Exam QFIIRM

Date: Friday, November 4, 2022

INSTRUCTIONS TO CANDIDATES

General Instructions

1. This examination has 6 questions numbered 1 through 6 with a total of 40 points.

   The points for each question are indicated at the beginning of the question.

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 the five-minute upload period expires.

Navigation Instructions

Open the Navigation Pane to jump to questions.

Press Ctrl+F, or click View > Navigation Pane:
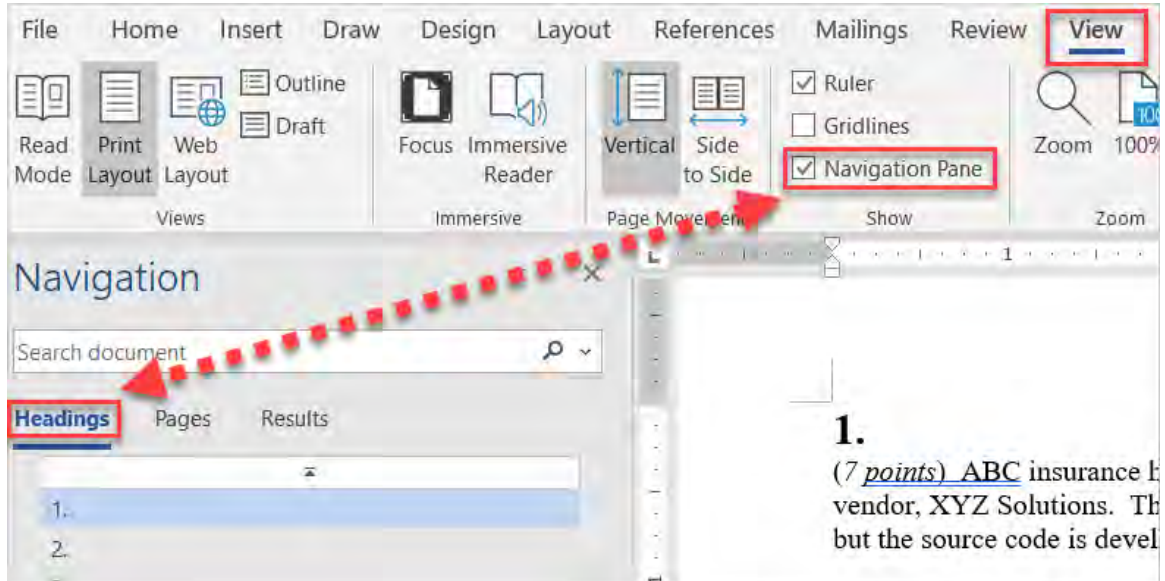
1.

(*7 points*) You work at XYZ insurance company, and they have recently launched an indexed annuity product. Policyholders can choose between one of two indices to link to their product: Index A or Index B. You have been assigned with evaluating the tail risks associated with this product.

In order to measure the concordance between the two indices, you look at the average index price each year over the past 15 years. The sum of the signs over each possible distinct value of i and j > i is 75.

$$\sum_{i=1}^{n-1} \sum_{j=i+1}^{n} sign((A_i - A_j)(B_i - B_j)) = 75$$

(a)   (*0.5 point*) Calculate the sample estimate of Tau for the dataset.

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

The Vice President (VP) of Investments uses 20 years of historical data and calculates Tau to be 0.50.

(b)   (*1.5 points*)

   (i)   Interpret the difference between your estimate for tau and the VP's estimate after their addition of 5 years to the data set.

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

   (ii)   Calculate Theta using the Gumbel copula and the VP's recommended Tau.

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

1. Continued

XYZ's management is concerned about the tail risk of this product line. They have asked you to evaluate the CTE(80) of the Indexed Annuity product using the historical return/loss statistics provided in the table below.

	Index A	Index B
Expected Return	7.5%	9.5%
Standard Deviation	15%	20%
Index Loss	500	375
Joint Loss	1035	

Gumbel Copula, where $\theta = 2$:

$$C(u, v) = e^{-((- \log(u))^\theta + (- \log(v))^\theta)^{\left(\frac{1}{\theta}\right)}}$$

(c)   (*2 points*)

   (i)   Calculate the probability that both Index A and B are negative using the Gumbel copula.

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

   (ii)   Calculate CTE(80) for Index A and B.

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

1. Continued

The VP of investments was satisfied with the results of your tail risk analysis. He is now interested in monitoring these risks on a daily basis and has tasked you alone with developing an infrastructure to automate the above calculations.

The VP is excited by the amount of time he will save reviewing results because the analysis will be automated. This new project requires more advanced programming and database skills than you or the VP currently possess. Due to the increased workload, you won't have time for detailed documentation.

