itself does not provide sufficient information to determine whether a bond is rich or cheap.	BECAUSE	OAS is the spread to short-term interest rates that equates the theoretical price of a bond to its market price.

ASSERTION		REASON
8. Interest rate caps and floors should not be used when the holding period of the underlying asset or liability is flexible or subject to change.	BECAUSE	Termination of interest rate caps and floors involves exit costs.

ASSERTION		REASON
9. A trustee may engage in a transaction that breaches another duty to the detriment of the participants because he is instructed to do so in accordance with the trust agreement.	BECAUSE	The trustee is under the obligation to manage the trust in accordance with the trust agreement.

10-16. Each of questions <u>10 through 16</u> 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).	

10. X. Real Assets

I. Patents

Y. Financial Assets

II. Appear only on the asset side of the balance sheet

III. Are created and destroyed in the ordinary course of doing business

11. X. Callable Bonds

I. Bond price at low yields is approximately equal to the price of an option-free bond.

Y. Putable Bonds

II. Negative convexity at low yield levels and positive convexity at high yield levels.

III. Positive convexity at all yield levels.

12.

X.	Lattice methods	I.	Allow for more realistic jumps in interest rates of varying amounts along a single path.
Y.	Simulation methods	II.	Easier to use to value instruments that have embedded American-style options.
		III.	Easier to use when more than one factor changes at the same time.

13.

X.	Forward contracts	I.	Dealer or broker
Y.	Futures contracts	II.	Bid-ask spread
		III.	High liquidity

14.

X.	Agency CMOs	I.	Usually rated by bond rating agencies.
Y.	Whole-loan CMOs	II.	Do not employ credit enhancement techniques.
		III.	Employ credit enhancement techniques.

10-16. Each of questions <u>10 through 16</u> 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).	

15.

X. Horizon matching

Y. Contingent immunization

I. Active management.

II. Reduces impact of non-parallel move of yield curve.

III. Always duration matched.

16.

X. Value-at-risk model

Y. Stress test

I. Measures the maximum loss in value a company's portfolio is likely to sustain over a period of time as a result of changes in market prices.

II. Measures a company's exposure to extreme movements in stock prices.

III. Uses average historical correlations among asset prices.

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17. You are given the following:

- issues traded: 4,800
- advances: 2,600
- declines 1,500
- unchanged: 650
- new highs: 150
- new lows: 50
- advancing volume (000): 470,000
- declining volume (000): 235,000
- total volume (000): 740,000

Calculate the "trin" statistic.

(A) 0.87

(B) 1.02

(C) 1.15

(D) 1.17

(E) 2.00

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18. An investor purchases 50 shares of a stock on January 28, 2004.

You are given the following:
- annual interest on borrowed funds: 7%
- value of each share on January 28, 2005: 100
- investor's return from January 28, 2004 to January 28, 2005: 30%

Calculate the original purchase price of each share, if the initial margin percentage is 75%.

(A) 66.23

(B) 80.48

(C) 81.63

(D) 85.06

(E) 86.02

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19. You are given the following:

- target return on capital: 15%
- net spread for residential mortgages: 1%
- net spread for mortgage bonds: 0.9%

- pre-tax return: 21%
- risk-free rate: 6%

- MCCSR factors:
  - BBB mortgage bonds: 2%
  - BB residential mortgages: 4%

Calculate the MCCSR-adjusted spread for residential mortgages and mortgage bonds, respectively.

(A)   (0.40%, 0.30%)

(B)   (0.40%, 0.60%)

(C)   (0.64%, 0.72%)

(D)   (0.70%, 0.60%)

(E)   (0.76%, 0.78%)

USE THIS PAGE FOR YOUR SCRATCH WORK

20. You are given the following:

Risk	Amount
C-1	80
C-2	100
C-3	90
C-4	10

Using Zeppatella's formula for incremental RBC, determine (Wa, Wi), where Wa is the weight associated with assets and Wi is the weight associated with insurance.

