THE CATHOLIC UNIVERSITY OF EASTERN AFRICA

A. M. E. C. E. A

P.O. Box 62157
00200 Nairobi - KENYA
Telephone: 891601-6
Fax: 254-20-891084
E-mail:academics@cuea.edu

MAIN EXAMINATION

JANUARY – APRIL 2014 TRIMESTER

FACULTY OF COMMERCE

DEPARTMENT OF ACCOUNTING AND FINANCE

REGULAR PROGRAMME

CMS 221: QUANTITATIVE METHODS

Date: APRIL 2014	**Duration: 2 Hours**
INSTRUCTIONS: Answer Question ONE and ANY OTHER TWO Questions	

Q1. a) Photo Chemicals produces two types of photographic developing fluids. Both products cost Photo Chemicals £1 per gallon to produce. Based on an analysis of current inventory levels and outstanding orders for the next month, Photo Chemical's management specified that at least 30 gallons of product1 and at least 20 gallons of product 2 must be produced during the next two weeks. Management also stated that an existing inventory of highly perishable raw materials required in the production of both fluids must be used within the next two weeks. The current inventory of the perishable raw material is 80 pounds. Although more of this material can be ordered if necessary, any of the current inventory that is not used within the next two weeks will spoil – hence, the management requirement that at least 80 pounds be used in the next two weeks. Furthermore, it is known that product 1 requires 1 pound of this perishable raw material per gallon and product 2 requires 2 pounds of raw material per gallon. Because Photo Chemical's objective is to keep its production cost at the minimum possible level, the firm's management is looking for a minimum cost production plan that uses all the 80 pounds of perishable raw material and provides at least 30 gallons of product 1 and at least 20 gallons of product 2.

Required:

Develop a linear programming model that can provide a minimum cost solution. (NB. DO NOT SOLVE) **(8 marks)**

b) Suppose that a decision maker faced with four decision alternatives and four states of nature develops the following profit payoff table:

	State of Nature			
Decision Alternative	**S_1**	**S_2**	**S_3**	**S_4**
d_1	14	9	10	5
d_2	11	10	8	7
d_3	9	10	10	11
d_4	8	10	11	13

If the decision maker knows nothing about the probabilities of the four states of nature, and assuming that the payoff table provides cost rather than profit payoffs, what is the recommended decision using the minimax regret approach. Show your workings.

(4 marks)

c) Given the following data:

Period	**Number of complaints**
1	80
2	65
3	55
4	58
5	64

Prepare a forecast using each of these approaches:

i) The appropriate naive approach. **(2 marks)**

ii) A three-period moving average. **(2 marks)**

iii) A weighted average using weights of 0.50 (most recent) 0.30 and 0.20. **(2 marks)**

iv) Exponential smoothing with a smoothing constant of 0.40. **(4 marks)**

d) Below is information on food items for the year 2004 and 2012.

	2004		2012	
Item	**Price**	**Quantity**	**Price**	**Quantity**
Margarine (1kg	Shs. 45	18	Shs. 92	27
Bread (800g)	Shs. 40	5	80	9
Milk $\left(\frac{1}{2} litre\right)$	25	70	50	65
Potato chips	35	27	55	33

Required:

Determine Fisher's ideal index. (NB: Use 2004 as the base period in your computations). **(4 marks)**

e) Consider the following two-person, zero-sum game. Playoffs are winnings for player A.

		Player B		
		b_1	**b_2**	**b_3**
	a_1	80	50	70
Player A	a_2	20	40	100

What is the optimal strategy for each player and what is the value of the game? **(4 marks)**

Q2. Northern Oil Company produces two grades of fuel oil: regular and premium. The profit contributions are $0.30 per gallon for regular fuel and $0.50 per gallon for premium fuel. Each gallon of regular fuel contains 0.3 gallons of grade A crude oil and each gallon of premium fuel contains 0.6 gallons of grade A crude oil. For the next production period, Northern has 18,000 gallons of grade A crude oil available. The refinery used to produce the fuels has a production capacity of 50,000 for the next production period. Northern oil's distributors have indicated that demand for the premium fuel for the next production period will be at most 20,000 gallons.

Required:

a) Formulate a linear programming model that can be used to determine the number of gallons of regular fuel and the number of gallons of premium fuel that should be produced in order to maximize total profit contribution. **(8 marks)**

b) Solve for the optimal solution using the graphical solution procedure. **(9 marks)**

c) Determine and interpret any slack and/or surplus variables in your optimal solution. **(3 marks)**

Q3. a) A manager must decide how many machines of a certain type to buy. The machines will be used to manufacture a new gear for which there is increased demand. The manager has narrowed the decision to two alternatives: buy one machine or buy two. If only one machine is purchased and demand is more than it can handle, a second machine can be purchased at a later time. However, the cots per machine would be lower if the two machines were purchased at the same time.

The estimated probability of low demand is 0.20, and the estimated probability of high demand is 0.70. The net present value associated with the purchase of the two machines is K£75,000 if demand is low and £130,000 if demand is high. The net present value for one machine and low demand is £90,000. If demand is high, there ae three options. One option is to do nothing, which would have a net present value of £90,000. A second option is to subcontract, that would have a net present value of £110,000. The third option is to purchase a second machine. This option would have a net present value of £100,000.

Required:

i) Using a tree diagram to analyze the problem, determine the number of machines that the manager should purchase initially. **(8 marks)**

ii) How much money should the manager be willing to pay in order to remove the element of uncertainty form the analysis of the problem? **(3 marks)**

b) The research staff of a marketing agency has assembled the following payoff table of estimated profits:

	Number	Received contract	Not received contract
Proposal	1	£10*	-2
	2	8	3
	3	5	5
	4	0	7

*Cost in thousands of K£es.

Required:

Relative to the probability of not receiving the contract determine the range of probability for which each of the proposals would maximize expected profit. **(9 marks)**

Q4. a) Under what circumstances would you choose to use:

i) A qualitative forecasting technique. **(1 mark)**

ii) A quantitative forecasting technique. **(1 mark)**

b) The following data shows the foreign exchange rate for Kenya and Tanzania. The units for rate are the number of Tanzanian shillings to 1 Kenyan shilling.

Date	Rate
July, 2013	1.2359
August, 2013	1.2555
September, 2013	1.2402
October, 2013	1.2229
November, 2013	1.2043
December, 2013	1.1777

January, 2014	1.1774
February, 2014	1.1815
March, 2014	1.1615
April, 2014	1.1572

Required:

i) Forecast the exchange rate for May, 2014 using:
   I) The appropriate naïve approach. **(2 marks)**
   II) A five month moving average **(2 marks)**
   III) A weighted average using 0.50 for April, 2014, 0.30 for March, 2014, and 0.20 for February, 2014. **(2 marks)**

ii) Given that a linear trend appears to be present in the data:
   I) Develop the equation for the linear trend component for the time series. **(6 marks)**
   II) Use the equation to forecast the exchange rate for May, 2006. **(2 marks)**
   III) What is the assumption of the trend line projection in forecasting? Why would you feel comfortable in using the trend equation to forecast the exchange rate for September 2014? **(2 marks)**

iii) Briefly describe **TWO** elements of a good forecast. **(2 marks)**

END