QFI IRM Model Solutions
Spring 2021

1.

Learning Objectives:
1. The candidate will understand the value of governance and its key elements in general and in the context of an investment operation.

2. The candidate will understand and be able to apply the components of an effective risk management system.

3. Understand and be able to apply different approaches to measuring risk exposures.

Learning Outcomes:
(1b) Identify sources of unethical conduct and explain the role of a fiduciary.

(1f) Demonstrate understanding of how ethics relates to business decision-making, and relate ethics in business to personal ethics.

(2b) Identify and describe the various kinds of risks, including market, credit, operational, etc.

(2c) Identify and describe various approaches for managing risks including risk budgeting, position limits, etc.

(3a) Explain the advantages and limitations of different risk metrics

Sources:
Chapter 9 of "Managing Investment Portfolios, Section 6", Maginn & Tuttle (pg. 633)

Chapter 17 of "VAR and Risk Budgeting Risk Management", Jorion (pg. 443-444)

Chapter 8 of "Financial Enterprise Risk Management", Sweeting (pg. 107)

Chapter 2 of "Quantitative ERM: Risk Taxonomy", Hardy & Saunders (pg. 47-49, 56)

Chapter 3 of "Investment Ethics", Peck (pg. 71-73)

Commentary on Question:
This question asked the candidate to perform simple risk budgeting calculations and to provide some short descriptions/assessments of risk metrics, non-financial risks, and ethical behavior pertaining to investment management.

1. Continued

Solution:

(a) You are a portfolio manager for a large, well-diversified pension plan with $1 Billion assets under management. You recently read the following statements in a research report on portfolio management:

- The Sortino ratio measures a portfolio's return in excess of a target return, taken as a percentage of the downside deviation.
- Sortino ratio does not penalize a portfolio manager for volatility from positive performance.
- The Sortino ratio addresses the non-normality issues associated with the Sharpe ratio.
- If the target return is the risk-free rate, the Sortino ratio equals the Sharpe ratio.

Assess the validity of each of the four statements.

Commentary on Question:
Candidates performed well on this question. Some candidates did not explain why statements were false and did not receive full credit.

The first bullet is correct. The Sortino ratio measure's a portfolio's return in excess of a target return, taken as a percentage of the downside deviation.

The second bullet is correct. The Sortino ratio does not penalize a portfolio manager for volatility from positive performance as it only considers downside deviation.

The third bullet is not correct. The Sortino ratio has the same non-normality issues associated with the Sharpe ratio.

The fourth bullet is incorrect. Even if the target return is the risk-free rate, the denominator of the Sortino ratio uses downside deviation while the denominator of the Sharpe ratio uses standard deviation.

(b)

(i) Determine the impact that this proposed change has on the risk budget diversification level, assuming asset returns are normally distributed.

(ii) Assess whether the proposed change achieves your objective to improve diversification benefits.

1. Continued

Commentary on Question:
Candidate performance was fair on this question. Many candidates did not demonstrate an understanding of risk budget, VaR and diversification in relation to one another.

(i) Impact

• Current Diversification Level = Σ(Original Asset VaRs) – Portfolio VaR
$$= (99 + 115 + 56) - 210 = 270 - 210 = \textbf{60 M}.$$

• Since all risk budgets are specified at 99% confidence level, $\alpha = 2.33$. Some candidates used Excel's *NORM.INV(0.99,0,1)* but most simply recalled the value.

• Proposed VaR for Equity = 2.33 x 250 x 18% = **104.85 M**
• Proposed VaR for Bonds = 2.33 x 450 x 9.5% = **99.6 M**

• Proposed Diversification Level = Σ(Proposed Asset VaRs) – Portfolio VaR
$$= (104.85 + 99.6 + 56) - 210 = 260 - 210 = \textbf{50 M}.$$

• Change in Diversification Level = 50 – 60 = **-10 M**

(ii) Assessment

• Since the proposal causes a reduction in diversification level, the objective is not met.

