SOCIETY OF ACTUARIES
Advanced Portfolio Management

Exam APM

AFTERNOON SESSION

Date: Friday, April 27, 2012
Time: 1:30 p.m. – 4:45 p.m.

INSTRUCTIONS TO CANDIDATES

General Instructions

1. This afternoon session consists of 9 questions numbered 9 through 17 for a total of 60 points. The points for each question are indicated at the beginning of the question. There are no questions that pertain to the Case Study in the afternoon session.

2. Failure to stop writing after time is called will result in the disqualification of your answers or further disciplinary action.

3. While every attempt is made to avoid defective questions, sometimes they do occur. If you believe a question is defective, the supervisor or proctor cannot give you any guidance beyond the instructions on the exam booklet.

Written-Answer Instructions

1. Write your candidate number at the top of each sheet. Your name must not appear.

2. Write on only one side of a sheet. Start each question on a fresh sheet. On each sheet, write the number of the question that you are answering. Do not answer more than one question on a single sheet.

3. The answer should be confined to the question as set.

4. When you are asked to calculate, show all your work including any applicable formulas.

5. When you finish, insert all your written-answer sheets into the Essay Answer Envelope. Be sure to hand in all your answer sheets since they cannot be accepted later. Seal the envelope and write your candidate number in the space provided on the outside of the envelope. Check the appropriate box to indicate morning or afternoon session for Exam APM.

6. Be sure your written-answer envelope is signed because if it is not, your examination will not be graded.

Tournez le cahier d'examen pour la version française.

475 N. Martingale Road
Schaumburg, IL 60173-2226

Printed in the U.S.A.
Exam APM-Front Cover

****BEGINNING OF EXAMINATION****
Afternoon Session
Beginning with Question 9

9. (*7 points*) With the current asset allocation, the expected return of the XYZ fund is 6.25%. The volatility of the fund has typically been around the fund's desired level of 10%, but the recent market turbulence has caused the fund's volatility to increase to 13%. To enhance the risk-return characteristics, your supervisor has tasked you with researching hedge funds that would replace a portion of the XYZ Fund.

(a) (*1 point*) While researching relative value hedge fund strategies you come across the following strategies:

(i) Equity market neutral

(ii) Convertible arbitrage

(iii) Fixed income arbitrage

Describe each strategy.

(b) (*1 point*) Describe considerations in assigning weights to the three hedge fund strategies in your hedge fund portfolio.

(c) (*1 point*) You decide on hedge fund ABC for a strategic allocation, which has an overall volatility that is comparable with bonds currently in the XYZ fund. Furthermore, the hedge fund is highly correlated with the U.S. equity in the XYZ fund. Your colleague suggests three possible ways to fund a 10% allocation to the hedge fund.

Asset Class	Current	Proposal 1	Proposal 2	Proposal 3
U.S. Equity	50%	45%	40%	50%
International Equity	10%	9%	10%	10%
Fixed Income	40%	36%	40%	30%
Hedge Fund ABC	0%	10%	10%	10%

Compare qualitatively the overall portfolio volatility under the three proposals and explain the differences.

9. Continued

Fred, a fellow portfolio manager, makes the following statement on assessing hedge fund programs:

"The best way to evaluate a hedge fund program is to determine an appropriate benchmark and measure performance against that benchmark. I propose that we use a hedge fund index as our benchmark."

(d) (*2 points*)

(i) Critique Fred's statement on assessing hedge fund programs; and

(ii) Describe shortcomings of his proposal.

Another portfolio manager, Andy, proposes the following benchmark for hedge fund ABC, which uses the large-cap growth (LG), large-cap value (LV) and small-cap (S) as the market indices:

$$Rp = 0.4\% + 0.4LG + 0.3LV + 0.1S$$

(e) (*2 points*)

(i) Identify the type of benchmark,

(ii) Interpret the coefficients of the above equation; and

(iii) Assess whether it meets the qualities of a valid benchmark.

10. (*9 points*) You are the head of ALM and Capital Management at Pluribus, a multi-line US life insurer. For the past decade you used Markowitz mean-variance optimization (MVO) as the major tool for strategic asset allocation and risk management.

In the aftermath of the financial crisis of 2008, you are eager to explore the tool called mean-conditional value-at-risk (M-CVaR) optimization. Considering three hypothetical asset classes (A, B and C), you run your old tool MVO and generate an efficient frontier. On the efficient frontier, you pick two strategies X and Y. For Strategy X, you also estimate the portfolio VaR and CVaR at a particular confidence level. The results are summarized below:

	Strategy X	Strategy Y
Expected Return	7%	10%
Standard Deviation	11.25%	18.44%
VaR	−11.5%	
CVaR	−16.1%	

To see the impact of skewness and kurtosis on M-CVaR optimization, you then design the following scenarios and run simulations using a multivariate truncated Levy flight (TLF) model.