(A)   (0.743, 0.437)

(B)   (0.793, 0.467)

(C)   (0.793, 0.507)

(D)   (0.862, 0.507)

(E)   (0.862, 0.682)

USE THIS PAGE FOR YOUR SCRATCH WORK

21-24. Questions 21 through 24 consist of an <u>assertion</u> in the left-hand column and a <u>reason</u> 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 <u>a correct explanation</u> of the assertion.

(B)   If both the assertion and the reason are true statements, but the reason is <u>NOT a correct explanation</u> 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>
21. Given the choice, investors prefer a portfolio on a higher indifference curve.	BECAUSE	Higher indifference curves correspond to higher levels of utility.

<u>ASSERTION</u>		<u>REASON</u>
22. A callable bond is negatively convex.	BECAUSE	A call option increases a bond's effective duration when interest rates fall.

	ASSERTION		REASON
23.	Modified duration is an inappropriate measure for bonds with embedded options.	BECAUSE	Modified duration assumes a flat yield curve.

	ASSERTION		REASON
24.	Dividend scale guarantees are put options within a participating life insurance policy.	BECAUSE	A put option gives the purchaser the right to sell at a fixed price.

25-31. Each of questions <u>25 through 31</u> 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).	

25. X. Refunding Provision

     Y. Call Provision

I. Will not provide protection against the issuance of common stock to retire debt.

II. Bonds cannot be redeemed for any reason.

III. Provides redemption protection against the issuance of debt ranking equal to or superior to the debt to be redeemed.

26. X. Multivariate density estimation (MDE)

     Y. Low-discrepancy method

I. Chooses points which are as uniformly distributed as possible.

II. Can only be used for classes of financial instruments for which liquid markets exist.

III. Nonparametric, model-free approach.

27. X. Amortized cost method   I. Assets held to maturity

         Y. Market value method   II. Assets available for sale

                                                III. Assets for trading

28. X. Return simulation   I. Evaluates the current level of yields by producing spot, discount, and forward rate structures.

         Y. Term-structure analysis   II. Predicts bond and portfolio behavior given alternative interest rate scenario projections.

                                                III. Values Treasury securities.

29. X. Duration bets   I. Pure index match

         Y. No duration bets   II. Minor mismatches

                                                III. Full-blown active

25-31. Each of questions 30 through 31 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:

	Lettered Item	Is Related to Numbered Items
(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).

30.

X.   Price sensitivity techniques

Y.   Cash flow techniques

I.   Maturity gap management

II.   Key rate duration

III.   Convexity

31.

X.   Z Bonds

Y.   Accretion-directed Classes

I.   No reinvestment risk during the accretion phase.

II.   Do not extend even if there are no prepayments.

III.   Price is highly sensitive to interest rate movements.

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32. You are given the following information with respect to a portfolio:

- duration: 3
- dispersion: 0.75
- all cash flows are positive

Time (t)	$PV(CF_t)$
1	1
2	X
3	Y
4	0
5	1

Determine the minimum value of Y.

(A) 0

(B) 3

(C) 4

(D) 9

(E) 26

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33. You are given the following with respect to a multiplicative binomial model:
- the current short rate is 4%
- rates are twice as likely to rise as they are to fall
- the volatility parameter is 20%

Determine the expected short rate two periods from now.

(A)   3.65

(B)   4.13

(C)   4.31

(D)   4.55

(E)   4.65

USE THIS PAGE FOR YOUR SCRATCH WORK

34. You are given the following with respect to a mutual fund:

- annual expense ratio: 1%
- gross annual rate of return: 10%

The back-end load fee starts at 4% and reduces by 0.5% on each anniversary.
An investor makes an initial investment of 5,000 on January 1, 2002.

Calculate the realized gain if the investor sells the shares on December 31, 2004.

(A)   941

(B)   1,216

(C)   1,281

(D)   1,313

(E)   1,455

COURSE 6
AFTERNOON SESSION

SECTION C – WRITTEN ANSWER

8.   *(4 points)* Describe the practical difficulties that may be encountered while implementing an asset allocation optimization model.

