
SOCIETY OF ACTUARIES
Foundations of CFE Exam

Exam CFEFD

AFTERNOON SESSION

Date: Wednesday, November 1, 2017

Time: 1:30 p.m. – 3:45 p.m.

INSTRUCTIONS TO CANDIDATES

General Instructions

1. This afternoon session consists of 5 questions numbered 9 through 13 for a total of 40 points. The points for each question are indicated at the beginning of the question. No questions pertain to the Case Study.
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 because 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 CFEFD.
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.

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

9. (7 points)

Big Manufacturing Company (BMC), with operations in the U.S. and Canada, would like to understand the impact of adverse exchange rate movements on its balance sheet.

BMC currently uses a deterministic model with USD and CAD risk-free forward rates as well as the interest rate parity relationship to estimate future exchange rates.

BMC's CRO suggests developing a real-world stochastic foreign exchange rate model with deterministic interest rates.

(a) (3 points)

- (i) Critique the current foreign exchange rate model.
- (ii) Explain why using a stochastic foreign exchange rate model with deterministic interest rates may be appropriate for BMC.
- (iii) Explain how to calibrate the CRO's proposed exchange rate model.
- (iv) Identify two considerations when using market data to calibrate the CRO's proposed exchange rate model.

Management implements the CRO's exchange rate model and makes the following decisions:

Decision	Element	Selected Option	Rejected Option
I	Random number generator	Pseudo random	True random
II	Risk measure	VaR	CTE
III	Variance reduction method	Importance sampling	Stratified sampling

(b) (4 points)

- (i) Compare and contrast the options for each of decisions I-III.
- (ii) Justify each decision made by management.

- 10.** (8 points) Your company is considering a special rewards program that increases sales of concert tickets. The CRO has asked you to prepare an analysis to measure the risk involved. The CEO wants to base decisions on profit.

Co-worker A ranks the risk of program failure as HIGH, MEDIUM or LOW.

Co-worker B estimates the probability of success of the program.

- (a) (2 points) Critique each of the co-worker's methods.

You develop your own method for analyzing the risk of the program. You calculate the Expected Opportunity Loss (EOL) using the following information:

	Program Succeeds	Program Fails
Probability	45%	55%
Change in profit if rewards program is adopted	\$50M	-\$5M
Change in profit if rewards program is not adopted	\$0	\$0

- (b) (1 point) Justify the appropriateness of your measurement method.

For a cost of \$3M you can acquire additional information to measure the outcome of the program with certainty.

- (c) (1 point) Recommend whether to pay for the additional information. Support your recommendation.

The CEO is unconvinced by any of the three methods. She suggests waiting for three months to make a decision on the rewards program.

- (d) (1 point) Explain how the EOL of the rewards program might change if the decision is delayed for three months.

10. Continued

Co-worker C determined that there is a 90% certainty that the rewards program would increase the number of ticket sales in a range of 10,000 to 50,000 additional tickets for the next year. Co-worker C assumes:

- Increase in ticket sales is normally distributed
- Price per ticket is \$250
- Cost of investment is \$5M

Co-worker C computes the EOL via the integral:

$$EOL = 250 \times \int_{-\infty}^n L(x) f(x; \mu, \sigma) dx$$

x = increase in tickets sold

n = break-even sales

L = loss function

f = pdf of the normal distribution

- (e) (1 point) Identify two shortcomings of Co-worker C's approach.
- (f) (2 points)
- (i) Compare the program outcome probabilities between your approach and that of Co-worker C.
 - (ii) Recommend an improvement to make the model results more consistent between these two approaches.

- 11.** (10 points) The new CRO of AAAA Bank feels that the current risk model for the trading operations might understate large losses and might not respond quickly enough to changes in volatility. He will select one of the following two options for updating the model:

Option	Initial Cost	CROs Estimated Success Rate	Additional Costs of Failure
Purchase from Vendor	\$10M	100%	N/A
Internal Development	\$5M	60%	\$12M

- (a) (1 point) Calculate the Expected Opportunity Loss of each option.
- (b) (1 point) Explain how Expected Value of Information could assist in this decision-making process.

You mention to the CRO that he could improve his estimate of the internal development's success rate by better analyzing the capabilities of his staff. He responds by saying,

"I've only been in this role a month, and have just started to get to know my team. It will take way too long and will be much too costly for me to get to the point where I will know for certain that we can complete this task."

- (c) (2 points) Critique the CRO's statement within an Applied Information Economics (AIE) framework.

To gain more information, the CRO can hire a consultant for the cost of \$1M to help evaluate the staff's capabilities. If hired, there is an equal probability that the estimated success rate of the project will either increase to 90% or decrease to 30%.

- (d) (2 points) Determine whether to hire the consultant. Show your work.