(c)

(i) Describe four key non-financial risks involved in investing in XYZ.

(ii) Assess XYZ's choice of mortality table for modeling its pension plans.

Commentary on Question:
Candidate performance was fair on this question. Many candidates either provided a list of risks without a connection to XYZ's position, or simply restated the given information. No credit was given for including Mortality or Pricing risk in part (i), since the focus is on non-financial risks, and furthermore this topic is covered in part (ii).

1. **Continued**

    (i)   <u>Describe …</u>

• Political Risk: The behavior of the leaders of Country A could lead to repercussions that may adversely impact operation and cashflow of the company. The media scrutiny could contribute to political instability, leading to logistical challenges and other problems for XYZ.

• Environmental Risk: The actions of Country C are likely related to the increased rates of flooding, which could prompt regulatory changes that prove costly to the company.

• Regulatory Risk: Since Country B's legislature may impose new rules addressing workers' rights and safety, the company could be responsible for higher operational costs.

• Legal risk: Workers in Country B might be emboldened by the current regulatory regime to bring forward lawsuits against XYZ for perceived deficiencies in safety protocols or other workers' rights.

    (ii)   <u>Assess</u>

It is inappropriate to apply XYZ's home country's mortality table to each of the foreign countries A, B, and C. The home country's table is unlikely to be representative of the actual mortality experienced in the other countries. There could be differences due to environment, local customs, etc. Using the same table could lead to mispricing of liabilities and/or insufficient reserving.

(d)

    (i)   Identify the investment tactic described above.

    (ii)   Describe the potential impact of this tactic on the portfolio.

    (iii)   Explain how your colleague's approach could be unethical.

Commentary on Question:
Candidate performance was fair on this question. Most candidates were able to identify leverage by name, but few candidates captured the impact on the portfolio and the reasons why the approach could be unethical.

    (i)   Leverage.

1. **Continued**

    (ii)   Leverage has the potential to magnify gains and losses on the portfolio above those which may arise in the absence of leverage. Leverage creates an opportunity for a manager to fare better than the client if magnified losses result in the client earning less in returns than they would pay to the manager in fees.

    (iii)   The approach could be unethical if your colleague fails to disclose hidden risks to the client. They also have a fiduciary duty to the client and must place the client's interest before their own.

2. **Learning Objectives:**
2. The candidate will understand and be able to apply the components of an effective risk management system.

3. Understand and be able to apply different approaches to measuring risk exposures.

Learning Outcomes:
(2f) Examine examples of risk management failure.

(3a) Explain the advantages and limitations of different risk metrics

(3b) Explain how different approaches and tests form a set of complementary investment risk metrics.

(3c) Analyze and evaluate risk aggregation techniques, including the use and misuse of correlation, integrated risk distributions and copulas.

(3d) Evaluate different measures of rare event risks.

(3e) Evaluate a company's or a portfolio's exposures to various risks.

Sources:
Quantitative Enterprise Risk Management, Hardy and Saunders, Ch. 10

Quantitative Enterprise Risk Management, Hardy and Saunders, Ch. 7

QFII-110-15: The Devil is in the Tails: Actuarial Mathematics and the Subprime Mortgage Crisis

Commentary on Question:
This question tested candidates' knowledge of various risk metrics, both qualitatively and quantitatively.

Solution:
(a)
  (i) Explain two limitations of using the Gaussian copula for risk management of CDOs.

  (ii) Describe an alternative approach to quantify the risk of a CDO portfolio using stress testing.

2.   Continued

Commentary on Question:
Candidates performed well on this part of the question. Most candidates provided at least two limitations with sufficient explanation to earn full credit. Some candidates defined a stress test as opposed to providing an alternative approach as the question requested and did not earn full credit.

(i)   Two limitations:
1. The Gaussian copula model exhibits no tail-dependence/default clustering; however, credit behavior of entities in CDOs can exhibit high tail dependence/default clustering.
2. Lack of modeling economic factors causing defaults weakens the ability to do stress testing.