(d)   (*1.5 points*) Describe three operational risks that could arise in this situation, based on *The Top Ten Operational Risks.*

> ANSWER:

(e)   (*1.5 points*) Recommend two ways to mitigate each of the three operational risks described above.

> ANSWER:

2.

(*6 points*) You have been working at FND Asset Management for five years and have recently transferred from risk management to asset valuation. You are hoping to apply what you've learned in risk management to your new role.

(a) (*1 point*) List the ten commandments of operational due diligence.

> ANSWER:

While getting acquainted with the models and past results, you observe some historical reported figures that you cannot reconcile with the historical model output. You bring this up with your manager Suzy, Head of Valuation. Suzy cannot reconcile or otherwise explain the difference between modeled and reported results. Suzy has been in her role for one year, and reports to Tim, Head of Sales.

(b) (*1.5 points*) Describe three violations of the commandments given this situation.

> ANSWER:

Suzy schedules a meeting with you and invites Tim. During the meeting, Tim explains that the discrepancy was the result of a trader who falsified certain valuation records in order to avoid a poor performance review and demotion. He is confident risks of such an event occurring again have been adequately reduced, given the following changes:

1. Executive leadership now regularly stress the importance of integrity and accuracy in keeping records

2. Regulators have increased the frequency and documentation requirements of audits

(c) (*1.5 points*)

(i) Evaluate the effectiveness of each change in reducing the risk of similar events happening in the future.

> ANSWER:

(ii) Recommend an additional action FND can take to reduce risks around trader behavior.

> ANSWER:

2. **Continued**

Recognizing your experience in risk management, Tim comes to you to assess some aspects of FND's client fee and disclosure practices. In particular he is concerned about the following:

1. Certain high-frequency strategies generate large numbers of trades, and correspondingly high brokerage commissions; these are charged directly to client accounts.

2. FND's preferred brokerage provides FND with its fund reporting software due to the volume of trades it provides. It allocates the value of these services to client accounts based on their assets under management (AUM).

3. Fees are fully disclosed upon request of the client.

4. Access to IPOs is made available on a pro-rata basis to all client accounts.

(d)   (*2 points*)

(i)   Assess whether each practice above aligns with the duties FND has as a fiduciary.

ANSWER:

(ii)   Recommend any necessary changes for those that do not.

ANSWER:

3.

(*8 points*) Simple Life Insurance Company is a large life insurance company that is currently measuring asset risks associated with its pension fund. In addition, the company is evaluating various risk measures to assess its operational risks.

(a)   (*0.5 point*) Define the following risks:

- Policy-mix risk
- Active-management risk

ANSWER:

Simple Life Insurance Company has two fund managers, Jane and Dave, who manage its pension fund of $700 million. You are given the following information regarding the current fund allocation and the fund manager's portfolio volatility. The two fund managers run portfolios with a correlation of 0.34 with each other.

	Current allocation ($ million)	Volatility
Jane	$350	13%
Dave	$350	13%

(b)   (*1 point*) Calculate the pension fund's risk budget using VaR at the 99% confidence level.

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

Simple Life Insurance Company wants to allocate the $700 million in a way that maximize the information ratio of the fund subject to an overall volatility of tracking error (TEV) of 4 percent. To achieve an exact TEV of 4 percent, some residual investment is needed in the benchmark, which has a TEV of zero. The portfolio is expected to return 2.9 percent. The two fund managers' performance is listed below.

	Current allocation ($ million)	Volatility (TEV)	Information Ratio
Jane	$350	6.0%	0.60
Dave	$350	6.0%	0.40
Index	None	0.0%	0.00

3. **Continued**

(c) (*2 points*)

(i) Assess the current allocation of the pension fund.

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

(ii) Calculate the optimal allocation.

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

(d) (*1.5 points*)

(i) Identify one coherent criterion that VaR does not satisfy.

ANSWER:

(ii) Explain why the coherent criterion in (i) is a desirable characteristic for an economic capital risk measure.

ANSWER:

Simple Life Insurance Company uses the following loss distribution in setting up economic capital for its operational risk:

L = 0 million, with probably of 0.4
L = 50 million, with probably of 0.56
L = U with probability of 0.04

Where U is a random variable uniformly distributed on the interval (50, 200)

(e) (*1 point*) Calculate the 95% Expected Shortfall

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

Simple Life Insurance Company realizes that operational risk is hard to quantify and wants to explore scenario analysis to better plan for the effect of this risk related to COVID-19 pandemic.

3. **Continued**

(f) (*2 points*)

(i) List the three considerations recommended from IAA Note on Stress Testing and Scenario Analysis in formulating a scenario.

ANSWER:

(ii) Describe how Simple Life should apply the three considerations in formulating a scenario.

ANSWER:

4.

(*7 points*) A local farm bureau contacts you to evaluate its means of managing credit risk via marking to market and to assess its investment portfolio.

