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**SOCIETY OF ACTUARIES**  
**Foundations of CFE Exam**

# Exam CFEFD

## MORNING SESSION

**Date:** Wednesday, April 26, 2017

**Time:** 8:30 a.m. – 11:45 a.m.

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### INSTRUCTIONS TO CANDIDATES

#### General Instructions

1. This examination has a total of 100 points. It consists of a morning session (worth 60 points) and an afternoon session (worth 40 points).
  - a) The morning session consists of 7 questions numbered 1 through 7.
  - b) The afternoon session consists of 5 questions numbered 8 through 12.

The points for each question are indicated at the beginning of the question. Questions 1 – 4 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.



## **CASE STUDY INSTRUCTIONS**

**The case study will be used as a basis for some examination questions. Be sure to answer the question asked by referring to the case study. For example, when asked for advantages of a particular plan design to a company referenced in the case study, your response should be limited to that company. Other advantages should not be listed, as they are extraneous to the question and will result in no additional credit. Further, if they conflict with the applicable advantages, no credit will be given.**



**\*\*BEGINNING OF EXAMINATION\*\***  
**Morning Session**

*Questions 1 – 4 pertain to the Case Study.*  
*Each question should be answered independently.*

**1.** (6 points)

- (a) (1 point) Explain why bidders generally pay a premium to acquire a company.
- (b) (1 point) Describe the following two potential strategies to limit the costs of an acquisition.
  - (i) Leveraged buyout
  - (ii) Freeze out merger

Blue Jay Air is considering upgrading its business lounges either by renovating its current lounges or by acquiring an airport lounge company. (Case Study Section 2.4.4)

Under the Market Value Added (MVA) framework, Blue Jay Air will not purchase Luxury Lounges unless the value added of the acquisition exceeds that of the renovation option.

Assume for the following calculations that the business risks inherent in both options are similar to the overall business risks of Omega Airline, a peer competitor of Blue Jay Air (Case Study Section 1.2.6). Blue Jay Air's tax rate is 35%.

- (c) (3 points)
  - (i) Calculate the MVA of renovating the lounges. Show your work.
  - (ii) Calculate the maximum offer Blue Jay Air should make for Luxury Lounges. Show your work.
- (d) (1 point) Identify two considerations of a capital allocation framework specific to Blue Jay Air that can be used to decide between these options.

*Questions 1-4 pertain to the Case Study.  
Each question should be answered independently.*

**2.** (8 points)

- (a) (1 point) Describe three situations in which a company may employ temporary working capital.
- (b) (1 point) Calculate Blue Jay Tire's permanent working capital (Case Study Section 3.4).

Blue Jay Tire's management has decided to issue a recall on all RU42WD tires in hopes of safeguarding its brand (Case Study Section 3.3). Due to increased reputational risk from the recall, Blue Jay Tire needs to temporarily increase capital by \$50 million for the next six months.

- (c) (2 points) Calculate the effective annual rate for each of the following financing options to fund the increased capital need.

Note: Annual Percentage Rate (APR) is compounded semi-annually.

- I. Promissory note with 5% compensating balance requirement bearing 1% APR interest. Loan interest is 9% APR.
  - II. Commercial paper offering \$95 for \$100 of face value
  - III. Secured loan collateralized by inventory with an upfront field warehouse cost of \$200,000, 10% APR
- (d) (1 point) Recommend one financing option from part (c) for Blue Jay Tire. Support your recommendation.

## 2. Continued

In addition to raising capital, Blue Jay Tire is uncertain of its liquidity needs to manage the costs of the recall. Management is exploring the following financing options:

- A. Line of credit
- B. Bridge loan
- C. Sale and lease back of property & equipment
- D. Issue long-term debt

(e) (3 points)

- (i) Describe each of the financing options A-D above.
- (ii) Evaluate the appropriateness of each of the financing options to address Blue Jay Tire's liquidity concerns.
- (iii) Recommend the financing option that Blue Jay Tire should utilize. Support your recommendation.

