Exam CFEFD

Date: Friday, October 27, 2023

INSTRUCTIONS TO CANDIDATES

General Instructions

1. This examination has 9 questions numbered 1 through 9 with a total of 70 points.

   The points for each question are indicated at the beginning of the question. Questions 2-4, and 8 pertain to the Case Study.

2. 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 provided in this document.

Written-Answer Instructions

1. Each question part or subpart should be answered either in the Word document or the Excel file as directed. Graders will only look at work in the indicated file.

   a) In the Word document, answers should be entered in the box marked ANSWER. The box will expand as lines of text are added. There is no need to use special characters or subscripts (though they may be used). For example, β_1 can be typed as beta_1 (and ^ used to indicate a superscript).

   b) In the Excel document formulas should be entered. Performing calculations on scratch paper or with a calculator and then entering the answer in the cell will not earn full credit. Formatting of cells or rounding is not required for credit.

   c) Individual exams may provide additional directions that apply throughout the exam or to individual items.

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

3. Prior to uploading your Word and Excel files, each file should be saved and renamed with your five-digit candidate number in the filename.

4. The Word and Excel files that contain your answers must be uploaded before time expires.

Navigation Instructions

Open the Navigation Pane to jump to questions.

Press Ctrl+F, or click View > Navigation Pane:
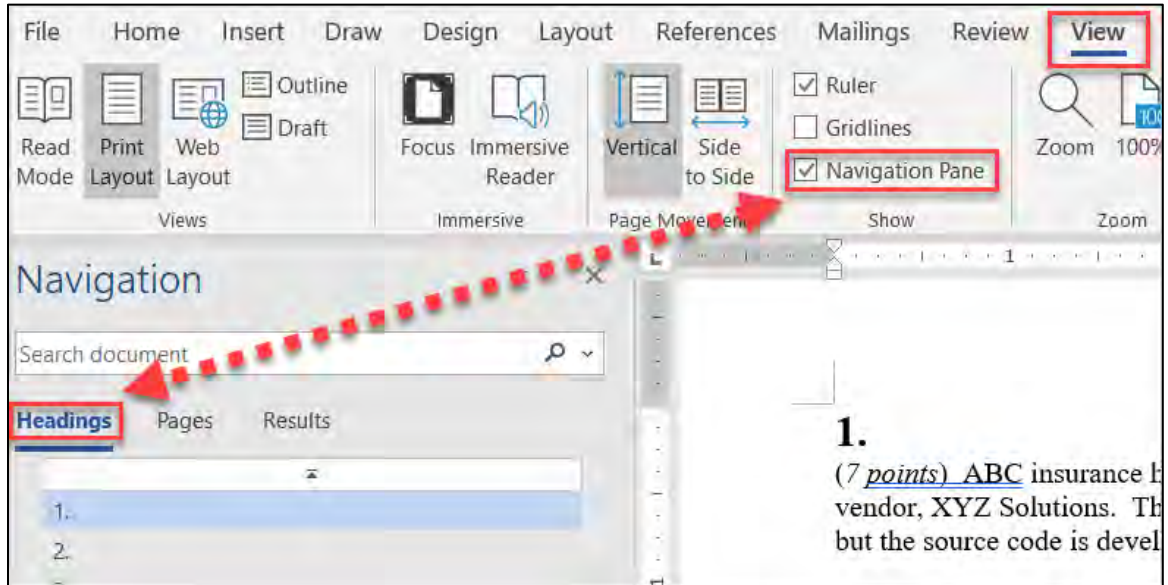
CASE STUDY INSTRUCTIONS

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.

1.

(*8 points*) CBA Insurance's Chief Risk Officer (CRO) is interested in understanding CBA's risk exposure, the company's financial breaking point, and the impact of a worst-case scenario. You have been tasked with using stress testing on CBA's financial model to address the CRO's concerns.

(a)   (*2 points*) Describe two benefits and two difficulties of stress testing.

> ANSWER:

(b)   (*1 point*) Recommend a specific stress-testing approach that addresses the CRO's concerns. Justify your recommendation.

> ANSWER:

Your manager has recommended the use of Value at Risk (VaR) as opposed to stress testing to gauge the risks to the company in crisis situations.

(c)   (*2 points*) Evaluate your manager's recommendation.

> ANSWER:

1. Continued

At a later date, you are tasked with conducting a Basic Frequency Backtest of the financial model's daily end-of-day Profit and Loss. The results of the Backtest are below.