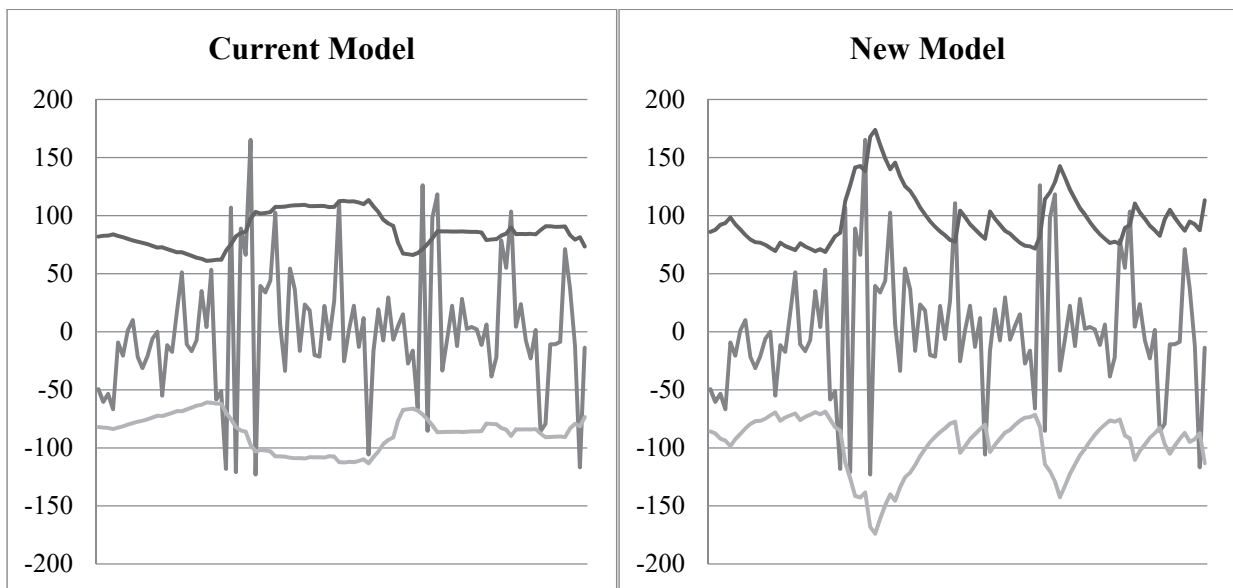
11. Continued

AAAA is implementing the new risk model. The CRO requests that you perform back-testing. You are considering the following approaches:

- I. Basic Frequency
- II. Conditional Testing (Christoffersen)
- III. Distribution Equality Tests

- (e) (2 points) Evaluate whether each of the above approaches is appropriate for back-testing the models.

The back-testing results are shown below based on 100 days of profit and loss data and the VaR(5) and VaR(95) bounds for the current and new models.



Model	Exceedances	Consecutive Exceedance Instances
Current	12	7
New	9	0

- (f) (1 point) Assess the validity of the current model under the three back-testing approaches, I-III.
- (g) (1 point) Assess the validity of the new model under the three back-testing approaches, I-III.

- 12.** (7 points) Cottle Life is launching a new rider on its term life product called “Fit to Save” (FTS). This rider offers policyholders reward points to reduce their premiums if they are actively involved in a fitness program. Since this concept is new to the market, there is currently no data available.

To incorporate FTS, Cottle’s pricing actuary, Joe, was given a hotel loyalty program model. He layered it on to the existing term life pricing model without modification.

The hotel loyalty program model covers both hotel stay rewards and extra points earned from the hotel’s loyalty credit card. The assumptions used in the hotel loyalty program model were developed using data from the past two years.

- (a) (2 points) Evaluate whether Joe has followed the guidance in the Proposed ASOP on Modeling. Justify your answer.
- (b) (2 points)
- (i) Identify three sources of model risk that Joe should consider while developing the FTS model.
 - (ii) Recommend steps Joe can take to mitigate each of the risks you identified in part (i).

Joe finished building the pricing model for FTS. Based on the company’s policy, the model vetting team needs to validate it before the FTS product launch.

- (c) (1 point) Describe how the team should validate the FTS model according to the Proposed ASOP on Modeling.
- (d) (2 points)
- (i) Identify three major subcategories of model risks to consider in model validation.
 - (ii) Describe the validation steps to minimize the model risks you identified in part (i).

13. (8 points) Conradz is a start-up company in the fast-growing technology industry and is considering options for its legal structure. You have been hired by Conradz to develop a corporate governance framework. As part of your preparation, you review the requirements of the Sarbanes-Oxley Act (SOX).

(a) (2 points)

- (i) Describe three central themes of SOX which are intended to achieve the goal of providing accurate financial data.
- (ii) Explain why SOX is relevant even if Conradz decides to remain privately held.

Your colleague, Ed, recommends that Conradz form a corporation instead of creating a general partnership. Ed says:

“As a corporation, Conradz owners will have more flexibility, lower costs, limited personal liability, and easier access to capital. In addition, as a corporation, Conradz will avoid the double taxation of income.”

(b) (2 points) Critique Ed’s statement.

Conradz decides to form a corporation.

(c) (2 points) Describe corporate governance best practices for a Board of Directors with respect to the following:

- (i) Size and composition of the Board
- (ii) Committee structure
- (iii) Experience requirements
- (iv) Compensation of Board members

(d) (1 point) Identify four general guidelines for the Board of Directors to meet its legal obligations.

(e) (1 point) Recommend two ways to mitigate agency conflict through management compensation policy.

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

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