*Questions 1-4 pertain to the Case Study.  
Each question should be answered independently.*

**3.** (9 points)

- (a) (2 points) Explain two reasons why it may be desirable for Frenz to retain earnings as cash (Case Study Section 4.3).
- (b) (2 points) All calculations are as of December 31, 2014.
  - (i) Calculate Frenz's share price.
  - (ii) Calculate the share price if Frenz repurchases \$100M worth of shares using retained earnings.
  - (iii) Calculate the share price if Frenz invests in the Vietombia project using retained earnings (Case Study Section 4.3, Exhibit 5).

Frenz's current management compensation package includes a financial bonus for projects that increase future annual earnings by at least \$10M.

- (c) (2 points) Assess whether the company should invest \$100M in the Vietombia project or repurchase \$100M worth of shares from the perspective of the following two stakeholders:
  - (i) Shareholders
  - (ii) Management
- (d) (2 points) Design an alternative compensation package that aligns management compensation with shareholders' interest without overexposing managers to Frenz's risks. Justify your reasoning.

Frenz decides to use its retained earnings for a share repurchase.

- (e) (1 point) Describe three transaction types that Frenz could use to repurchase its shares.



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**Questions 1-4 pertain to the Case Study.  
Each question should be answered independently.**

- 4.** (10 points) Darwin Life (Darwin) is increasing its model projection period from 30 years to 60 years. To do so, Darwin needs a new long-term discount rate assumption.

Darwin's Chief Actuary proposes the "macroeconomic" approach.

- (a) (1 point) Describe three parts of the long-term interest rate extrapolation problem that the "macroeconomic" approach addresses.
- (b) (1 point) Describe two goals of developing extrapolated yield curves.
- (c) (1 point)
  - (i) Explain which goal from part (b) Darwin's VA Hedging Actuary would support.
  - (ii) Describe the primary issue Darwin's VA Hedging Actuary would encounter if the alternative goal from part (b) is prioritized.

RPPC suggests that Blue Jay Air implement the new long-term discount rate assumption in the valuation of its Defined Benefit Pension Plan.

- (d) (1 point)
  - (i) Explain which goal from part (b) Blue Jay Air's Chief Pension Accountant would support.
  - (ii) Describe the primary issue Blue Jay Air's Chief Pension Accountant would encounter if the alternative goal from part (b) is prioritized.

#### 4. Continued

After implementation of the “macroeconomic” approach, external auditors have asked to see the following scenarios:

- I. The speed of convergence to the “unconditional forward rate” (UFR) is reduced from 40 years to 10 years.
  - II. The “longest reliable horizon” (LRH) is increased from 15 years to 30 years.
- (e) (2 points) Describe the expected impact of each scenario I and II on:
- (i) Darwin’s VA Hedging Actuary’s ability to effectively hedge.
  - (ii) Blue Jay Air’s Chief Pension Accountant’s ability to value the pension liability.

Three years later, Darwin is not satisfied with the “macroeconomic” approach and considers implementing the Static Control Model. It considers the following three scenarios:

- A. US Interest Rates are expected to remain at historically low levels for an extended period of time.
  - B. Darwin’s ERM department implements a risk governance framework requiring that all models be market consistent.
  - C. An NAIC regulation is passed requiring that long-term interest rate models used to discount long-term liability cash flows have continuous forward interest rates.
- (f) (2 points) Evaluate the appropriateness of implementing the Static Control Model for each scenario A, B and C above.

The auditor is concerned that Darwin’s hedging program is not robust enough to protect against interest rate volatility.

- (g) (2 points) Recommend four improvements to Darwin’s interest rate risk management strategy. Justify your recommendation.

**5.** (11 points)

(a) (1 point)

- (i) Describe the “Equivalent Bets” test.
- (ii) Describe how management could utilize the “Equivalent Bets” test for project evaluation.

Management is considering five potential projects below:

Current Management Expectations			
Project	Expected Present Value of Profits	Expected Standard Deviation of PV of Profits	Risk Categorization
A	100	20	Medium
B	200	50	High
C	50	20	High
D	75	15	Medium
E	125	15	Low
Total	550	???	???

(b) (1 point) List four disadvantages of the “high-medium-low” risk categorization method.

Despite its shortcomings, management likes the “high-medium-low” risk categorization due to its simplicity and familiarity.

(c) (2 points)

- (i) Design criteria that quantify the high, medium and low risk categories using the information in the table above. Show your work.
- (ii) Describe one flaw of using a simple sum of standard deviation of PV of profits for all projects to calculate “Total” risk.