Number of Days in Period	600
Number of Observations with Profits above the Upper Risk Bound (VaR at the 5% confidence level)	36
Number of Observations with Losses below the Lower Risk Bound (VaR at the 95% confidence level)	40

(d) (*3 points*)

(i) Describe one advantage and one disadvantage of a Basic Frequency Backtest.

ANSWER:

(ii) Interpret the results of the Backtest from the table above.

The response for this part is to be provided in the Excel spreadsheet.

2.

(*8 points*) You are a consultant engaged by Blue Jay Air (BJA) to advise on its international expansion strategy. Since the separation of BJA from RPPC, BJA has pursued ambitious growth opportunities. (Case Study section 2.7)

Based on the research from your team, the median debt-to-equity ratio in the airline industry is 5.5x.

(a)   (*3 points*)

   (i)   Calculate BJA's net debt-to-value ratio over the last three years. Show your work.

   The response for this part is to be provided in the Excel spreadsheet.

   (ii)   Describe the evolution of BJA's capital structure over the last three years. Support your answer by referring to the financial statements.

   The response for this part is to be provided in the Excel spreadsheet.

BJA's Finance Team has updated their previous analysis for the two alternatives to support the international expansion project:

   • Purchase the international plane fleet
   • Upgrade the existing plane fleet for international travel

BJA needs an independent review of its capital budgeting model in order to secure a fixed debt financing agreement to support the international expansion project. The model calculates a net present value using the companywide cost of capital and the expected free cash flows of each alternative. Refer to tab Q2_b in the Excel spreadsheet for BJA's capital budgeting model.

(b)   (*1.5 points*) Critique the Finance Team's capital budgeting model, assuming that the expected free cash flows are accurately forecasted.

   The response for this part is to be provided in the Excel spreadsheet.

2. **Continued**

In a recent meeting with the Finance team, Elmer Saunders, the Corporate Treasurer, argued:

> *"I don't think it's worth exploring other capital budgeting methods. We have worked hard to develop a state-of-the-art model to forecast projected free cash flow… anyway, any capital budgeting method should ultimately produce the same estimate of the project's value… there's no point in spending more time with other methods just to get back to the same results, purchasing a new fleet for international flights has the highest NPV, it is the way to go!"*

(c)   (*3.5 points*)

(i)   Evaluate Elmer's argument.

ANSWER:

(ii)   Recommend a capital budgeting method for the international expansion strategy. Justify your recommendation.

ANSWER:

3.

(*7 points*) You are asked to analyze Big Ben Bank's financial statements. (Case Study section 5)

(a)   (*1 point*) List four insights financial ratio analysis can provide about a company.

> ANSWER:

(b)   (*2 points*) Calculate the following financial ratios for Big Ben Bank for the years 2021 and 2022. Show your work.

    (i)   ROA

> *The response for this part is to be provided in the Excel spreadsheet.*

    (ii)   Leverage Ratio

> *The response for this part is to be provided in the Excel spreadsheet.*

    (iii)   ROE

> *The response for this part is to be provided in the Excel spreadsheet.*

Big Ben Bank is considering making changes to its use of leverage in the future.

(c)   (*4 points*) Recommend a leverage ratio range for Big Ben Bank to target in the future, assuming no change in the current economic environment. J ustify your recommendation.

> ANSWER:

4.

(*12 points*) Star InsurTech (SIT) is reviewing the interaction and risks of its Life and P&C business units. (Case Study section 9.3)

Karen Stat, the actuary for SIT, has put together an ERM dashboard to monitor the risk exposures.

(a)   (*6 points*)

(i)   Describe three key questions applicable to SIT that the ERM dashboard should address. Justify your response using the Case Study.

ANSWER:

(ii)   Recommend three Key Risk Indicators (KRIs) that are specific to SIT. Justify your answer.

ANSWER:

Based on information from the ERM dashboard, Karen is concerned about costs. She considers implementing an Activity Based Cost (ABC) system at SIT.

(b)   (*3 points*)

(i)   Describe the three key stages in the implementation of an ABC system.

ANSWER:

(ii)   Explain, using two specific examples from the Case Study, how ABC implementation considerations for the Life Insurance partner differ from those for the P&C partner.

ANSWER:

4. Continued

Advancing digital innovations is important to SIT's new business sales. SIT has implemented three improvements to the IT systems in its Life business and one improvement to the IT systems in its P&C business, for a total overhead cost of $100,000. SIT needs to allocate the overhead to each business unit using the following information provided.

	# Policies Sold	Labor Hours per Policy	Number of IT improvements
Life	100	6	3
P&C	500	3	1

(c)   (*3 points*)

    (i)   Calculate the overhead allocation to each business unit (Life and P&C) using the traditional costing method. Show your work.