(ii)   Calibrate to a copula with tail dependence (t-copula, etc.) and analyze tail values of the stress test.

(b)

(i)   Calculate the sample Spearman correlation coefficient.

(ii)   Calculate the concordance for the first pair (x_1, y_1).

(iii)   Assess your client's concern using the risk measures above. Justify your response.

Commentary on Question:
Candidate performance was fair on this question. Most candidates were able to calculate the Spearman correlation coefficient, however many candidates struggled to assess the client's concern using the risk measures.

(i)   Rank the values for x and y:

x_i^r	y_i^r
3	3
7	8
1	1
4	7
8	6
6	4
5	5
9	9
2	2

2. **Continued**

Calculate the sample Pearson calculation on the ranks:

$$\rho_s = \frac{1}{n-1}\sum_1^9 \frac{x_i^r - \overline{x^r}}{s_x} \times \frac{y_i - \overline{y^r}}{s_y} = .850$$

$$s_x = s_y = 2.738613$$

(ii)   Total concordance for the first pair can be found following the table below:

J	Rank(x)	Rank(y)	Sign(x1-xj)	Sign(y1-yj)	Sign $\prod(x_1 - x_j)(y_1 - yj)$
1	3	3	-	-	-
2	7	8	-1	-1	1
3	1	1	1	1	1
4	4	7	-1	-1	1
5	8	6	-1	-1	1
6	6	4	-1	-1	1
7	5	5	-1	-1	1
8	9	9	-1	-1	1
9	2	2	1	1	1
	Total Concordance				8

(iii)   The Pearson correlation coefficient measures the linear relationship between the losses, which can yield misleading dependency conclusions and is not appropriate to address the client's concerns. Spearman's correlation and Kendall's τ are rank correlation coefficients and better suited. They are both high, indicating high dependency and reinforcing the misleading potential of Pearson correlation which indicated a weak dependency. The high value of Kendall's τ from the sample suggests the losses are highly concordant, meaning large losses in one portfolio are associated with large losses in the other. Therefore, the client's concern is valid.

(c)

(i)   Explain two reasons why a firm would use a reverse stress test.

(ii)   Calculate the 95% CTE if an independence copula is used.

(iii)   Determine the smallest value of Kendall's τ such that the limit is breached.

2. **Continued**

Commentary on Question:
Candidates performed poorly on this question. Most candidates were able to describe reverse stress testing and appropriately explain at least one benefit. However, candidates performed poorly on the remainder of this part. Many candidates did not provide clear and logical work to support their answers.

(i)
    1. Working backwards from a stressed outcome to identify scenarios could reveal hidden vulnerabilities and key risks.
    2. Reverse stress testing can provide meaningful risk insights for portfolios with significant positions in new markets or instrument types which do not yet have historical periods of stress to use as references/benchmarks.

(ii)   Given an independence copula, the joint probability distribution is:

Loss (Millions)	Probability
$200 (Loss in Both Portfolios)	$1.83\% = 1/e^2 * 1/e^2$
$100 (Loss in One Portfolio Only)	$23.40\% = 1/e^2 * (1-1/e^2) * 2$
$0 (No Loss in Either Portfolio)	74.76%

95% CTE = Average loss above the 95th percentile
The 95th percentile is in the $100M loss probability mass.

95% CTE = [$200 * (1.83%) + $100 * (5% - 1.83%)] / 5% = **$137 Million**

(iii)   A CTE of $200M means losses in both portfolios simultaneously.
Solve for the joint probability of this occurrence to be at least 5%.
Probability[N<0, M<0] >= 5%
Copula[$1/e^2$, $1/e^2$] = EXP[-2 * 2^(1-τ)] >= 5%
τ >= 1 - LN[-1/2 * LN(5%)] / LN[2] = **0.41709**

3. **Learning Objectives:**
1. The candidate will understand the requirements and methods of governing investments.

