

**KABARAK**



**UNIVERSITY**

**UNIVERSITY EXAMINATIONS**

**2009/2010 ACADEMIC YEAR**

**FOR THE DEGREE OF BACHELOR OF SCIENCE IN  
ECONOMICS AND MATHEMATICS**

**COURSE CODE: MATH 416**

**COURSE TITLE: TIME SERIES ANALYSIS AND FORECASTING**

**STREAM: Y4S1**

**DAY: WEDNESDAY**

**TIME: 9.00 – 11.00 A.M.**

**DATE: 11/08/2010**

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**INSTRUCTIONS:**

- Answer question ONE and any other TWO questions
- Begin each question on a separate page
- Show your workings clearly

**PLEASE TURNOVER**

**QUESTION ONE (30 MARKS)**

- a) What do you understand by the following
- i) Stationary time series (2 marks)
  - ii) Autocorrelation (2 marks)
  - iii) Forecasting (2 marks)
- b) Show that the ACF of the AR(2) process is given by

$$\rho_1 = \frac{\alpha_1}{1 + \alpha_2} \quad \text{and} \quad \rho_2 = \frac{\alpha_1^2 + \alpha_2 - \alpha_2^2}{1 - \alpha_2} \quad (6 \text{ marks})$$

- c) What are the requirements of good forecasting system (4 marks)
- d) For each of the following models, classify it as an ARMA(p,q) process, express it in the backward shift operator form and determine whether it is causal and/or invertible
- i)  $X_t = 0.3X_{t-1} + Z_t$  (4 marks)
  - ii)  $X_t = Z_t - 1.3Z_{t-1} + 0.4Z_{t-2}$  (4 marks)
- e) Show that the property of correlation is given by  $|\rho| \leq 1$  (6 marks)

**QUESTION TWO (20 MARKS)**

- a) Derive the autocovariance and autocorrelation functions of MA(2) process given by

$$X_t = Z_t + \theta_1 Z_{t-1} + \theta_2 Z_{t-2} \quad \text{Where } Z_t \text{ is White Noise } (0, \sigma^2) \quad (10 \text{ marks})$$

- b) The model  $X_t = Z_t + 0.7Z_{t-1}$  represents an invertible MA (1) process with  $\theta = 0.7$ . For an MA (1) calculate the autocorrelation and partial autocorrelation functions. (10 marks)

**QUESTION THREE (20 MARKS)**

Consider the AR (2) process given by  $X_t = X_{t-1} - 1/2X_{t-2} + Z_t$

- i) Is this process stationary? (8 marks)
- ii) What is its ACF? (12 marks)

**QUESTION FOUR (20 MARKS)**

- a) What do you understand by the spectral density function (3 marks)
- b) Find the power spectral density functions of
  - i) Purely Random process (5 marks)
  - ii) First-Order Moving Average (6 marks)
  - iii) First-order AR process (6 marks)

**QUESTION FIVE (20 MARKS)**

Describe clearly the main components of Time Series (20 marks)