> *The response for this part is to be provided in the Excel spreadsheet.*

    (ii)   Calculate the overhead allocation to each business unit (Life and P&C)) using the ABC method. Show your work.

> *The response for this part is to be provided in the Excel spreadsheet.*

    (iii)   Recommend which overhead allocation method SIT should use. Justify your answer using the results from (i) and (ii) above.

> *The response for this part is to be provided in the Excel spreadsheet.*

5.

(*7 points*) Company XYZ Life has formed a task force to explore key success and risk factors for implementing blockchain technology in operational areas. A member of the task force proposes that XYZ purchase Dai stablecoins on a centralized exchange to gain a working knowledge of blockchain technology.

(a)   (*2 points*) Critique the following statements that the member of the task force makes.

   (i)   A Dai stablecoin is a safe investment because it is "stable."

ANSWER:

   (ii)   A centralized exchange is more user-friendly than a decentralized exchange.

ANSWER:

   (iii)   A centralized exchange does not use custodial trading, and, therefore, there is less trust required.

ANSWER:

The task force is trying to more broadly understand decentralized insurance.

(b)   (*2 points*) Describe two ways a smart contract supports the ideals of decentralized insurance.

ANSWER:

5. **Continued**

The task force is considering implementing blockchain technology in two operational areas, underwriting and claims processing. It develops a proposal for doing so, as follows:

- Term insurance policies are written as smart contracts.
- The smart contract instruction set determines underwriting and pricing for a potential policyholder.
- Once approved, the smart contract creates an unchangeable policyholder record that can immediately pay out legitimate claims based on a death certificate verification.
- If a claim is deemed false, the smart contract dissolves.

(c)   (*3 points*) Describe two benefits and two risks of the proposal.

> ANSWER:

6.

(*8 points*) Conglomerate Holdings, a US multinational organization has a wholly owned subsidiary, Sunshine Sprockets, established Jan 1, 2022, in the Sunshine Islands, a tax-free zone. The Sunshine Islands currency is the Shinee, Š.

Sunshine Sprockets had considered taking out long-term debt of Š20M to purchase the plant and equipment needed for manufacturing, but to minimize initial capital outlays and avoid debt, Conglomerate Holdings and Sunshine Sprockets decided to lease the plant and equipment.

While the Sunshine Islands had been financially stable until recently, inflationary pressures have become substantial in 2022, and the country is experiencing hyperinflation.

All components of Sunshine Sprockets' assets and liabilities at year-end 2022 are in Š (shown in 000's below).

	2022
Assets	
Cash / Short Term Investments	3,000
Inventory	3,000
Accounts Receivable	4,000
Total Assets	**10,000**
Liabilities & equity	
Accounts Payable	2,000
Total Liabilities	**2,000**
Capital Stock	7,000
Retained Earnings	1,000
Total Equity	**8,000**
Total Liabilities & Equity	**10,000**

Date	$US per Š
Jan 1, 2022	0.90
Average 2022	0.65
Weighted avg when non-monetary assets/liabilities were acquired	0.50
December 15, 2022 when dividends were declared	0.45
December 31,2022	0.45

6. Continued

(a)   (*2 points*)

   (i)   Describe the method Conglomerate Holdings should adopt to translate the company's financial statements into $US.

ANSWER:

   (ii)   Prepare the 2022 balance sheet under US GAAP according to the method described in (i). Show your work.

The response for this part is to be provided in the Excel spreadsheet.

(b)   (*1.5 points*)

   (i)   Describe Sunshine Sprockets' net monetary exposure.

ANSWER:

   (ii)   Explain the impact of the net monetary exposure during this period of hyperinflation to Sunshine Sprockets.

ANSWER:

(c)   (*2.5 points*) Analyze how using Shinee-denominated long-term debt to fund the purchase of Sunshine Sprockets' plant and equipment would have impacted the translation of the company's equity at the end of the year, assuming no depreciation. Show your work.

The response for this part is to be provided in the Excel spreadsheet.

(d)   (*2 points*) Recommend two actions, in addition to having borrowed to purchase plant and equipment, that Sunshine Sprockets could have taken to reduce the negative impact of hyperinflation on Sunshine Sprockets' value to Conglomerate Holdings. Justify your recommendation.

ANSWER:

7.

(*5 points*) Company XYZ has recently implemented a new predictive model, which is designed to better predict lapse behavior of policyholders.