2. The candidate will understand and be able to apply the components of an effective risk management system.

Learning Outcomes:
(1f)   Demonstrate understanding of how ethics relates to business decision-making, and relate ethics in business to personal ethics.

(2a)   Explain the importance of risk culture in an investment firm.

(2b)   Identify and describe the various kinds of risks, including market, credit, operational, etc.

(2c)   Identify and describe various approaches for managing risks including risk budgeting, position limits, etc.

(2d)   Explain the features of a best practices enterprise risk management system.

(2e)   Evaluate a company's risk management process.

(2f)   Examine examples of risk management failure.

Sources:
QFII-120-20: IAA Note on ERM for Capital and Solvency Purposes in the Insurance Industry, pp. 9-38

QFII-103-14: Advances in Risk Management and Risk Governance and Financial Enterprise Risk Management, Sweeting, Paul, 2nd Edition, 2017, Chapter 20

Investment Ethics Ch. 7

QFII-117-19: Chapter 7 of Strategic Risk Management Practice: How to Deal Effectively with Major Corporate Exposures, Andersen & Schroder (pp. 4-19)

3. **Continued**

Commentary on Question:
This question tested candidates' knowledge of ERM frameworks and examined ways to assess and interpret risk. Overall, candidates performed well on this question. Candidates had the most difficulty in the critique of the colleague's approach following the environmental scan in part (e).

Solution:
(a)   List three best practices in operating an effective risk committee.

       Commentary on Question:
       Candidates did well on this question. Some candidates listed the best practices of ERM framework instead of risk committee and hence did not receive full credit.

- Members have a diverse background
- Ensure that the Risk Committee "asks questions"
- Obtain support of the Board and management buy-in

(b)

       (i)   Identify four important qualities of a risk conscious culture.

       (ii)   Explain how two of the qualities identified were lacking in the Space Shuttle Challenger case study.

       Commentary on Question:
       Candidate performance was fair on this question. Most candidates were able to list the qualities of risk conscious culture, but some failed to link the qualities to the Challenger case study.

       (i)
- Employee are educated on their role in risk awareness and management
- Clear policies and procedures are in place
- Risks are well-understood
- Risk tolerances are established and tracked

       (ii)
- Quality 2: The definition of failure was flawed, where components not behaving as designed was not deemed a failure if the behavior did not cause an accident.
- Quality 3: NASA management did not understand the risks associated with the o-rings

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3. Continued

(c)   Recommend whether the Board should include this candidate on its risk committee. Justify your response.

Commentary on Question:
Most candidates did well on this question. Candidates need to provide both a recommendation and justification for full credit.

Recommendation:

Do not add this candidate to the risk committee

Rationale:

Although she has useful qualifications (outside director and industry experience), she might be influenced by her friendship with CEO and thus be less objective.

(d)

   (i)   Critique the previous CRO's approach to the environmental scan.

   (ii)   Recommend two ways to expand upon this scan for scenario planning.

Commentary on Question:
Candidates exhibited a fair performance on this part of the question. Most candidates failed to identify the CRO's approach as formal search. Also, most candidates identified pros and cons of Survey instead of criticizing the scanning approach.

(i)
- Previous CRO's approach was formal search
- It can miss important risks due to the narrow nature of a predefined list.
- Surveying only management, which limits perspective

(ii)
- Include some undirected viewing to identify new risks and trends
- Survey employees on the front lines, suppliers and customers

3. Continued

(e)

    (i)   Critique your colleague's approach.

    Commentary on Question:
Candidates performed relatively poorly on this part. Most candidates received partial credit if they were able to state that Product Design, Market Demand and Laws/Regulations have same impact on Production Capability. However, most candidates failed to identify the best solution is to take a direct approach given the relatively low passive score for Production Capability.

- A direct approach is more appropriate
- Production capability has the lowest passive score, given the low column sum (totals to 3).

