MURANG'A UNIVERSITY OF TECHNOLOGY

SCHOOL OF PURE, APPLIED AND HEALTH SCIENCES

DEPARTMENT OF MATHEMATICS AND ACTUARIAL SCIENCE

UNIVERSITY ORDINARY EXAMINATION

2024/2025 ACADEMIC YEAR

FOURTH YEAR **FIRST** SEMESTER EXAMINATION FOR BACHELOR OF SCIENCE IN APPLIED STATISTICS WITH PROGRAMMING

AMS 403 – TIME SERIES ANALYSIS II

DURATION: 2 HOURS

INSTRUCTIONS TO CANDIDATES:

1. Answer question ONE and any other two questions.
2. Mobile phones are not allowed in the examination room.
3. You are not allowed to write on this examination question paper.

SECTION A – ANSWER ALL QUESTIONS IN THIS SECTION

QUESTION ONE (30 MARKS)

Describe the following time series models:

a) Autoregressive model (7marks)
b) Moving average model (7marks)
c) Autoregressive integrated moving average model (6marks)
d) Centralised autoregressive conditional heteroscedasticity model (5marks)
e) Time series neural networks (5marks)

SECTION B – ANSWER ANY TWO QUESTIONS IN THIS SECTION

QUESTION TWO (20 MARKS)

The following are the daily stock prices of a company listed at the Nairobi stock exchange for a period of 12 days:

3.1, 2.7, 4.5, 4.5, 6.8, 6.4, 8.2, 9.2, 14.6, 17.1, 22.8, 32.1

a) Compute the daily log returns r_t (6marks)
b) Compute the sample mean, variance, and skewness, kurtosis, minimum and maximum of the daily log return. (6marks)
c) Perform the Jarque and Bera test on the normality of r_t (3marks)
d) Test the null hypothesis $H_0: \rho_1 = \rho_2 = \rho_3 = 0$ (3marks)
e) Write R code to perform the analysis in c) and d) above. (2marks)

QUESTION THREE (20 MARKS)

Suppose that daily log return of a security follows the model:

$$r_t = -0.15 + 0.32r_{t-1} - 0.28r_{t-2} + a_t$$

Where $\{a_t\}$ is a Gaussian white noise with mean zero and variance 0.05

Assume that $r_9 = 0.18$ and $r_{10} = 0.12$

a) Determine whether the model is stationary (5marks)
b) Find the mean and variance of the return series r_t (6marks)
c) Compute the lag-1 and lag-2 autocorrect ions of r_t (3marks)
d) Computer the 1- and 2- step ahead forecasts of the return series at the forecast origin $t = 10$ (3marks)
e) What are the associated standard deviations of the forecast errors? (3marks)

QUESTION FOUR (20 MARKS)

Discuss the following non-linear time series models:

a) Threshold Autoregressive (TAR) models (5marks)
b) Markov switching models (5marks)
c) Nonlinear Autoregressive (NAR) models (5marks)
d) State space models (5marks