UNIVERSITY OF JOHANNESBURG

FACULTY	: College of Business and Economics
DEPARTMENT	: Department of Finance and Investment Management
CAMPUS	: APK Auckland Park
MODULE	: RISK MEASUREMENT 2 (RMT8X02)
SEMESTER	: Second
EXAM	: November 2021

DATE	: November 2021	**SESSION**	: AM/PM
ASSESSOR(S)	: MR K KLYNSMITH		
MODERATOR	: MR P VENTER		
DURATION	: 3 HOURS	**MARKS**	: 44

NUMBER OF PAGES: 3 PAGES (excluding cover page)

INSTRUCTIONS:

1. Answer ALL THE QUESTIONS
2. Number your answers clearly

QUESTION 1 [7]

1.1 Define the concept of a model within a banking context…….(2)
1.2 Based on above, why are standardised capital approaches typically not considered models……..……...(2)
1.3 Explain the pitfalls of conservatism in a model risk context……(3)

QUESTION 2 [2]

2.1 Value-at-Risk is formally defined as

$$VaR_\alpha = inf\{l \epsilon R: P(L > l) \leq 1 - \alpha\} = inf\{l \epsilon R: P(L \leq l) \geq \alpha\}$$

where

α is the confidence level, for example $\alpha = 0.95$ or $\alpha = 0.99$ and
L is the associated loss random variable.

Assume we have the following discrete loss random variable:

$$L = \begin{cases} 100 & with\ probability\ 0.005 \\ 50 & with\ probability\ 0.045 \\ 10 & with\ probability\ 0.100 \\ 0 & with\ probability\ 0.850 \end{cases}$$

Using above, calculate $VaR_{0.95}$ explaining how the VaR formula should be interpreted in the discrete setting provided above……..……(2)

QUESTION 3 [8]

You are requested to implement a value-at-risk model for a new portfolio Π. The portfolio is exposed to a single share S and the USDZAR exchange rate X. The Traded Market Risk team indicates that the position in the portfolio cannot be valued in their risk system and hence you need to make use of sensitivities obtained from the Front Office valuation system.
Assume the following numerical risk metrics can be extracted from the risk system:

- $\Pi(t, S \times 1.01, X) - \Pi(t, S, X)$, i.e. the ZAR amount the portfolio Π changes by for 1% relative change in the referenced share price S and
- $\Pi(t, S, X \times 1.01) - \Pi(t, S, X)$, i.e. the ZAR amount the portfolio Π changes by for 1% relative change in the referenced USDZAR exchange rate X.

Assume we have share price data denoted by $S_t, S_{t-1}, S_{t-2} \ldots S_{t-520}$ and exchange rate data denoted by $X_t, X_{t-1}, X_{t-2} \ldots X_{t-520}$. Explain how you will calculate a 99% confidence level 1 day value-at-risk using historical simulation and the above mentioned data – your explanation needs to follow the steps and instructions outlined below:

3.1 Write out equations for the calculation of the first three (i.e. three most recent) historical returns (of the share price and exchange rate)……..……..……..….(2)
3.2 Write out equations for the calculation of the first three simulated share prices and exchange rates (i.e. share prices and exchange rates under scenario)……..…..…(2)
3.3 Write out equations illustrating how (following on from the previous step) to simulate changes in portfolio values……..……..…..…(2)
3.4 What model risk is associated with the use of above mentioned sensitivity based approach (vs. full revaluation) and what control/monitoring tools can be implemented to minimize this risk?.....(2)

QUESTION 4 [6]

The calculation of regulatory capital for Traded Market Risk is outlined in regulation 28 of the South African banking regulations. You are required to provide and explain the following modeling requirements (as per the Regulations) of the Internal Models Approach (IMA):

5.1 What holding period should be used? What is the intention of this?.....(2)
5.2 The Value-at-Risk calculation should be based on a historical observation period or sample of no less than one year. The Regulator may however require a bank to calculate its value-at-risk using a shorter observation period. Why, according to the regulations, might this be required?.....(2)
5.3 Banks are allowed to make use of the square root of time rule to scale VaR to the appropriate holding period. Under which conditions does this approximation hold (i.e. what are the statistical assumptions underlying this approximation)…..…….....(2)

QUESTION 5 [7]

The Basel Committee on Banking Supervision issued a document outlining the revised minimum capital requirements for Market Risk (also referred to as the Fundamental Review of the Trading Book). You are required to discuss some of the recommended changes through answering the following questions:

6.1 Specify which profit and loss metrics are required for backtesting vs. which profit and loss metrics are required for the profit and loss attribution tests. You are not required to define these……(2)
6.2 Why are different profit and loss metrics used for backtesting vs. the pnl attribution tests? ……(2)
6.3 The backtesting framework is based on a three-zone approach. Discuss why such an approach is required (through specifically noting the two types of errors considered in the paper) and why it is not sufficient to simply compare the number of exceptions with the number of test days times the percentile used…….…….....(3)

QUESTION 6 [7]

The Financial Sector Conduct Authority (FSCA) and Prudential Authority (PA) published the margin requirements for non-centrally cleared over the counter derivative transactions. These are outlined in Joint Standard 2 of 2020.

7.1 What risk does the placement of margin mitigate?……..(1)
7.2 Initial Margin (IM) can be calculated using a standardized or quantitative approach. What confidence level and holding period should be used in the quantitative approach?.....(2)
7.3 What is the ISDA SIMM Model, how does this fit into the above context?.....(2)
7.4 What model performance monitoring tools can be implemented for the ISDA SIMM model?.....(2)

QUESTION 7 [6]

8.1 Define Economic Capital……..……..(2)
8.2 Assume an expected profit of 10m and a loss at the 99.95th percentile of 5m.
8.2.1 Calculate the Economic Capital from a capital adequacy and shareholder (or performance measurement) perspective……..……(2)
8.2.2 Assume there is currently a capital supply of 7m. Explain how these two metrics can still result in a similar capital adequacy assessment……(2)