    (ii)   Identify the risk with the greatest influence.

    Commentary on Question:
Most candidates performed well on this part.

- The most influential risk is Laws/Regulations. This is the risk with the highest row sum (totals 7).

(f)

    (i)   Explain how each of these three risks can impact ABC.

    Commentary on Question:
Most candidates did well on this part. For risk C, some candidates misunderstood the risk and interpreted it as an increased tax burden for ABC.

    A. ABC does not have diversified production. Events such as political climate change in the overseas country or catastrophes (weather, terrorism, civil unrest, worksite accident) could heavily impact the production of trucks.
    B. ABC does not have a diversified customer base. Any changes in consumer preferences in their home country could have a large impact on their ability to sell their trucks.
    C. Ending tax incentives could negatively impact demand for ABC vehicles.

3. **Continued**

    (ii)   Classify each risk (A, B, and C) under the most appropriate risk factor from the influence matrix in part e).

        Commentary on Question:
        Most candidates did well on this part.

        A. Production Capability
        B. Market Demand
        C. Laws/Regulations

    (iii)   Propose a strategy for ABC to mitigate each of the three risks identified above.

        Commentary on Question:
        Most candidates did well on this part. Some candidates proposed a strategy to mitigate all three risks together, instead of proposing a strategy for each of the risks. Credit was awarded if the strategy was appropriate and well justified.

        A. Diversify production facilities across multiple foreign countries and/or domestically
        B. Expand sales into foreign markets (diversify consumer base)
        C. Expand product line into other types of vehicles (less reliant on particular laws/regulations)
.

4.   **Learning Objectives:**
1.   The candidate will understand the value of governance and its key elements in general and in the context of an investment operation.

Learning Outcomes:
(1a)   Compare the interest of key stakeholders.

(1b)   Identify sources of unethical conduct and explain the role of a fiduciary.

(1c)   Describe governance mechanisms that attempt to address these conflicts.

(1f)   Demonstrate understanding of how ethics relates to business decision-making, and relate ethics in business to personal ethics.

Sources:
"Investment Ethics, Ch. 1-3" by Peck

QFII-116-19: Chapter 45 of Risk Management: Foundations for a Changing Financial World

Commentary on Question:
This question tested candidates' knowledge of ethics and their ability to apply this knowledge to various company policies as well as soft-dollar applications.

Solution:
(a)   Define the term moral hazard.

   Commentary on Question:
   Candidate performance was poor on this question. Many candidates defined the term in a general sense and not in a manner consistent with syllabus material.

   A party does not fully bear the cost of their risk-taking behavior.
   As a result of this behavior, they take more risks than they would otherwise.

(b)   Recommend whether each policy should be maintained, discontinued, or adjusted. Justify your recommendations.

   Commentary on Question:
   Candidate performance was fair on this question. Many understood the improvements needed for these policies, but some did not correctly identify the treatment of soft dollar arrangements and the legal concerns around the practice.

4. Continued

(i) Discontinued – this is illegal; SOX explicitly disallows any lending or credit lines

(ii) Adjusted – fiduciary holds higher standard of responsibility than fees

(iii) Maintained – company is fulfilling obligation to allow access to info used

(iv) Adjusted – time period should extend to capture a full market cycle

(c) Assess how this arrangement affects each of these parties:

    (i)   XYZ

    (ii)   Mutual fund managers

    (iii)   Mutual fund clients

Commentary on Question:
Candidate performance was fair on this question. Most candidates were able to earn at least partial credit, however many did not consider the implications of the arrangement for future clients.

    (i)   XYZ
- Able to collect higher fees / higher order flow for a brokerage increases its earnings
- Able to attract additional customers

    (ii)   Portfolio Managers
- XYZ's research likely exceeds what individual managers would be able to do on their own
- Fund outperformance may attract future clients

    (iii)   Clients
- Can profit from manager's excess returns
- paying for research through higher brokerage fees

(d)

    (i)   Critique the broker's actions above.

