COURSE 6
MORNING SESSION

SECTION A-WRITTEN ANSWER

****BEGINNING OF EXAMINATION****

1. *(6 points)* You are given the following with respect to corporate bonds:

Rating	Spread Over Treasuries (basis points)
AAA	20
AA	30
A	40

The one-year rating transition matrix is as follows:

Rating at Beginning of Year	Rating at End of Year		
	AAA	AA	A
AAA	0.8	0.1	0.1
AA	0.1	0.7	0.2
A	0.0	0.1	0.9

(a) Describe the top down value-added strategies for active bond management.

(b) Describe the corporate bond sector selection strategies.

(c) Calculate the expected two-year horizon spread over Treasuries for a AAA-rated bond.

Show all work.

2. *(5 points)* You are given the following:

	Probability	One Year Return
Stock X	0.60 0.20 0.20	10% 5% -10%
Stock Y	0.75 0.25	20% -20%

- risk-free rate is 4%
- the investor has a one-year horizon
- the investor is indifferent between investing in Stock Y and earning the risk-free rate

Determine whether or not the investor would purchase Stock X.

Show all work.

3. *(5 points)* You are given the following:

- margin requirement on short sales: 50%
- maintenance margin: 30%
- an investor's account with a broker currently holds:
  - value of T-bills: 10,000
  - number of shares of XYZ stock: 500
- stock prices:

Date	ABC Stock Price	XYZ Stock Price
June 2, 2003	103	75
June 3, 2003	102	76
June 4, 2003	99	77
June 5, 2003	100	75
June 6, 2003	101	80
June 9, 2003	105	72
June 10, 2003	115	65

The investor tells the broker to short 1,000 shares of the ABC stock on June 3, 2003. The broker executes the order on the first day allowed. Shares are traded once per day.

(a) Calculate the additional cash (if any) necessary to satisfy the margin requirement.

(b) Calculate the amount of the margin calls (if any) between June 3, 2003 and June 10, 2003.

Show all work.

4. *(9 points)* You are given the following with respect to an Extended Vasicek Trinomial Lattice Model:

- $s = 0.02$
- $\Delta t = 1$ year
- $R(1) = 0.08$
- $R(2) = 0.09$
- $R(3) = 0.10$
- $a = 0.4$

(a) Describe the key characteristics of this model.

(b) Calculate the value of $q(0)$ using the Hull and White approximation.

(c) Calculate the value of $p_2(0,0)$.

(d) Calculate the value of a one-year cap with a notional amount of 100 and a strike interest rate of 9.5%.

Show all work.

5. *(7 points)* You are given the following with respect to non-callable default-free zero-coupon bonds:

Time to Maturity (t)	Current Price
1 year	980.392
2 years	942.596
3 years	888.996
4 years	838.561
5 years	765.134

You are given the following with respect to a five-year option-free bond:

- annual coupons of $(2+t)\%$ are paid at the end of each year
- par value of 1,000
- yield-to-maturity (y) of 5.50%

For the five-year annual coupon bond:

(a) Calculate the Macaulay duration.

(b) Calculate the Macaulay convexity.

(c) Calculate the Fisher-Weil duration.

(d) Calculate the Fisher-Weil convexity.

(e) Calculate the elasticity of the price using a discount factor of $1/(1+y)$.

(f) Calculate the value of M-squared.

Show all work.

6. *(8 points)* You are given the following with respect to a defined benefit pension plan:

- final pension is based on career average salaries without an explicit provision for post-retirement indexation
- assets of the pension plan are actively managed by two external managers
- no contributions were made to the fund in 2002

The plan balance sheet for the previous two years is as follows:

	December 31, 2001	December 31, 2002
Assets		
Fixed Income	100	104
Equities	100	80
Liabilities		
Accumulated Benefit Obligation	180	198
Projected Benefit Obligation	195	213

The plan sponsor is concerned with the volatility of the pension plan surplus and is reviewing the investment portfolio structure and asset allocation.

(a) Describe the fundamental decisions involved in the construction of a pension plan investment portfolio.

(b) Compare active to passive investment management strategies.

(c) Recommend a strategy for the pension plan.

(d) Calculate the surplus rate of investment return for 2002.

(e) Formulate the surplus optimization analysis for the plan and recommend an asset allocation.

(f) Propose stress tests to assess the sensitivity of the surplus to sharp changes in asset prices.

Show all work.

7. *(5 points)* With respect to auto loan asset-backed securities (ABS) and auto lease ABS, describe the risks associated with each of these securities and explain how these risks can be mitigated.

