CHUKA UNIVERSITY

UNIVERSITY EXAMINATIONS

EXAMINATION FOR THE AWARD OF DEGREE OF BACHELOR OF SCIENCE IN ACTURIAL SCIENCE

ACMT 312: LINEAR MODELS AND FORECASTING

STREAMS: **TIME: 2 HOURS**

DAY/DATE: WEDNESDAY 12/04/2023 **11.30 A.M – 1.30 P.M**

INSTRUCTIONS:

Question One

a)   Outline one advantage and one disadvantage of Artificial Intelligence method of forecasting. (2 marks)

b)   What is the difference between qualitative and quantitative forecasting? Give four examples for each. (6 marks)

c) Calculate the 5-year weighted Moving Average forecasts with weights =1,2,1,2,1. (8 marks)

Year	1	2	3	4	5	6	7	8	9	10	11	12
Sales	5.2	4.9	5.5	4.9	5.2	5.7	5.4	5.8	5.9	6	5.2	4.8

d) Discuss four measures that you can use to determine how accurate your forecast is. (8 marks)

e) Discuss how forecasting can be useful in three different fields. (6 marks)

Question Two

a) Discuss the more commonly used AI systems in forecasting (6 marks).

b) Calculate the seasonal indices for each season for the rain fall (in mm) data given below. (7 marks)

Year	SEASON			
	I	II	III	IV
2001	118.4	260.0	379.4	70
2002	85.8	185.4	407.1	8.7
2003	129.8	336.5	403.1	12.0
2004	283.4	360.7	472.1	14.3
2005	231.7	308.5	828.8	15.9

c)Use the below data to construct the simple linear regression equation of Y on X (7 marks)

$$n = 7, \sum_{i=1}^{n} x_i = 113, \quad \sum_{i=1}^{n} x_i^2 = 1983,$$

$$\sum_{i=1}^{n} y_i = 182 \text{ and } \sum_{i=1}^{n} x_i y_i = 3186.$$

Question Three

a) Differentiate between time series models and causal models of forecasting. (2 marks)

b) Data regarding the sales of bottled water in the last 12 time periods is given below. The manager wants to forecast 1 time period ahead in order to plan properly.

Time	1	2	3	4	5	6	7	8	9	10	11	12
sales	28	27	33	25	34	33	35	30	33	35	27	29

Determine the forecasts using

    (i)   Naïve method   (6 marks)

    (ii) 3 period moving average   (6 marks)

    (iii) simple exponential smoothing taking $\alpha = 0.1$.   (6 marks)

Also compute the error, MAD, MAPE, and MSE for each method to check the forecasting accuracy for the last six periods.

Question Four

a)Given an actual demand of 61, a previous forecast of 58, and alpha of 0.3, what would the forecast for the next period be using simple exponential smoothing? (2 marks)

b)Find the linear trend projection forecast for August. (8 marks)

Month	Period	Actual Demand
Jan	1	1000
Feb	2	1150
March	3	1200
April	4	1240
May	5	1300
June	6	1310
July	7	1350
August	8	?????

c) Discuss how Responsiveness and Stability are achieved when the below methods are used

      i)Moving Average. (2 marks)

ii)Weighted Moving Average. (2 marks)

iii)Simple Exponential Smoothing. (2 marks)

d)List four limitations of judgmental method of forecasting. (4 marks)

Question Five

a) List the characteristics of exponential smoothing. (5 marks)

b) Sachus runs a chain of movie theaters in Chuka and has enjoyed success with a Wednesday night at the movies promotion. By offering half of its regular Kshs. 9 admission price, average nightly attendance has risen from 500 to 1500 persons. Popcorn and other snacks revenues tied to attendance has also risen dramatically. Historically, the University has found that 50% of all moviegoers buy a Kshs.5 cup of buttered popcorn. Eighty percent of these popcorn buyers, plus 40% of the moviegoers that do not buy popcorn ,each spend on average Kshs.4 on soda and other snacks.

i)   Write an expression describing total revenue from tickets plus popcorns plus other snacks?   (5 marks)

ii)   Forecast total revenues for both regular and Special Wednesday night pricing. (5 marks)

iii)   Forecast the total profit contribution earned for the regular and special Wednesday night pricing strategies if the contribution is 30% on movie ticket revenues and 80% on popcorn and all other snacks revenues   (5 marks)