    (ii)   Recommend an alternative action where appropriate.

4. **Continued**

Commentary on Question:
Candidates performed poorly on this question. Most candidates correctly identified the flaw in choosing only the wealthiest clients and a fairer way to allocate shares; few candidates identified the lack of timeliness as an issue.

(i)   Broker should not limit to large and profitable clients
        Broker should not call due to the difference in timing
        Broker should not set amount of shares offered until all orders known

(ii)   All clients for which the IPO meets the investment objectives should be given the opportunity to invest
        Clients should be informed simultaneously, as in email
        Fairer way to distribute shares is on pro rata basis, based on account value

(e)

(i)   Assess each of the findings from your investigation above.

(ii)   Recommend whether XYZ should hire HFC, based on your investigation.

Commentary on Question:
Candidate performance was fair on this question. Many candidates, however, did not correctly identify bullets 1-3 as good practice.

(i)   Bullet 1
        - Good practice
        - Due diligence team should have ability to withhold any investments not meeting minimum standards

        Bullet 2
        - Good practice
        - Senior management should be accountable

        Bullet 3
        - Good practice
        - Monthly valuation is sufficiently frequent

        Bullet 4
        - Could be a red flag
        - High turnover could indicate a problem

(ii)   Qualified acceptance, as HFC applies generally good practices
        However, turnover should be understood

5.

Learning Objectives:
3.   Understand and be able to apply different approaches to measuring risk exposures.

Learning Outcomes:
(3a)   Explain the advantages and limitations of different risk metrics

(3b)   Explain how different approaches and tests form a set of complementary investment risk metrics.

(3c)   Analyze and evaluate risk aggregation techniques, including the use and misuse of correlation, integrated risk distributions and copulas.

(3d)   Evaluate different measures of rare event risks.

(3e)   Evaluate a company's or a portfolio's exposures to various risks.

Sources:
Quantitative ERM: Stress Testing

IAA Note on Stress Testing and Scenario Analysis

Commentary on Question:
This question tested candidates' knowledge of stress testing and scenario analysis. Candidate performance was fair on this question.

Solution:
(a)   Describe each of the following attributes of stress scenarios:

        (i)   Comprehensive

        (ii)   Extreme

        (iii)   Plausible

        Commentary on Question:
        Overall candidates performed well on this question, with a majority of candidates being able to describe comprehensive and extreme scenarios, but struggling more with plausible scenarios.

        (i)   A comprehensive set of scenarios means one scenario or another covers all key risk factors that a company is exposed to.

        (ii)   An extreme set of scenarios means the scenarios used for testing should not understate the risks facing the company. An extreme scenario may mean the company faces insolvency.

5. **Continued**

      (iii)   A plausible scenario means it is possible the scenario may happen, even if it may not have happened in the past. Having a scenario be plausible allows management to believe the scenario may occur so they will not dismiss the results and take the required actions to address the risks.

(b)   Your colleague makes the following suggestions:

- "Our firm already runs a series of prescribed scenarios that have been fully specified by state regulators to all life insurance companies domiciled here. We should use these scenarios for management's request."
- "Senior management should not be included in the design of scenarios because it would introduce bias."
- "We should develop probabilities for our scenarios, but make sure to communicate that the probabilities are subjective and have significant uncertainty."

Critique each suggestion above.

Commentary on Question:
Candidates performed well with this scenario. Most correctly identified which statements were true or false, but some struggled with explaining why.

1. This statement is false, companies should not just rely on prescribed scenarios. Although prescribed scenarios are beneficial to regulations, they may not cover risks or scenarios specific to the firm. In addition, company specific scenarios can cover all risks the company is exposed to and management is interested in.
2. This statement is false, companies should include Senior management in the design of the scenarios. Including senior management helps ensure they will buy into the scenario and rely on the results, as well as reduces bias that may be introduced if they see results before approving scenarios.
3. This statement is true, it is helpful and common to provide estimated probabilities for scenarios to give some context. However, it is necessary to disclose the uncertainty around the probability.