Scenario Analysis	Asset A	Asset B	Asset C
Scenario 1 (normal tails)			
Skewness	0.0	0.0	0.0
Kurtosis	3.0	3.0	3.0
Scenario 2 (mixed tails)			
Skewness	0.0	0.0	0.0
Kurtosis	3.5	3.5	6.0
Scenario 3 (fat tails)			
Skewness	0.0	−0.5	0.0
Kurtosis	6.0	6.0	6.0

(a) (*1 point*) Identify four shortcomings in using Markowitz MVO for strategic asset allocation.

(b) (*3 points*) Estimate the portfolio VaR and CVaR for Strategy Y at the same confidence level:

(i) For Scenario 1 based on MVO

(ii) For Scenario 1 based on M-CVaR optimization

10. Continued

(c) (*2 points*) Given the risk free rate of 2%:

(i) Determine which of strategies X or Y is more efficient if the Sharpe ratio is used as the criterion for Scenario 1.

(ii) Determine which of strategies X or Y is more efficient if the CVaR ratio is used as the criterion for Scenario 1.

(d) (*1 point*) Describe changes between the M-CVaR allocations and the MVO allocations for Scenario 2. Justify your answer.

(e) (*1 point*) Describe changes between the M-CVaR allocations and the MVO allocations for Scenario 3. Justify your answer.

(f) (*1 point*) Rather than simply use pure historical returns, you want to use the Black-Litterman model.

Describe two key ingredients that are necessary to apply the Black-Litterman model.

11. (*5 points*) The CFO of Company XYZ is reviewing the profile of two fixed-income portfolio managers. He has asked you to pick one of them using an "imperfect foresight" approach based on the following information:

	Index			Strategy			
	%	Duration (years)	Return (bps)	%	Manager A Return (bps)	%	Manager B Return (bps)
Industrials	30.0	2.51	0.15	27.0	0.18	54.0	0.15
Utilities	5.0	2.75	0.20	30.0	0.20	15.0	0.16
Finance	50.0	2.66	– 0.02	15.0	– 0.06	10.0	0.00
Yankees	15.0	2.70	0.10	28.0	0.16	21.0	0.16

(a) (*1 point*) Define a skillful manager and compare and contrast the ability to choose any winning sector versus the best sector.

(b) (*1 point*) Calculate each manager's outperformance of the index.

(c) (*2 points*) Calculate each manager's skill at choosing the winning sector.

(d) (*1 point*) Recommend which manager should be selected and justify your recommendation.

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12. (*11 points*) The balance sheet of company ABC Ltd. is as follows:

Balance sheet of ABC Ltd. (Market Value $million)			
Asset	100	Debt	20
		Equity	80
Total	100	Total	100

Both the debt and the equity are fully traded in the market. The outstanding debt is a single zero-coupon bond.

Bond Face Value ($million)	50
Bond Years to Maturity	30
ABC's Equity Volatility	19%
ABC's Asset Volatility	15%

To recapitalize the balance sheet, the Chief Financial Officer of ABC Ltd. is considering two programs:

1. Equity/Debt Swap

2. More Debt Issuance

Assume that the risk-free rate is constant at 3% and the capital markets are perfectly liquid.

(a) (*3 points*) Compare and contrast the following key features of the structural approach (e.g. KMV) and the reduced-form approach (e.g. DSL) in credit risk modeling.

(i) General Methodology

(ii) Credit events being modeled

(iii) Risk drivers

(iv) Strengths of models

(v) Weaknesses of models

12. Continued

(b) (*4 points*) In the Equity/Debt Swap program, suppose that ABC Ltd. issues $10 million of equity to repurchase $10 million of debt.

(i) Calculate the debt value after the swap using the Black-Scholes-Merton model.

(ii) Calculate the impact of the swap on the company's credit spread.

(c) (*4 points*) In the More Debt Issuance program, suppose that the new bond has a maturity of 30 years, pays no coupons, and is senior to the first issue. The expected loss given default (LGD) for the new bond and for the old bond is 5% and 20%, respectively.

(i) Calculate the default intensity using the reduced-form approach.

(ii) Calculate the credit spread on the new debt issuance.

13. (*6 points*) Fort Pension Plan has the following characteristics:

(i) Portfolio value of $100 million

(ii) Initial funded ratio of the pension plan is 100%

(iii) Weighted-average duration of pension assets of 5.5

(iv) Pension liabilities duration of 15

(a) (*1 point*) Explain the expected effect of falling interest rates on the pension plan funded ratio.

(b) (*3 points*) The plan sponsor chooses to match the duration of assets and liabilities using the following interest rate swap:

- 10-year interest rate swap
- The duration of the swap is 8.5

(i) Explain qualitatively how a swap hedges the impact of changes in interest rates on the funded ratio.

