



# THE CATHOLIC UNIVERSITY OF EASTERN AFRICA

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**MAIN EXAMINATION**

**JANUARY – APRIL 2014 TRIMESTER**

**FACULTY OF COMMERCE**

**DEPARTMENT OF ACCOUNTING AND FINANCE**

**ORDINARY DIPLOMA PROGRAMME**

**CID 083: QUANTITATIVE TECHNIQUES**

**Date: APRIL 2014**

**Duration: 2 Hours**

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

- Q1. a) A Jean Manufacturer makes three types of Jeans, each of which goes through three manufacturing phases – cutting, sewing and finishing. The number of minutes each type of product requires in each of the three phases is given below:

Jean	Cutting	Sewing	Finishing
I	8	12	4
II	12	18	8
III	18	24	12

There are 5200 minutes of cutting time, 6000 minutes of sewing time, and 2200 minutes of finishing time each day. The company sell all the Jeans it make and make a profit of Shs. 300 on each Jean I, Shs. 450 on each Jean II and Shs. 600 on each Jean III.

**Required:**

Develop a linear programming model that can be used to determine the number of Jeans in each category that the company should make each day in order to maximize profit (NB. DO NOT SOLVE).

**(8 marks)**

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

Plant	Warehouses					Plant capacity
	W <sub>1</sub>	W <sub>2</sub>	W <sub>3</sub>	W <sub>4</sub>	W <sub>5</sub>	
P <sub>1</sub>	10	20	5	9	10	9000
P <sub>2</sub>	2	10	8	30	6	4000
P <sub>3</sub>	1	20	7	10	4	8000
Warehouse demand	3000	5000	4000	6000	3000	21000

**Required:**

- i) Develop a linear programming model for minimizing transportation costs. **(9 marks)**
- ii) How would you modify your linear programming model if the following special case were to rise:  
P<sub>2</sub> to W<sub>2</sub> route should carry at most 1000 units. **(1 mark)**
- c) Catholic University is considering building a new multipurpose athletic complex on campus which will provide a new gymnasium for interuniversity basketball games, expanded office space, classroom, and intramural facilities. The following activities have to be undertaken before construction can begin.

Activity	Description	Immediate predecessor	Time (Weeks)
A	Survey building site	-	6
B	Develop initial design	-	8
C	Obtain board approval	A, B	12
D	Select architect	C	4
E	Establish budget	C	6
F	Finalize design	D, E	15
G	Obtain financing	E	12
H	Hire contractor	F, G	8

**Required:**

- i) Draw a project network. **(8 marks)**
- ii) What are the critical activities and what is the project's completion time. **(2 marks)**
- iii) If activity A is delayed by 2 weeks, what is the project's completion time? **(2 marks)**

Q2. Olympic Sporting Equipment, Inc., makes two different types of hockey sticks, a medium-sized stick and a big – stick. The firm has 900 hours of production time available in its cutting and sewing department, 300 hours available in its finishing department, and 100 hours available in its packaging and shipping department.

The production time requirements and the profit contribution per hockey stick are given in the following table.

Model	Production Time (Hours)			Profit
	Cutting and sewing	Finishing	Packaging and shipping	
Medium – sized stick	1	$\frac{1}{2}$	$\frac{1}{8}$	£5
Big stick	$\frac{3}{2}$	$\frac{1}{3}$	$\frac{1}{4}$	£8

Assuming that the company is interested in maximizing the total profit contribution, answer the following questions:

- a) Develop the linear programming model that can be used to determining the number of small and big hockey sticks that need to be produced in order to maximize profit. **(8 marks)**
  - b) Find the optimal solution using the graphical solution procedure. How many hockey sticks of each size should Olympic manufacture and what is the total profit contribution Olympic can earn with these production quantities? **(9 marks)**
  - c) How many hours of production will be scheduled in each department in order to manufacture these quantities? **(3 marks)**
- Q3. IBM manufactures the central processing Unit (CPU) for a line of personal computers. The CPUs for the African market are manufactured in their Catholic University Plant (Nairobi), Cairo and Johannesburg and shipped

to warehouses in Luanda, Algier, Abjan, Accra and Lagos for further distribution. The following transportation table shows the number of CPUs available at each plant and the number of CPUs required by each warehouse. The shipping costs (in tents of dollar per unit) are also shown in each cell.

Plant	Warehouse					CPUs available
	Accra	Algiers	Luanda	Abdjan	Lagos	
Johannesburg	10	20	5	9	10	9000
Cairo	2	10	8	30	6	4000
Nairobi	1	20	7	10	4	8000
CPUs	3000	5000	4000	6000	3000	21,000

**Required:**

- Determine the amount that should be shipped from each plant to each warehouse to minimize the total shipping cost. What is the total shipping cost? **(7 marks)**
- If the transportation costs per unit along the routes were to be regarded as profit per unit, develop a transportation plan that minimizes profit. Which routes would be used and how many CPUs would be carried on each route? What is the total profit obtained? **(13 marks)**

Q4. Carol is in charge of planning and coordinating next December's sales management training program for her company. Carol listed the following activity information for this project.

Activity	Description	Immediate Predecessor	Time (Weeks)		
			Optimistic	Most probable	Pessimistic
A	Plan topic	-	1.5	2.0	2.5
B	Obtain speakers	A	2.0	2.5	6.0
C	List meeting locations	-	1.0	2.0	3.0
D	Select location	C	1.5	2.0	2.5
E	Finalize speaker travel plans	B, D	0.5	1.0	1.5

F	Make final check with speakers	E	1.0	2.0	3.0
G	Prepare a mail brochure	B, D	3.0	3.5	7.0
H	Take reservations	G	3.0	4.0	5.0
I	Handle last minute details	F, H	1.5	2.0	2.5

**Required:**

- a) Compute the expected activity time and variance for each activity. **(8 marks)**
- b) Draw a project network. **(8 marks)**
- c) What are the critical activities and what is the expected project completion time? **(2 marks)**
- d) What would be the expected project completion time if an activity on the critical path was delayed by 1 week? **(2 marks)**

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