
SOCIETY OF ACTUARIES
Foundations of CFE Exam

Exam CFEFD

MORNING SESSION

Date: Wednesday, November 2, 2016

Time: 8:30 a.m. – 11:45 a.m.

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 8 questions numbered 1 through 8.
 - b) The afternoon session consists of 5 questions numbered 9 through 13.

The points for each question are indicated at the beginning of the question. Questions 1 through 5 in the morning session 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 – 5 pertain to the Case Study.
Each question should be answered independently.

- 1.** (5 points) The companies of RPPC have the following goals:
- I. Frenz: fund its expansion strategy (Case Study Section 4.2.2)
 - II. Blue Ocean P&C: reduce capital required for solvency purposes
 - III. Darwin Life: improve its capital position
 - IV. Big Ben Bank: transfer the risk of a block of its long term loans
- (a) (3 points) Recommend a suitable capital management strategy for each of I, II, III and IV. Justify your recommendations.
- (b) (2 points) Explain why Blue Ocean P&C and Darwin Life company policies require higher credit ratings than Blue Jay Air's.

Questions 1 – 5 pertain to the Case Study.
Each question should be answered independently.

2. (7 points) RPPC is considering entering the health insurance business through the acquisition of Rose Health Insurance, a US-based insurer. Too Big Bank is also interested in acquiring Rose. The expected return for the Rose acquisition is 11% for RPPC and 6% for Too Big Bank. Assume each company pays taxes at 35%.

(a) (1 point) Calculate the weighted average cost of capital for RPPC and Too Big Bank (Case Study Section 1.2.6). Show your work.

Assume the acquisition target leverage ratio is the same as the acquiring company's leverage ratio. The unlevered cost of capital of the acquisition is 10% for both companies. Suppose each company can utilize either of the following funding frameworks to acquire Rose:

- I. Equity, with the proportion of equity increasing by an additional 10%.
- II. Debt, with the proportion of debt increasing by an additional 10%.

(b) (2 points) Assess which companies should pursue the acquisition under each funding framework by recalculating the WACC. Show your work.

(c) (1 point) Explain two factors for RPPC to consider if it decides to issue debt.

(d) (1 point) Explain two factors for RPPC to consider if it decides to issue equity.

In addition to financial performance, best-in-class capital allocation frameworks also consider:

- Competitive advantage period
- Portfolio fit
- Risk profile
- Environment
- Value

Assume RPPC plans to acquire Rose through Darwin Life.

(e) (2 points) Explain how two of the capital allocation framework considerations can be assessed by Darwin Life in the acquisition of Rose.

*Questions 1 – 5 pertain to the Case Study.
Each question should be answered independently.*

3. (11 points) Blue Jay Air is considering proposals to either lease or purchase a new fleet of planes for its international operations. (Case Study Section 2.6 – Exhibit 4)

- (a) (2 points) Describe three reasons Blue Jay Air might choose to lease rather than purchase the new fleet.
- (b) (1 point) Propose two clauses that Blue Jay Air might want to include in a contract if it chooses to lease.

Blue Jay Air is considering each of the following debt funding options if it chooses to purchase the fleet:

- I. Private placement debt
- II. Callable bonds
- III. Convertible bonds
- IV. Secured debt

- (c) (2 points) State one advantage and one disadvantage for Blue Jay Air for each of options I – IV.

Assume the following for the remainder of the question:

- If it purchases the fleet, Blue Jay Air will sell it at the end of 5 years for \$1.4B.
 - Blue Jay Air's tax rate of 35% is the same as RPPC's.
 - Blue Jay Air's cost of debt of 8% is the same as RPPC's.
 - The lease expenditure would be paid in equal annual installments.
 - All revenues and expenses occur at year-end (except plane purchase / lease payments which occur at the start of the year).
- (d) (2 points) Calculate the free cash flows over the next five years under both the lease and purchase options.

3. Continued

- (e) (2 points)
 - (i) Calculate the after-tax cost of debt.
 - (ii) Assess the appropriateness of using the after-tax cost of debt to discount the incremental future cash flows between the lease and purchase options.
- (f) (2 points) Evaluate whether Blue Jay Air should lease or purchase the international plane fleet. Justify your recommendation.

*Questions 1 – 5 pertain to the Case Study.
Each question should be answered independently.*

4. (7 points) You are an actuarial student working on asset-liability analysis for Darwin Life's general account. You are given:

- Market value of general account liabilities = \$9.5 million
- Duration of general account liabilities = 7.2 years

(a) (2 points) Calculate the duration of Darwin Life's shareholders' equity as of year-end 2014 (Case Study Section 7.8 – Exhibit 2). Show your work.

To test the impact of an increasing interest rate environment, you run a scenario assuming a 120 basis point parallel shift up of the entire yield curve. The yield curve at year-end 2014 is 3% in all durations.

(b) (2 points) Calculate the market value of shareholders' equity as of year-end 2014 in this scenario using the duration analysis from part (a). Show your work.