(ii) Recommend a specific trade to hedge the plan liabilities using this swap. Show your work.

(iii) Explain potential risks and implementation challenges.

(c) (*2 points*) Describe how you would use the following derivatives in hedging interest rate risk for the pension plan and compare the relative advantages of the two strategies:

(i) Interest rate swaption

(ii) Two separate interest rate swaptions in a collar strategy

14. (*4 points*) Company ABC is setting up an ALM infrastructure. The first step is to set up a grouping of asset classes. Miss Hung, the ALM Actuary, has directed her analyst to perform preliminary grouping. The analyst has the following proposal.

Asset Classes	Composition
U.S. Equities	U.S. public equities, real estate
World Public Equities	Asia public equity, U.S. public equities, Europe public equities
Fixed Income	Public bonds, mortgages

The correlation matrix of the value of company assets is as follows:

	A	B	C	D	E	F
A. U.S. public equities	1					
B. Real estate	0.1	1				
C. Asia public equities	0.9	0.9	1			
D. Europe public equities	0.8	0.9	0.8	1		
E. Public bonds	0.1	0.3	0.4	0.5	1	
F. Mortgages	0.5	0.7	0.5	0.0	0.2	1

(a) (*1.5 points*) Critique the analyst grouping of the asset classes.

(b) (*1 point*) Recommend a new grouping and provide the rationale.

Miss Hung is considering adding a new asset class. The Company uses the Sharpe Ratio when deciding on addition of a new asset class. Assume the existing portfolio has a return of 7% and standard deviation of 10% and a Sharpe Ratio of 0.5. The new asset class has a standard deviation of 15% and correlation of 70% with the existing portfolio.

(c) (*1.5 points*) Calculate the minimum yield requirement for the new asset class to be added to the existing portfolio.

15. (*6 points*) Your company's Chief Investment Officer is considering adding an alternative asset fund to the investment portfolio. He is considering investing in either a hedge fund or a private equity fund.

(a) (*2 points*) Your CIO is concerned about the likelihood of increased regulation of the hedge fund industry.

Describe the risks that the regulators are concerned about and the validity of their concerns.

(b) (*3 points*) With respect to the private equity fund, your CIO heard that leveraged buy-outs (LBOs) offer a better risk-return tradeoff than venture capital.

(i) Explain the arguments behind this assertion

(ii) Assess why the conclusion in (i) might not be correct.

(c) (*1 point*) Explain why hedge funds have a competitive advantage over private equity firms when bidding for operating assets.

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16. (*9 points*) You work in the investment department of an insurance company and you manage a $1 billion equity portfolio. The company is investigating three approaches to equity investing (active, passive and semi-active).

(a) (*0.5 point*) Explain the views on equity market informational efficiency that are consistent with each of the three approaches.

(b) (*1 point*) Identify four factors that determine characteristics of an equity index.

You are considering adopting a passive investing approach and the following index stock-weighting methods:

(i) Price-weighted

(ii) Equal-weighted

(iii) Value-weighted

Market Data for the Constituent Stocks in the Index

Stock	A	B	C
Share price at 12/31/2010	$50	$10	$78
Share price at 12/31/2011	$28	$32	$73
Adjusted Yearly Return		220%	−6.4%
Number of shares outstanding at 12/31/2010	100,000	50,000	200,000
Number of shares outstanding at 12/31/2011	200,000	50,000	200,000
Weights of Index (Value-weighted)	23.7%	2.4%	73.9%

Note: Stock A split 2 for 1 after the market close on 12/31/2010.

(c) (*1 point*) Calculate the index return for the period between 12/31/2010 and 12/31/2011 under the price-weighted method.

(d) (*2 points*) Identify the stock that had the most significant contribution to the index return in 2011 for each method.

(e) (*2 points*) Describe the advantages and disadvantages of each index stock weighting method, using details from the previous calculation to illustrate.

16. Continued

(f) (*1 point*) Recommend an index stock-weighting method that would be most appropriate for the passive investing approach.

(g) (*1.5 points*) On 12/31/2011 a new company D is listed with a market capitalization of $100 million and a stock price of $1,000.

(i) Evaluate under which index stock-weighting method the inclusion of stock D will have the least impact on the index weights for A, B and C.

(ii) Explain whether the inclusion of stock D would change your recommendation in (f) above.

17. (*3 points*)

(a) (*1 point*) Define Brady bonds and explain the motivation behind the creation of Brady bonds.

(b) (*1 point*) Compare the characteristics of Brady bonds and other emerging market bonds.

(c) (*1 point*) Explain the motivation to invest in emerging market debt.

****END OF EXAMINATION****
Afternoon Session

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