SOCIETY OF ACTUARIES
Advanced Portfolio Management

Exam APM

AFTERNOON SESSION

Date: Friday, November 4, 2011
Time: 1:30 p.m. – 4:45 p.m.

INSTRUCTIONS TO CANDIDATES

General Instructions

1. This afternoon session consists of 8 questions numbered 11 through 18 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.

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Exam APM-Front Cover

****BEGINNING OF EXAMINATION****
Afternoon Session
Beginning with Question 11

11. (*7 points*) Company X is considering the purchase of a zero-coupon bond with the following characteristics:

- Principal payable at maturity: 100
- Years to maturity: 2
- Estimated annual hazard rate: 0.09
- Loss given default: 40%

The current effective annual risk-free rate is 10%. In the next year, assume that this rate might move up to 12% with probability of 70% or move down to 8% with probability of 30%.

(a) (*3 points*) Calculate the price of the bond using the Reduced-Form Approach.

(b) (*2 points*) Determine the equivalent default risk-adjusted short-rate process for the life of the bond.

(c) (*2 points*) Propose enhancements that can be incorporated into a continuous time model of the default risk-adjusted short rate process.

12. (*14 points*) You are an investment consultant assisting your client, University of Actuaries, in reviewing the governance of its Endowment Fund. The Endowment Fund is operated by a Trustee.

The goals of the Endowment Fund are to provide stable and sustainable funding to support the University's annual operating budget and to protect the donated capital on an inflation-adjusted basis.

The spending rate has averaged 4% of market value of assets in recent years. The University's inflation rate has averaged 3% in recent years.

The recent financial crisis resulted in many problems for the University and its Endowment Fund. Annual forecasted expenses are up, new donations are down and the market value of assets ($450M) of the Endowment is now below the donated capital ($500M).

Although the University has no formal Statement of Investment Policy for the Fund, they have established benchmark weights for performance monitoring purposes. You are provided with the following information as of January 1, 2011:

	Current Allocation	Benchmark Allocation	Expected Return
Domestic Equity	25%	30%	8%
Foreign Equity	25%	30%	9%
Fixed Income	45%	30%	5%
Commodities	5%	10%	10%
Total	100%	100%	
Standard Deviation of Return	8.5%	11%	

(a) (*3 points*) Design a risk/return objective and constraints for the Endowment Fund including a description of relevant factors.

(b) (*2 points*) Assess if the current benchmark allocation meets the risk/return objective and recommend changes if necessary.

12. Continued

(c) (*1 point*) Explain the benefits and costs of rebalancing.

(d) (*1 point*) Assess different rebalancing strategies that could be considered for the Endowment Fund.

(e) (*2 points*) Evaluate the role of commodities in the Endowment Fund portfolio.

(f) (*2 points*) Define the duties of the Trustee.

(g) (*3 points*) You estimate the Endowment Fund's Board of Trustees risk aversion (R_A) to be 4.

Determine whether the Current Allocation or the Benchmark Allocation would be preferred if the decision is based on:

(i) Maximizing the expected utility for your client, or

(ii) Minimizing the probability of returns below 3%.

13. (*9 points*) Firm A is exploring the possibilities of adding non-traditional investments such as hedge funds, venture capital, and leveraged buyouts to their current investment portfolio.

Asset	Volatility
Firm A's existing portfolio, P_0	10%
Hedge Fund X	12%
Firm A's Target Portfolio, P_1	9%

The correlation of hedge fund X to P_0 is 0.3.

(a) (*1 point*) Describe the characteristics of hedge funds.

(b) (*4 points*) Firm A is considering adding Hedge Fund X to their investment portfolio:

(i) Explain how Firm A's portfolio volatility could decrease after the addition of a long position in Hedge Fund X.

(ii) Calculate the proportions of the existing portfolio and hedge fund X to achieve the targeted volatility.

(iii) Calculate the proportions of the existing portfolio and hedge fund X to achieve the minimum portfolio volatility.

(c) (*1 point*) Compare the pros and cons of investing in a fund of hedge funds or a single hedge fund.

(d) (*2 points*) Compare the risk-return profiles of:

(i) Venture Capital

(ii) Leverage Buyouts

(e) (*1 point*) Describe practical considerations involved when deciding to invest in private equity.

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14. (*7 points*) ABC Life Insurance Company has a portfolio of bonds benchmarked to the XYZ Capital Aggregate Bond Index (XYZ-Agg). The components of the XYZ-Agg Index are grouped into cells by three categories: Sector, Quality, and Duration.

The following shows the detailed breakdown of the Aa-rated quality Grade/Mid Duration grouping of the index (referred to as the Grouping below):

- Grouping Duration: 7.78
- Grouping Return: –0.18%

	Short Half	**Long Half**	**Total**
Treasury sector			
Benchmark Weight	41%	59%	100%
Duration	6.70	9.50	8.35
Return	–0.20%	–0.15%	–0.17%
MBS sector			
Benchmark Weight	36%	64%	100%
Duration	6.10	8.20	7.44
Return	–1.00%	–1.20%	–1.13%
Corporate sector			
Benchmark Weight	35%	65%	100%
Duration	6.60	7.90	7.45
Return	0.40%	0.43%	0.42%
Foreign sector			
Benchmark Weight	55%	45%	100%
Duration	6.40	7.80	7.03
Return	0.35%	0.41%	0.38%

The following shows the return and outperformance of investing in a single sector on a duration-neutral basis relative to the overall Grouping:

	Duration-neutral Return	Outperformance
Treasury sector	–0.18%	0.00%
MBS sector	–1.16%	–0.98%
Foreign sector	0.41%	0.59%

14. Continued

(a) (*2 points*) Calculate the following for the Corporate Sector:

(i) the allocation weights to the Short and Long Half duration buckets of this sector to create a duration-neutral portfolio with respect to the Grouping

(ii) the sector return

(iii) the sector outperformance

(b) (*4 points*) ABC Life wishes to hire an Investment Manager skilled at selecting outperforming sectors. Calculate the mean, standard deviation of outperformance, and information ratio of the Sector Allocation Strategy within the Grouping assuming:

(i) Investment Manager A selects sectors randomly.