COURSE 6
MORNING SESSION

SECTION B-MULTIPLE CHOICE

1. You are given the following with respect to an optimal risky portfolio:

- expected return: 7%
- risk premium: 3%
- variance: 100

Calculate the slope of the capital allocation line (CAL) for this portfolio.

(A) 0.03

(B) 0.04

(C) 0.30

(D) 0.40

(E) 3.00

USE THIS PAGE FOR YOUR SCRATCH WORK

2. You are given the following with respect to a portfolio consisting of two mutual funds:

Mutual Fund	Weight	Variance
Stock	25%	100
Bond	75%	36

The correlation coefficient between the fund returns is -0.5.

Calculate the variance of the portfolio.

(A) 3.91

(B) 15.25

(C) 26.50

(D) 37.25

(E) 40.75

USE THIS PAGE FOR YOUR SCRATCH WORK

3-8. Each of questions 3 through 8 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).

3.

X. Multiple asset performance

Y. Contingent immunization

I. Allocates a portion of the initial portfolio to active management with the balance being immunized.

II. Option valuation-based approach to fixed-income asset allocation.

III. Objective is to achieve a portfolio return equal to the return of the best performing of the various fixed income asset classes held in the portfolio, less a predetermined strategy cost.

4.

X. Arbitrage Pricing Theory

Y. Capital Asset Pricing Model

I. Assumes an unobservable market portfolio.

II. Provides an unequivocal statement on the expected return-beta relationship for all assets.

III. Highlights the crucial distinction between diversifiable and nondiversifiable risk.

5.

X. Putable Bond

Y. Callable Bond

I. Positive convexity

II. As interest rates decrease, the bond duration decreases

III. Negative convexity

6.

X. Markowitz Portfolio Selection Model

Y. Index Model

I. Separates risk into macro and micro components.

II. Requires a large number of estimates.

III. Allows for specialization of effort in security analysis.

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(E) The correct answer is not given by (A), (B), (C) or (D).

7.

X. Insured asset allocation

Y. Tactical asset allocation

I. Assumes the investor's risk tolerance is unaffected by changes in the investor's circumstance.

II. Assumes expected returns, variances and correlations remain the same over time.

III. Goal is to take advantage of perceived inefficiencies in capital markets.

8.

X. Limit-buy order

Y. Stop-buy order

I. Buy stock when the price falls below a given price limit.

II. Often accompanies short sales.

III. Buy stock when the price rises above a given price limit.

USE THIS PAGE FOR YOUR SCRATCH WORK

9. You are given the following with respect to two portfolios:

	Portfolio A	Portfolio B
Expected Return	10%	8%
Variance	2%	3%

An investor has all his funds in Portfolio A. His expected utility is the same as for a certain return of 6%.

Calculate the equivalent certain return for Portfolio B for this investor.

(A) –0.50%

(B) 2.00%

(C) 3.00%

(D) 3.67%

(E) 6.50%

USE THIS PAGE FOR YOUR SCRATCH WORK

10. You are given the following with respect to a treasury bill:

- price on June 30, 2003: 9,800
- par value: 10,000
- maturity date: December 31, 2003

Calculate the difference between the effective annual rate and the bank discount yield as of June 30, 2003.

(A) 0.12%

(B) 0.13%

(C) 0.16%

(D) 0.17%

(E) 0.21%

USE THIS PAGE FOR YOUR SCRATCH WORK

11-15. Questions 11 through 15 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.

	ASSERTION		REASON
11.	The large number of issuers and dollar amount outstanding make the credit card asset-backed securities (ABS) sector a particularly active secondary market.	BECAUSE	The spreads for credit card ABS are a benchmark for other ABS sectors.

	ASSERTION		REASON
12.	Scenario approaches to assessing risks tend to result in asset risks that are low by historical standards.	BECAUSE	There is a behavioral regularity that makes people reluctant to forecast explicitly low-probability events in which extreme outcomes would occur.

	ASSERTION		REASON
13.	Proponents of the efficient market hypothesis do not advocate technical analysis.	BECAUSE	Technical analysis relies on earnings and dividend prospects, expectations of future interest rates, and risk evaluation.

	ASSERTION		REASON
14.	In times of high interest rates, investors will accept lower yields from a bond with a sinking fund provision.	BECAUSE	A sinking fund provision enhances the liquidity of the debt.

