STRATHMORE INSTITUTE OF MATHEMATICAL SCIENCES

MASTER OF SCIENCE IN DATA SCEIENCE AND ANALYTICS

**CAT**

**DSA 8304 Risk Management Analytics**

**Total Marks: 100 Marks Time: 3.5 Hours**

Instructions: Attempt all questions.

1. Differentiate the following terms as used in financial risk management :
2. risk vanities vs risk fatalism (2 marks)
3. pure vs speculative risks (2 marks)
4. static vs dynamic risks (2 marks)
5. systematic risk vs unsystematic risk (2 marks)

2.The recommendations of the Basel Committee after the 2007 Financial Crisis highlighted the importance of top management and board involvement in stress testing. In particular, top management and board members should be involved in setting stress-testing objectives, defining scenarios, discussing the results of stress tests and decision making. It makes the point that the banks that fared well in the financial crisis were the ones where senior management as a whole took an active interest in the development and operation of stress testing, with the results of stress testing serving as an input into strategic decision making.

1. Apart from involvement in stress testing, explain 2 other ways that the risk committee is able to influence the risk culture and capabilities in an organization (6 marks)
2. Further to the recommendations by the Basel Committee, discuss key aspects of rational risk taking for a business concern (8 marks)
3. Failure of the risk committee to perform the duties explained or their involvement in the risk function or risk management process may bring about costs. Explain. (6 marks)

3.An investment bank holds a portfolio of Global ETFs and Infrastructure bonds with allocations of USD 800,000 and USD 700,000 on each instrument. On Monday 6th June 2023. The 7 day quoted prices of the instruments were as follows:

| Asset Class | 6/06/23 | Day 1 | Day 2 | Day 3 | Day 4 | Day 5 | Day 6 | Day 7 |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Equity | 40 | 43.2 | 44.5 | 47.6 | 40.9 | 38.34 | 42.2 | 39.6 |
| Bond | 100 | 97.86 | 99.8 | 102.1 | 101.9 | 94.56 | 93.9 | 96.67 |

The Pearson correlation estimate between the ETFs and Infrastructure bonds was determined to be 0.1472.

**Required:**

1. Compute the 7-day 95% Value-at-Risk (VaR) of the constructed portfolio (9 marks)
2. Compute the 252-day 95% Expected Shortfall of the portfolio, given that the standard Gaussian density function is (6 marks)
3. Given that the analyst is required by the regulator to also report the 252-day Stressed 95% VaR and 252- day Stressed Expected Shortfall estimates assuming correlations and portfolio volatility increased by 20% and 50% respectively. (7 marks)

4. Describe the risk management control cycle in detail, clearly outlining each step. Apply the cycle to a contemporary risk management issue, such as climate change or cybersecurity threats, explaining how each step of the cycle can be used to manage these risks effectively. Also, discuss the role of artificial intelligence and machine learning in enhancing the risk management control cycle in the current era of digital transformation (10 marks).

1. Analyze the 5 limitations of different machine learning algorithms (such as decision trees, neural networks, and support vector machines) in predicting credit default risk (10 marks).
2. Besides its involvement in stress testing, analyze three other ways that the risk committee is able to influence risk culture and capabilities in an organization. Provide examples of recent corporate governance scenarios where the risk committee has played a pivotal role in fostering an effective risk culture (10 Marks).
3. Discuss the importance of model validation in risk analytics. What are the key challenges and considerations in validating risk prediction models, particularly those built using machine learning techniques? (8 marks).
4. Discuss the potential for bias in risk prediction models, particularly those built using machine learning techniques. What are the ethical implications, and how can such biases be mitigated? (6 marks).
5. Examine the importance of a robust risk analytics infrastructure in financial institutions. How can such an infrastructure support effective risk management, and what are the key components? (6 marks).