(c)   Your manager states: "In a stressed environment, we cannot depend on negative correlations to hold. Instead, we should rely on the lines of credit to meet margin calls when the derivatives lose value."

Assess the validity of your manager's statement.

5. Continued

The first part of the statement is true regarding correlations. Correlations do not always hold in extreme scenarios so you cannot rely on historical experience.

The second part of the statement is false. While the lines of credit may be helpful they cannot be relied upon during times of stress when liquidity may dry up.

(d)

(i)   Explain the importance of a stress scenario narrative.

(ii)   Identify the type of behavioral bias exemplified by senior management's assessment.

(iii)   Assess the appropriateness of your scenario.

(i)
A stress scenario narrative provides a concise and understandable explanation of the conditions expected during the scenario's life. A convincing and believable narrative is crucial to achieve buy-in from senior management and other stakeholders.

(ii)
Senior management's assessment is an example of recency bias. Recency bias occurs when too much emphasis is placed on recent events when assessing the potential for future events. In this case, recent crises have had long-term growth occur after rapid declines, causing senior management to underestimate the probability of the proposed stress scenario.

(iii)
This is an appropriate scenario for the firm to consider. It is extreme as a prolonged low interest rate environment would make the high interest rate guarantees very costly for the company. The scenario is also plausible as it mimics what has actually occurred in Japan.

5. **Continued**

(e)
      (i)   Identify the type of dependency present in each risk factor pair above.

      (ii)   Explain how the dependency arises in each risk factor pair above.

Commentary on Question:
Candidate performance was fair on this question. While most candidates were able to identify the phase-shift and time-lagged dependencies, few were able to identify the feedback dependency.

(i)
- Credit and Unemployment: Feedback
- Credit and Equity: Phase-shift
- Equity and Interest Rates: Time-lagged dependency

(ii)
- Credit and Unemployment: Feedback
  Higher unemployment will cause higher credit defaults, which will then cause higher unemployment, and so on.

- Credit and Equity: Phase-shift
  Under normal circumstances, equity markets would not be materially impacted by defaults, but as defaults build, once they exceed a certain threshold, equity markets will decline.

- Equity and Interest Rates: Time-lagged dependency
  A fall in interest rate occurs some period of time after a fall in equity markets, as Government entities take time to respond to market events

6.   **Learning Objectives:**
2.   The candidate will understand and be able to apply the components of an effective risk management system.

Learning Outcomes:
(2a)   Explain the importance of risk culture in an investment firm.

(2b)   Identify and describe the various kinds of risks, including market, credit, operational, etc.

(2e)   Evaluate a company's risk management process.

Sources:
The Top Ten Operational Risks: A Survival Guide for Investment Management Firms and Hedge Funds, Miller and Lawton, 2010 (pp. 1, 24-28)

Commentary on Question:
This question tested candidates' knowledge of a company's risk management process and risk management system, specifically with regard to operational risk.

Solution:
(a)
    (i)   Define operational risk.

    (ii)   Explain two reasons why ABC needs an effective operational risk control process.

    Commentary on Question:
    Candidates performed poorly on this question. Most candidates mentioned internal processes in the first part, but only some mentioned external events. For the second part, most candidates stated that controlled operational risk can reduce costs, but only a few also noted the reduced reputational risk.

    (i)
    Operational risk is the risk of loss resulting from inadequate or failed internal processes, people and systems or from external events.

6. **Continued**

(ii)
- Failure of operational risk control processes could lead to significant direct costs.
- There can also be costs due to damaged reputation. It could take years to reassure investors, regulators, and trading partners that the firm is well-managed.

(b) ABC has decided to start a company-wide initiative to automate manual processes to help minimize operational risk. An actuarial student who reports to you has written some documentation about how to automate manual processes and makes the following statements:

1. The use of computers in place of humans ensures accurate results.

2. As the automated process matures and moves into production, the need to understand the manual calculation becomes obsolete. Automation implies an understanding of the manual calculation and the ability to adapt when software or methodologies change.