	ASSERTION		REASON
15.	Contingent immunization provides the flexibility to alternate between an active investment strategy and an immunized investment strategy.	BECAUSE	Contingent immunization has an effective monitoring procedure to ensure the safety net investment return is not violated.

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

- assets on January 1, 2002: 200 million
- shares outstanding throughout the year: 10 million
- dividend income: 2 million
- fund appreciation in 2002: 8%
- fees: 0.5%

No securities were sold during the year.

No capital gain distributions were made during the year.

Dividends and fees are paid on December 31, 2002.

Calculate the net asset value as of December 31, 2002.

(A) 20.2

(B) 21.5

(C) 21.6

(D) 21.7

(E) 21.8

USE THIS PAGE FOR YOUR SCRATCH WORK

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

- annual coupon rate: 5%
- time to maturity: 2 years
- call price: 100
- par value: 100

You are also given the following with respect to one-year interest rates:

- current rate (r_0): 5.0%
- the lower rate one year forward (r_L): 4.25%
- standard deviation: 0.1

Using Fabozzi's binomial interest rate tree, calculate the value of the bond.

(A) 95.23

(B) 95.50

(C) 99.91

(D) 100.00

(E) 100.26

USE THIS PAGE FOR YOUR SCRATCH WORK

18-23. Each of questions 18 through 23 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
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(D)	Y	I and III only

(E) The correct answer is not given by (A), (B), (C) or (D).

18.

X. Enhanced indexing strategy

Y. Pure bond index matching

I. Least risk of underperforming the index.

II. Matches primary risk factors without acquiring each issue in the index.

III. Common strategy used by smaller funds.

19.

X. Caps and Floors

Y. Interest Rate Swaps

I. Protect the user from changes in interest rate volatility.

II. Provide asymmetric coverage in capping liability costs.

III. Protect the rate of return on assets.

20.

X.	Collateralized mortgage obligation (CMO) classes that provide for redirection of principal payments	I.	Accretion-directed classes
Y.	CMO classes that provide for redirection of interest payments	II.	Targeted amortization classes
		III.	Z bonds

21.

X.	Pure Expectations Theory	I.	Term structure of interest rates reflects the market's current expectations of future short-term rates.
Y.	Market Segmentation Theory	II.	Market participants have investment strategies dictated by the nature of their liabilities.
		III.	Does not account for risks inherent in investing in bonds.

22.

X.	Digital options	I.	Payoff depends on whether the underlying asset value is above or below a fixed amount on the expiration date.
Y.	Gap options	II.	Include all-or-nothing options.
		III.	Payoff is only made if the asset price on the expiration date is above or below a strike price different from that used for the payoff.

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	Lettered Item	Is Related to Numbered Items
(A)	X	I and II only
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(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).

23.

X. Interest rate collar

Y. Interest rate corridor

I. Purchase of a cap at one strike rate and the sale of a floor at a lower strike rate.

II. Purchase of a cap at one strike rate and the sale of another cap at a higher strike rate.

III. Described as swapping into a bond.

USE THIS PAGE FOR YOUR SCRATCH WORK

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

- coupon: 5%
- redemption value: 100
- current market price: 100
- conversion ratio: 1.18
- floor price: 97.00
- stock price: 82.75

Calculate the minimum value of this bond.

(A) 95.00

(B) 97.00

(C) 97.65

(D) 100.00

(E) 100.25

USE THIS PAGE FOR YOUR SCRATCH WORK

25. You are given the following with respect to a putable bond:

• annual coupon rate:	8%
• time to maturity:	2 years
• current put price:	105
• put price in one year:	102
• current one-year interest rate:	6%
• one-year interest rate in one year:	4.8% or 7.5% with equal probability

Calculate the value of the put option.

(A) 0.00

(B) 0.72

(C) 1.45

(D) 4.27

(E) 5.00

USE THIS PAGE FOR YOUR SCRATCH WORK

26-30. Questions 26 through 30 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:

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(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.

	ASSERTION		REASON
26.	Mean reverting interest rate generators tend to produce interest rates at or close to their upper or lower bounds.	BECAUSE	Mean reversion factors tend to increase volatility.

	ASSERTION		REASON
27.	Under FASB 115, reported earnings from assets classified as available-for-sale will be impacted by unrealized gains or losses.	BECAUSE	Under FASB 115, assets classified as available-for-sale are valued on a market value basis.

	ASSERTION		REASON
28.	In equilibrium, it is rare for collateralized mortgage obligations (CMOs) to trade rich compared to collateral.	BECAUSE	Collateral spreads quickly tighten as more CMOs are issued.