(a)   (*1 point*) Describe four ways to manage credit risk other than marking to market.

ANSWER:

The bureau has a minimum acceptable return of 4.5% per year, and the risk-free rate is 1% per year. Consider the following historical data for a prospective investment, Investment A.

	Yr1	Yr2	Yr3	Yr4
Annual Return	12%	-2%	-3%	12%

(b)   (*2.5 points*)

    (i)   Compare and contrast the Sharpe and Sortino ratios.

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

    (ii)   Calculate the Sharpe and Sortino ratios for Investment A.

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

The other investment under consideration is Investment B, which has the following characteristics:

Sharpe Ratio	0.4
Sortino Ratio	1.2

(c)   (*1 point*) Recommend Investment A or B for the farm bureau.

ANSWER:

4.   Continued

The farm bureau also invested in another strategy that utilizes options, where the returns are as follows:

	Yr1	Yr2	Yr3	Yr4
Annual Return	10%	-3%	-4%	9%

(d)   (*1.5 points*)

(i)   Explain why RoMAD would be preferable to the Sharpe or Sortino ratio for this investment.

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

(ii)   Calculate RoMAD over the four-year period.

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

The bureau currently allocates capital based entirely on VaR positions and conducts business in the highly regulated banking industry.

(e)   (*1 point*)

(i)   Critique the client's current capital allocation strategy.

ANSWER:

(ii)   Recommend changes to the capital allocation strategy, if needed.

ANSWER:

5.

(*5 points*) You work as an investment advisor for high-net-worth individuals. You meet with Rami, a VP of marketing at a nation fast food chain. Rami is planning to retire in five years and has engaged you to review the adequacy of his current portfolio.

(a)   (*1.5 points*) Provide six additional pieces of information you need to assess the adequacy of any investment strategy for Rami.

> ANSWER:

During this meeting, Rami provides you with projected returns for corporate bonds and private equity. You also obtain the following information from Rami:

- The projected returns come from Rami's sister, also a financial advisor to high-net-worth individuals, but he cannot disclose any of the underlying assumptions.
- A public research firm recently projected Rami's employer should expect a significant increase in profit from a product to be launched in 2023.
- Rami believes that regulations in Country X are excessive and depress corporate performance as compared with other countries

Based on this information, Rami directs you to do the following:

1. Invest a modest amount of his portfolio in Rami's employer's stock

2. Use the provided return projections to determine the optimal asset allocation

3. Avoid investments based in Country X

(b)   (*2 points*)

(i)   List the four ethical principles that guide your role as Rami's investment advisor.

> ANSWER:

(ii)   Explain whether each point of Rami's direction is acceptable given these principles.

> ANSWER:

5. **Continued**

You are made aware of a recently launched fund that includes investment grade collateralized debt obligations (CDO). Based on your analysis of the fund's prospectus, your knowledge of the managing firm, and your Rami's investment objectives, you believe it would be a positive addition to his portfolio. While you understand the overall strategy of the fund, you cannot fully explain the structure of the CDOs involved.

(c)   (*1.5 points*) Determine how to proceed and whether to recommend the CDO fund to Rami. Justify your response.

> ANSWER:

6.

(*7 points*) ABC Hobby Shop specializes in selling collectible trading cards and is considering hiring you as a risk management consultant. To explain the relevance of risk management, you present case studies of Barings Bank and Long-Term Capital Management (LTCM).

(a)   (*1.5 points*)

     (i)   Describe two risks overlooked in both the Barings and LTCM cases.

> ANSWER:

     (ii)   Identify one risk that is unique to each case.

> ANSWER:

ABC has a simple business model for this relatively stable market, and there is a fixed budget available for risk identification.

(b)   (*2 points*)

     (i)   Define the four modes of environmental scanning.

> ANSWER:

     (ii)   Explain which of these modes of environmental scanning is least appropriate for ABC.

> ANSWER:

6. Continued

After identifying risks via the environmental scanning process, you begin to explore some risk assessment tools.

(c) (*1.5 points*)

(i) Compare and contrast a risk map and risk timing map.

ANSWER:

(ii) Describe what is unique about an influence matrix compared to a risk map.

ANSWER:

ABC chooses to use an influence matrix, which appears below. Given that ABC sells physical trading cards that vary in popularity over time, the risks contained in the influence matrix are: Consumer Preferences, Competition, and Fire.

	Risk 1	Risk 2	Risk 3
Risk 1	-	1	0
Risk 2	2	-	0
Risk 3	0	0	-

(d) (*2 points*)

(i) Identify which risk corresponds to each of Risk 1, Risk 2, and Risk 3 in the influence matrix. Justify your response.

ANSWER:

(ii) Recommend a strategy to mitigate the risk with the lowest passive score.

ANSWER:

END OF EXAMINATION