(a)   (*1 point*) Define the following terms:

    I.   Descriptive features

    II.   Prediction subject

ANSWER:

You are asked to review the new model's performance. A table containing the predicted results in the last month is provided below.

		Prediction	
		Lapse	Do not lapse
Target	Lapse	5,445	433
	Do not lapse	907	17,899

(b)   (*2 points*)

    (i)   Calculate the precision and recall based on the table provided. Show your work.

The response for this part is to be provided in the Excel spreadsheet.

    (ii)   Evaluate the model performance. Justify your answers.

The response for this part is to be provided in the Excel spreadsheet.

7. **Continued**

Senior management is concerned about how stable this model would be over a long period of time.

(c)   (*2 points*)

(i)   Assess the reliability of a predictive model over time.

ANSWER:

(ii)   Propose two ways to address the concern from senior management.

ANSWER:

8.

(*8 points*) Julia Reich, RPPC's new Chief Risk Officer, is learning more about Darwin (Case Study section 6). She has no background in insurance accounting or reserving methodologies.

(a)   (*1.5 points*)

(i)   Define redundant reserves.

ANSWER:

(ii)   Explain why some of Darwin's products may have redundant reserves.

ANSWER:

Julia is particularly interested in the term portfolio and wants to understand more about captive reinsurers.

(b)   (*2 points*) Explain two pros and two cons associated with using a captive reinsurer.

ANSWER:

8. **Continued**

In reviewing Darwin's term portfolio Alexis Marino, Darwin's Chief Financial Officer, forwarded you the following email draft:

> "In my review of the term product portfolio, I have estimated that economic reserves are approximately 50% of statutory reserves. Based on recent transactions from our competitors, a reinsurer might be prepared to pay 15% in excess of the statutory reserves to assume the block. As I've observed for years, Darwin is very secure, its businesses are very stable, and there are opportunities for growth in other areas of the company.

As a result, I recommend the following:

- Darwin should use reinsurance to support its future growth.
- Darwin should consider exploring traditional or financial reinsurance for the inforce term block."

(c)   (*3 points*)

(i)   Describe how you would calculate the value of each capital tranche of Darwin's term business.

ANSWER:

(ii)   Describe two different ways that a reinsurer might be willing to provide capital support.

ANSWER:

8. Continued

(d) (*1.5 points*)

    (i) Compare and contrast the following two approaches from Alexis's message:

        I. Traditional reinsurance

        II. Financial reinsurance

ANSWER:

    (ii) Recommend the best approach given Alexis's view of the company. Justify your recommendation.

ANSWER:

9.

(*7 points*) ABC Life wants to determine VaR and CTE using nested stochastic modeling of a new structured liability driven by equity market exposure represented by the random variable X.

- The modeling R&D department developed an approach where for each outer scenario, a computation $g(X[t])$ must be performed to determine the market value of the liability at time t years in the future.
- Each calculation of g is done over 200 risk-neutral scenarios of $X[t]$, where g is a decreasing function of $X[t]$.
- The interest rate for the period is $y(t)$ which is a continuously compounded rate, with its equivalent annual effective rate of $r(t)$
- 10,000 outer scenarios are generated for the variable X i.e., $X[t; 1], \cdots, X[t; 10,000]$
- Consider the values of the X_t in increasing order (order statistics) as $X[t; (1)] \leq X[t; (2)] \leq \cdots \leq X[t; (10,000)]$

(a)   (*1 point*) Write an expression for the value of the liability at time zero in terms of $y(t)$ and $X[t]$.

> ANSWER:

(b)   (*2 points*)

(i)   Explain how VaR99 can be calculated by computing g for fewer than 10,000 outer scenarios of $X[t]$.

> ANSWER:

(ii)   Determine the minimum total inner scenario computations needed to determine VaR99.

> ANSWER:

9. Continued

Below is a generalized expression for CTE99 of the time zero liability in terms of the order statistics of X[t; (j)], $1 \leq j \leq 10{,}000$:

$$CTE99 := \frac{A}{B} \sum_{1 \leq j \leq B} C$$

(c) (*1.5 points*)

    (i) Determine a function for A.

> ANSWER:

    (ii) Determine the value of B.

> ANSWER:

    (iii) Determine a function for C.

> ANSWER:

(d) (*1.5 points*) Determine how many computations are required for computing CTE99 given that g is a decreasing function of X[t].

> ANSWER:

After building the above nested stochastic model, your intern produced the following results below for your review:

Metric	Value (in M)
VaR 99	134
CTE 99	120

(e) (*1 point*) Evaluate the validity of these results.

> ANSWER:

END OF EXAMINATION