3. The main driver of incomplete audit trails is the age of systems: newer applications are less susceptible than older vendor systems.

4. Interfaces between multiple systems are usually sources of problems.

Evaluate each of these statements.

Commentary on Question:
Candidate performance was fair on this question. Most candidates identified and described pros and cons for the majority of items.

1. Pros:
- Computers are better at calculating than actuaries because there will not be human errors such as transposing numbers, mistyping numbers in a calculator/computer, etc.

Cons:
- There is the possibility that they are calculating numbers inaccurately if the program had errors before implementing.
- A computer will only do what we tell/program them to do. They won't demonstrate initiative like performing reasonability checks unless we program them to and define "unreasonable".

6. Continued

2. Cons:
   - When the process in which the program is a part of starts to change due to reasons such as new software or a change in methodology, knowing how to do the calculation manually will be imperative when troubleshooting, testing and validating the new software/methodology.
   - Automation doesn't necessarily imply an understanding of doing the calculation manually. Running a program doesn't mean the person knows the necessary steps, as well as the unnecessary steps in an automated environment, in order to make sure that the vital portions are not skipped.

3. Cons:
   - Newer, less robust applications are just as susceptible as older vendor systems. The age of the application or system has nothing to do with the risk of an incomplete audit trail.
   - It's the documentation and governance in place that determines the risk of an inadequate audit trail.

4. This is a correct statement. Multiple systems originally built in a phased implementation process to accommodate a subset of the information that could be transferred between them are susceptible to errors. Generally, the early project phases were poorly documented and subsequent phases are delayed, leaving IT and operations departments unsure how an interface will perform when confronted with a new set of inputs.

(c) Describe the interests of ABC and XYZ in this engagement to implement the automated trading system.

Commentary on Question:
Candidates performed poorly on this question. Most candidates stated that ABC needs to pay XYZ a fee, and XYZ seeks a high price to make profits for its shareholders. Many candidates did not describe the productivity or reduced risk ABC would receive from the trading system and XYZ's desire to deliver well on its services to maintain its reputation.

ABC seeks to maximize profits for its shareholders by successfully implementing a trading system that will improve its productivity (automated process instead of manual) and reduce operational risk. XYZ is a supplier of ABC's since it is offering services for a fee. ABC's interest is to acquire high quality services (expertise on implementation of the trading system from XYZ) at a reasonable price (lower price is better for ABC but against the interests of XYZ).

6.   Continued

XYZ seeks a high price for its services (which is against the interests of ABC) in order to maximize profits for its own shareholders. It is also interested in ensuring a certain level of quality is provided so that its reputation is maintained/improved for the long-term.

(d)   Critique each aspect of the engagement in the context of operational risk.

Commentary on Question:
Candidates performed poorly on this question. Most candidates identified the conflict of interest regarding XYZ's ownership of DEF, however many struggled to effectively critique the other aspects of the question.

Point 1:
Pro: IT's perspective on the cost and requirements of the system are important but insufficient for making this decision.

Con: While it makes sense that XYZ didn't make this decision for ABC, ABC's operations team should have been involved in selecting the system (in addition to IT) because they better understand the needs of the business.

Point 2:
Con: Ensure that any consultant (XYZ in this case) under consideration is independent, which will assist with validation efforts

Con: Conflict of interest/bias – consultants should fully disclose any compensation arrangements or other relationships with vendors. XYZ owns DEF, so it probably cannot be objective.

Point 3:
XYZ may not have experience working with a buy-side firm, so they might not understand their needs.

Point 4:
Con: Confirm that XYZ has a plan for transferring knowledge to ABC's staff during the project. This ensures ABC's team can operate independently when XYZ is finished.

Pro: At least XYZ plans on being available for guidance after project is complete