## 5. Continued

Management is considering a 6<sup>th</sup> project. Current labor costs are 80, but management can enter into labor negotiations which would result in costs of either 50 or 150. Management expects a 35% chance of achieving its 50 cost goal; otherwise the costs will be 150.

(d) (1 point) Calculate the Expected Opportunity Loss of:

- (i) Entering into labor negotiations.
- (ii) Not entering into labor negotiations.

Assume that management has entered labor negotiations and the expected revenues for the 6<sup>th</sup> project are uniformly distributed between 100 and 200.

Note:  $E(X^2)$ , the second moment of PV of profits, is 4,333.

(e) (2 points) Categorize the risk of this new project, according to the criteria in part (c)(i). Show your work.

Management can hire Red Car Consulting (RCC) to assist in the labor negotiation. For a cost of 5, RCC can provide insights that will increase the odds of the favorable result from 35% to 40%.

(f) (2 points)

- (i) Calculate the Expected Value of Information of hiring RCC.
- (ii) Recommend whether or not to hire RCC. Justify your recommendation.

As the labor negotiations have progressed, the assumption of labor costs is revised to follow a uniform distribution.

(g) (2 points) Explain why the risk categorization of the 6th project could change based on the revised assumption.

6. (8 points) Begonia Environmental Construction Company (BECC) is a leading company in the fast-growing construction sector of country Xenia.

BECC stock entered the national stock market index of Xenia a year ago, when the stock price was \$50. The stock market index of Xenia has decreased slightly during the year, along with the price of BECC stock, which is currently at \$40. The CFO of BECC is concerned about generating future profits and believes shares of BECC are over-valued.

- (a) (1 point) Describe three behavioral reasons why an investor would continue to hold BECC stock at this time.
- (b) (2 points)
- Explain two goals of the CFO according to the rational manager theoretical framework and assuming perfect capital markets.
  - Describe the additional goal the CFO has to consider when the assumption of investor rationality is relaxed.

The objective function of a rational manager can be expressed as:

$$\max_{K,e} \lambda [f(K, \cdot) - K + e\delta(\cdot)] + (1 - \lambda)\delta(\cdot)$$

- (c) (1 point) Describe the following components of the objective function:
- $f(K, \cdot) - K$
  - $e\delta(\cdot)$
  - $\delta(\cdot)$
  - $\lambda$

## **6. Continued**

The CFO's compensation depends on BECC's stock price at the end of the year.

- (d) (2 points) Evaluate how the compensation arrangement impacts the components of the objective function in part (c).
- (e) (2 points) Assess whether the CFO would take the following actions in light of her compensation package. Justify your assessment.
  - (i) Acquire an undervalued company
  - (ii) Manage accruals in reported earnings
  - (iii) Issue new equity shares

**7.** (8 points)

(a) (1 point) List three reasons for mapping positions to risk factors.

You are a risk manager of the Polar Animal Hedge Fund. This \$10 million fund consists of two publicly traded stocks on the Zoo Stock Exchange.

Stock	Weight	Beta
Arctik Fox Inc.	50%	1.2
Snowee Owl Corp.	50%	0.8

- Risk free rate is 0%.
- Zoo Stock Exchange's market index, Zoo Composite, has annual volatility,  $\sigma = 20\%$ .
- Stock returns are assumed to be normally distributed.
- The standard normal variate at the 95<sup>th</sup> percentile is 1.645.

(b) (2 points) Calculate VaR(95) over a 1-year horizon by mapping both stocks to Zoo Composite.

Your boss is concerned about the reliability of your VaR(95) calculation.

(c) (3 points)

- (i) Describe two assumptions made in the mapping process.
- (ii) Explain how your result in part (b) would compare to a VaR(95) result without mapping (i.e. overestimate, underestimate, equal to, or uncertain). Justify your answer.



## 7. Continued

The two stocks are positively correlated. You have asked your intern to develop stress tests for the VaR framework. Your intern proposes three scenarios:

- I. Increase each stock's volatility
  - II. Increase each stock's volatility and reduce their correlation
  - III. Increase each stock's volatility and increase their correlation
- (d) (2 points) Rank the effectiveness of the stress tests I, II and III above. Justify your ranking.

**\*\*END OF EXAMINATION\*\***  
**Morning Session**

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