(ii) Investment Manager B is 40% skilled in selecting outperforming sectors.

(iii) Investment Manager C is 40% skilled in selecting the single best outperforming sector.

(c) (*1 point*) Explain why it may be misleading to compare managers using only Information Ratios.

15. (*5 points*)

(a) (*2 points*) Describe and compare the following credit spread measures:

(i) Z-spread

(ii) Par asset swap spread

(iii) Par equivalent CDS spread

(b) (*1.5 points*) Using the Z-spread measure, calculate the Bond-CDS basis given the following information:

(i) A one-year bond with a 2.5% annual coupon priced at $96.7

(ii) The bond has a face value of $100 and is option-free

(iii) The effective annual risk-free rate is 5%

(iv) Default probability is 16.5%

(v) Expected recovery rate is 83.3%

(c) (*1 point*) Describe two of the main drivers of the Bond-CDS basis.

(d) (*0.5 points*) Demonstrate the trade you would do to take advantage of the pricing discrepancy.

16. (*6 points*)

(a) (*2 points*) Describe the theoretical and practical limitations of using risk-neutral pricing methods for credit derivatives. List the situations where it may not be appropriate to use a Risk Neutral pricing method for a credit derivative.

(b) Consider a corporate zero coupon bond of 1 year term with a maturity value of 100. In the event of a default, the recovery value of the bond is 65. The physical (real world) default probability is 10%. The bond is currently trading at 91. The risk-free interest rate is 5%.

(i) (*1 point*) Calculate the implied discount rate under the physical (real world) default probabilities.

(ii) (*1 point*) Calculate the risk-neutral default probability.

(iii) (*2 points*) Compare the risk-neutral probability to the real world physical probability and describe why they differ.

17. (*6 points*) Your CIO recently returned from his vacation at the resort in the nation of Naboo. He was very impressed with Naboo and asked his chief economist to research the country's economy and equity market outlook. Naboo 40, (N40) a market-capitalization weighted index, is the index that tracks the movement of the 40 largest stocks in Naboo.

At a staff meeting the chief economist presented the following historical information from the nation of Naboo:

Year	1950	1970	1990	2010
N40 Index Volatility	31%	27%	23%	19%
Average Bid-Ask Spread $	3.25	3.05	1.80	1.20
Inflation Rate	2.5%	3.2%	2.7%	2.2%
Unemployment Rate	8%	6%	7%	5%
10 Year Government Bond Yield	4.8%	6.0%	5.5%	4.3%
Tax Rate	39%	35%	30%	32%
N40 Index Dividend Yield	4.3%	5.1%	5.0%	4.2%
GDP $Nbillions	5.5	7.5	8.1	11.6
AfterTax Corporate Profits $Nmillions	425	581	589	846

The P/E ratio of N40 increased 120% from 1950 to 2010.

(a) (*2 points*) Assess if the increase in the P/E ratio of N40 is likely to be anomalous or not.

(b) (*2 points*) The chief economist in your company has predicted that through 2020 Naboo's GDP will rise 3% annually to $N15.6 billion and after-tax corporate profits will rise 6% annually to $N1.5 billion, assuming all other factors remain constant. Based on this analysis, the CIO wants to invest in the N40.

Assess your economist's predictions and their implications for growth in the N40 index.

(c) (*1 point*) Describe how Robert Shiller's feedback model may explain the rapid growth of the P/E ratio of N40.

(d) (*1 point*) Explain what might prevent rational investors from implementing arbitrage to correct feedback bubbles.

18. (*6 points*) You are the new advisor to the State of Columbia Lottery Commission, and are required to formulate an investment strategy to fund the Commission's required payments over the next 20 years. The lottery agency is a state agency, which is exempt from taxes, and has been directed to avoid any losses or shortfalls. The payments which will be made at the end of each year, are as follows:

End of Year	Payment
1	20 MM
2	19 MM
…	…
20	1 MM

(a) (*2 points*) Describe briefly how this liability schedule will impact considerations of an investment policy.

(b) (*2 points*) Previously, the assets were invested in 5-year bonds, which are now maturing, and will provide an immediate cash flow of 175 MM. You are considering developing either a dedicated bond portfolio or active immunization.

For each of these two strategies:

(i) Describe the strategy.

(ii) Describe the advantages and disadvantages of using the strategy to fund this particular liability stream.

(c) (*2 points*) In response to part (b) above, a dedicated bond portfolio was developed. The cost of the portfolio was 180 MM. As an alternative to the dedicated bond portfolio approach, which would require an additional 5 MM, the prior advisor had suggested that a portion of the proceeds from the maturing bonds be invested in emerging market debt.

(i) Describe the characteristics and risks of emerging market debt.

(ii) Describe the advantages and disadvantages of using this investment type to fund this liability stream.

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

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