You are given the following information for the UL block at year-end 2014:

- Each asset in the UL portfolio has a duration of 8.4 years.
- The duration of the UL liability is 9.1 years.
- Darwin Life's duration matching policy is found in Case Study Section 7.6.2.
- Potential new Asset A: 8-year zero-coupon bond with yield of 2.5%
- Potential new Asset B: 15-year bond that pays a coupon of 15% of face value every 5 years and has a yield of 3.0%.

(c) (2 points) Construct a compliant UL asset portfolio using Asset A and/or Asset B. Show your work.

(d) (1 point) Critique Darwin Life's method of asset-liability management.

Questions 1 – 5 pertain to the Case Study.
Each question should be answered independently.

5. (8 points)

- (a) (1 point) Describe the type of each risk model used by Big Ben Bank (Case Study Section 6.1.3).

Your boss says, “I don’t know why we spend all this time developing models, they are never right anyway.”

- (b) (1 point) Critique your boss’s statement.
- (c) (3 points)
- (i) Describe four guidelines risk managers use to manage model risk.
- (ii) Identify one good practice and one poor practice from RPPC’s model risk framework (Case Study Section 1.3.10). Justify your choices.

You are the risk manager of Big Ben Bank. You have collected 200 daily P/L observations from two different portfolios using a VaR confidence level of $\alpha = 95\%$.

- I. Portfolio A has an exceedance level of 5
 II. Portfolio B has an exceedance level of 16

Cumulative Distribution Function of binomial distribution ($n = 200, p = 1 - \alpha = 0.05$)							
x	3	4	5	6	7	8	9
	0.01	0.03	0.06	0.12	0.21	0.33	0.45
x	10	11	12	13	14	15	16
	0.58	0.70	0.80	0.87	0.92	0.96	0.98

- (d) (2 points) Determine whether the model is valid for each portfolio by conducting one-sided frequency tests. Show your work.
- (e) (1 point)
- (i) Identify a limitation of the validation test used above.
- (ii) Recommend an alternative test.

6. (6 points)

(a) (1 point) Describe the three types of real options that occur in capital budgeting.

Your company has just committed to invest in a 3-year project.

- Initial investment = \$10,000
- Each year the project's end of year cash flows have a 50% probability of being either \$2,000 or \$6,000.
- Assume the cost of capital is 14%.

(b) (1 point) Evaluate the decision made to invest in the project based on NPV analysis. Show your work.

Assume at the end of the first year, your company will know whether the project is a success (cash flow will always be \$6,000) or a failure (cash flow will always be \$2,000). At that time, your company has the option to abandon the project and receive its salvage value.

(c) (2 points) Determine the salvage value at the end of the first year that will set the value of the option to abandon to be zero. Show your work.

If the first project is a success, your company has a 70% chance of investing in an additional similar project. If the first project is a failure, your company has only a 20% chance of investing in a second project. Assume your company has invested in a second project.

(d) (2 points) Calculate the probability that your company's first project was a success. Show your work.

7. (9 points) Tulip, Inc. has 10 million shares outstanding with a current share price of \$25. Tulip has no debt outstanding and \$30 million in excess cash.

(a) (1 point) Describe two agency costs of retaining cash.

Tulip plans to distribute \$30 million to its shareholders via either a one-time dividend or share repurchase.

(b) (2 points)

(i) Calculate Tulip's share price following implementation of each payout strategy.

(ii) Determine which payout strategy is optimal in the perfect capital market conditions of Modigliani-Miller.

Butch is a long-term Tulip shareholder whose dividends are taxed at 35% and whose capital gains are taxed at 15%.

(c) (2 points)

(i) Determine which payout strategy Butch would prefer. Support your answer.

(ii) Determine which payout strategy Butch would prefer if his dividend tax rate is the same as his capital gains tax rate. Support your answer.

Tulip's management believes that its shares are underpriced and that the true value of the company is \$270 million.

(d) (1 point) Describe how Tulip's management, acting in the interests of its long-term shareholders, would use its proposed \$30 million payout to signal this information to the market.

Assume the company repurchases \$30 million worth of shares. Afterwards, investors revise their opinion to agree with management's valuation of the company.

(e) (3 points)

(i) Calculate Tulip's new share price.

(ii) Calculate the amount gained by Tulip's remaining shareholders due to the share repurchase.

- 8.** (7 points) Golden Carrot Asset Management LLC (“GCAM”) has recently hired you to manage the hedging strategy of its equity portfolio. GCAM’s equity hedge primarily consists of standard European options.

Geometric Brownian motion is used to model stock prices.

- (a) (2 points) Describe four hedging parameters (i.e. Greeks) that provide information on the sensitivity of the portfolio.
- (b) (2 points)
- (i) Describe two major assumptions of geometric Brownian motion that violate actual stock price dynamics.
 - (ii) Explain why practitioners still use the Black-Scholes framework given the limitations noted in part (i).

GCAM’s CIO has requested a meeting with you to discuss changing GCAM’s hedge positions from European options to options that are path-dependent.

- (c) (1 point) Describe two methods of valuing path-dependent options.
- (d) (2 points) Compare and contrast the methods to calculate VaR for standard European options and path-dependent options.

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

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