	ASSERTION		REASON
29.	Reducing the C-2 component of risk-based capital (RBC) through a YRT reinsurance agreement may not decrease the total RBC requirements of a life insurance company.	BECAUSE	The covariance adjustment between the C-1, C-2 and C-3 components of the RBC requirements can be negative for a life insurance company.

	ASSERTION		REASON
30.	The valuation of derivatives generally assumes that the derivative security can be replicated using a self-financing portfolio of traded securities.	BECAUSE	Derivative valuation models generally assume that there are market frictions such as transaction costs.

END OF MORNING SESSION OF THE EXAMINATION

COURSE 6
AFTERNOON SESSION

SECTION C-WRITTEN ANSWER

****BEGINNING OF THE AFTERNOON SESSION OF THE EXAMINATION****

8. *(4 points)* You are given the following with respect to shares of Bre-XYZ:

State of Economy	Probability	Share Price on May 1, 2004
Boom	0.20	100
Normal Growth	0.65	50
Recession	0.15	20

- share price on May 1, 2003: 45
- semi-annual cash dividend: 2
- rate of inflation: 2.5%

(a) Calculate the expected holding-period return.

(b) Calculate the standard deviation of the holding-period return.

(c) Calculate the purchasing power of 1,000 to be received in 10 years.

Show all work.

9. *(8 points)* You are given the following with respect to European style options on a common stock:

- strike price: 100
- current market price of the underlying stock: 95
- standard deviation of the underlying stock returns: 0.14
- dividend rate of the underlying stock: 3% payable continuously
- time to maturity for the options: 3 months

You are also given the following selected values from the Standard Normal Cumulative Distribution Function:

Z	N(Z)
0.1	0.5398
0.2	0.5793
0.3	0.6179
0.4	0.6554
0.5	0.6915
0.6	0.7257
0.7	0.7580
0.8	0.7881
0.9	0.8159
1.00	0.8413

The risk-free rate is 3%.

(a) List the assumptions underlying the Black-Scholes option model.

(b) Calculate the value of the call option ignoring the dividend.

(c) Calculate the value of the put option ignoring the dividend.

(d) Calculate the value of the call option including the dividend.

(e) Calculate the value of the put option including the dividend.

Show all work.

10. *(6 points)* You are given the following with respect to an option-free bond portfolio:

- the value of the bond portfolio using the current yield curve is 800
- the value of the bond portfolio using the current yield curve with a parallel shift upwards of 20 basis points is 788
- the value of the bond portfolio using the current yield curve with a parallel shift downwards of 20 basis points is 813

(a) Using the methodology outlined in the Fabozzi textbook, estimate the value of the bond portfolio for a parallel shift upwards of 200 basis points in the yield curve.

(b) Explain how the inclusion of convexity impacts your estimate.

Show all work.

11.

(a) *(4 points)* Describe the issues and practical considerations in immunizing a portfolio of insurance liabilities.

(b) *(1 point)* Describe cash flow matching.

(c) *(1 point)* Describe contingent immunization.

12. *(6 points)*

(a) With respect to corporate bonds, describe the role of the corporate trustee.

(b) Differentiate the levels of security offered by various corporate bonds.

13. *(6 points)* You are given the following for an insurance company that currently offers term insurance and fixed deferred annuities:

- corporate pre-tax target return on capital of 18%
- risk-based capital (RBC) formula:
  $1.5 * \sqrt{\left(\text{asset default risk component}^2 + \text{mortality risk component}^2\right)}$

Asset Default Risk Component (C-1)			
Asset Class	Amount (millions)	RBC Factor	Historical Mean Return
Bond	600	1%	7%
Real Estate	300	7%	8%
Common Stock	100	20%	10%

Mortality Risk Component (C-2)		
	Amount (millions)	RBC Factor
Net Amount at Risk	10,000	0.1%

The industry-wide ratio of C-1 to C-2 is 1.5.

The risk-free rate is 6%.

(a) Describe the shortcomings of this RBC formula.

(b) Calculate the RBC-adjusted spread for this company's asset portfolio.

(c) Evaluate the competitive advantage of the company's product lines from a cost of capital perspective.

Show all work.

14. *(4 points)*

(a) Describe and compare the various prepayment models used to evaluate a block of mortgage-backed securities (MBS) pass-throughs.

(b) Describe the effects of prepayment rates on the cash flows of MBS pass-throughs.

END OF EXAMINATION