9.   *(5 points)* You are given the following information about a universe of securities:

- R_f: 0.0300
- $E(R_M)$:   0.0700
- s^2_M: 0.0450

The market covariance grid is:

Security	Market Weight	Covariance Matrix			
A	0.35	9%	2%	2%	8%
B	0.25	2%	12%	1%	2%
C	0.25	2%	1%	3%	5%
D	0.15	8%	2%	5%	12%

(a)   Calculate the market price of risk.

(b)   Calculate the contribution to the variance of the market portfolio for securities B and D.

(c)   Calculate the equilibrium expected rate of return for securities B and D.

Show all work.

10. *(6 points)* You are given the following with respect to T-bills issued on February 1, 2004:

Term to Maturity	Spot Price
1 month	98.50
2 months	98.40
3 months	98.20
4 months	98.00

A futures contract is available for delivery of a 3-month T-bill on March 1, 2004.

(a)   Compare forward contracts to futures contracts.

(b)   Determine the implied price of the futures contract.

(c)   Recommend an arbitrage strategy to be implemented on February 1, 2004 if the market price of the futures contract at that time is 97.5. Calculate the profit and cash flows each month until all contracts are mature.

Show all work.

11. *(6 points)* You are given the following with respect to a one-period interest rate contingent claim:

- martingale probability: 50%
- variance of the security: 0.2755%
- risk-free rate: 5%
- payment if interest rates go up: 105
- payment if interest rates go down: 95

(a)   Calculate the martingale security price.

(b)   Calculate the "true" market price of risk.

(c)   Calculate the "true" probability.

Show all work.

12. *(8 points)* You are given the following:

Time to Maturity	Effective Annual Spot Rate
0.5 years	5.00%
1.5 years	5.50%
2.5 years	6.10%
3.5 years	6.25%
4.5 years	6.50%

- the valuation date is December 31, 2004
- liability cash flows are as follows:

Time of Cash Flow	Liability Amount
June 30, 2005	25
June 30, 2006	20
June 30, 2007	15
June 30, 2008	10
June 30, 2009	5

- the Macauley duration of the liabilities is 1.75 years
- the convexity of the liabilities is 5.5 years
- the universe of publicly traded bonds at 100 par value as at December 31, 2004 is as follows:

Bond	Maturity	Annual Coupon	Effective Annual Yield
A	June 30, 2005	10.0%	5.00%
B	June 30, 2006	7.5%	5.50%
C	June 30, 2007	6.5%	6.50%
D	June 30, 2008	5.0%	6.50%
E	June 30, 2009	4.0%	6.50%

(a)   Calculate the Macauley duration of Bond B.

(b)   Compare immunization and cash flow matching strategies.

(c)   Construct an immunized portfolio using Bond A and Bond E that protects against interest rate movements.

(d)   Determine a cash flow matched portfolio using the universe of available bonds.

Show all work.

13. *(6 points)* A bond portfolio consists of three bonds, each issued at the same par value. You are given the following projected results over a one-year planning horizon under three different interest rate scenarios.

Scenario	Bond	Total Annual Return %	Duration
1	X	11.9	2.3
	Y	10.1	1.4
	Z	10.7	1.1
2	X	8.2	2.3
	Y	8.4	1.4
	Z	8.3	1.1
3	X	5.7	2.3
	Y	6.1	1.4
	Z	5.6	1.1

Each of the three scenarios is equally likely to occur and the total portfolio consists of one of each of the bonds.

(a)   Describe Strategic Frontier Analysis.

(b)   Using the Strategic Frontier Analysis, plot the graph and evaluate each of the bonds.

(c)   Describe Relative Return Value Analysis.

(d)   Using the Relative Return Value Analysis, plot the graph and evaluate each of the bonds.

Show all work.

14. *(5 points)* You are given the following with respect to a Treasury instrument:

- days to maturity: 110
- bid: 4.48%
- ask: 4.46%
- change: +0.02%
- ask yield: 4.50%

(a)   Calculate as of today:
         (i)   Market Price
         (ii)   Bond Equivalent Yield
         (iii)   Effective Annual Yield

(b)   Describe the characteristics of U.S. Treasuries and how they are made available to markets.

(c)   Describe the characteristics of Agency Securities and how they are made available to markets.

Show all work.