



# THE CATHOLIC UNIVERSITY OF EASTERN AFRICA

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**MAIN EXAMINATION**

**MAY – JULY 2016 TRIMESTER**

**FACULTY OF COMMERCE**

**DEPARTMENT OF ACCOUNTING AND FINANCE**

**REGULAR PROGRAMME**

**CID 083: QUANTITATIVE TECHNIQUES**

**Date: JULY 2016**

**Duration: 2 Hours**

**INSTRUCTIONS: Answer Question ONE and ANY OTHER TWO Questions**

- Q1. a) Quality Air Conditioning manufactures three home air conditioners: an economy model, a standard model, and a deluxe model. The profits per unit are Shs. 63, Shs. 95 and Shs. 135 respectively. The production requirements per unit are as follows:

	<b>Number of Fans</b>	<b>Number of cooling coils</b>	<b>Manufacturing time (Hours)</b>
Economy	1	1	8
Standard	1	2	12
Deluxe	1	4	14

For the coming production period, the company has 200 fan motors, 320 cooling coils and 2400 hours of manufacturing time available.

**Required:**

Develop a linear programming model that can be used to determine the number of economy, standard and deluxe models to produce in order to maximize profit (NB: DO NOT SOLVE) **(8 marks)**

- Q3. A product is produced at three plants and shipped to three warehouses (the transportation costs per unit are shown in the following table).

Plant	Warehouse			Plant capacity
	$W_1$	$W_2$	$W_3$	
$P_1$	30	16	24	300
$P_2$	10	10	8	500
$P_3$	12	18	10	100
Warehouse demand	200	400	300	

Eg the transportation cost per unit on  $P_3 - W_1$  route

**Required:**

- Develop a linear programming model for minimizing transportation costs. **(7 marks)**
- How would you modify your linear programming model if the following special cases were to arise:

The route  $P_2$  to  $W_2$  must carry at least 100 units. **(2 marks)**

- Embassy club is undertaking renovation of its main building. The project is scheduled to begin October 1<sup>st</sup> 2016 and February 1<sup>st</sup> 2017 (17 weeks) completion date is destined. The club management identified the following renovation activities and their estimated times.

Activity	Immediate predecessor	Time (weeks)
A	_____	3
B	_____	1
C	_____	2
D	A, B, C	4
E	C, D	5
F	A	3
G	D, F	6
H	E	4

**Required:**

- Draw a project network and determine the project completion time. **(9 marks)**
- Will the project be completed by February 1, 2017? Support your answer. **(1 mark)**

- iii) If activity C is delayed by 7 weeks, will the project be completed by February 1, 2017? Support your answer. **(3 marks)**

Q2. A small construction firm specializes in building and selling single-family homes. The firm offers two basic types of houses, model A and model B. Model A houses require 4000 labour hours, 2 tons of stone and 2000 board feet of lumber. Model B requires 10,000 labour hours, 3 tons of stone and 2000 board feet of lumber. Due to long lead times (i.e. the time between when an order is made and when it is delivered) for ordering supplies and the scarcity of skilled and semi-skilled workers in the area, the firm will be forced to rely on its present resources for the upcoming building season. It has 400,000 hours of labour, 150 tons of stone and 200,000 board feet of lumber. Model A yields a profit of Kshs. 300,000 per unit and model B yields Kshs. 600,000 per unit.

**Required:**

- a) Formulate a linear programming model to determine the number of houses of model A and model B in order to maximize profit (assuming the firm will be able to sell all the units it builds). **(8 marks)**
- b) Find the optimal solution using the graphical solution procedure. How many houses of model A and model B should the firm construct and what is the total profit contribution that the firm can earn with this construction quantities. **(9 marks)**
- c) Determine the number of hours tons of stone, and the amount of board feet number that will be used in the construction of the number of houses suggested in part (b) above? **(3 marks)**

Q3. Keroche Industries has three breweries (factories 1, 2 and 3) and four distributors (Warehouses A, B, C and D) as illustrated in the following transportation problem:

		A	B	C	D	Supply
Factory	1	4	7	7	1	100
	2	12	3	8	8	200
	3	8	10	16	5	150
Demand		80	90	120	160	450

(NB: The transportation cost per unit from factory to warehouse is in K£s)

**Required:**

- a) Determine the number of units that should be shipped from each factory to each warehouse in order to minimize total shipping cost. What is the total shipping cost? **(10 marks)**
- b) If the transportation costs along the routes were now to be regarded as profit per unit, develop a transportation plan that maximizes profit. Which routes would be used and how many units would be carried on each route? **(10 marks)**

Q4. The Manager of Village Market Swimming Club is planning the Club's Swimming team program. The first team practice is scheduled on October 2. The activities, their immediate predecessors, and the activity time estimates (in weeks) are as follows:

Activity	Description	Immediate predecessor	Time (Weeks)		
			Optimistic	Most probable	Pessimistic
A	Meet with board	-	1	1	2
B	Hire coaches	A	4	6	8
C	Reserve pool	A	2	4	6
D	Announce program	B, C	1	2	3
E	Meet with coaches	B	2	3	4
F	Order team suits	A	1	2	3
G	Register swimmers	D	1	2	3
H	Collect fees	G	1	2	3
I	Plan first practice	E, H, F	1	1	1

**Required:**

- a) Compute the expected activity time and variance for each activity. **(9 marks)**
- b) Draw a project network and determine the expected project completion time. **(9 marks)**
- c) Determine the standard deviation of the expected project completion time? **(2 marks)**

**\*END\***