



**FACULTY OF MANAGEMENT  
JUNE EXAMINATION 2014**

**DEPARTMENT: TRANSPORT AND SUPPLY CHAIN MANAGEMENT**

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<b><u>MODULE</u></b>	<b>:</b>	<b>QUANTITATIVE MANAGEMENT TECHNIQUES IN LOGISTICS</b>
<b><u>CODE</u></b>	<b>:</b>	<b>LMA8X06/LBE08X7</b>
<b><u>DATE</u></b>	<b>:</b>	<b>17 JUNE 2014</b>
<b><u>DURATION</u></b>	<b>:</b>	<b>3 HOURS</b>
<b><u>TIME</u></b>	<b>:</b>	<b>12:30 -15:30</b>
<b><u>TOTAL MARKS</u></b>	<b>:</b>	<b>180</b>

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<b><u>EXAMINER(S)</u></b>	<b>:</b>	<b>DR. S CARSTENS</b>
<b><u>EXTERNAL MODERATOR(S)</u></b>	<b>:</b>	<b>DR K LAMBERT</b>
<b><u>NUMBER OF PAGES</u></b>	<b>:</b>	<b>3</b>

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**INSTRUCTIONS TO CANDIDATES:**

- Question papers must be handed in
- This is a closed book assessment
- Read the questions carefully and answer only what is asked
- Number your answers clearly
- Write neatly and legibly
- Structure your answers by using appropriate headings and sub-headings
- The general University of Johannesburg policies, procedures and rules pertaining to written assessments apply to this assessment.

## ANSWER ALL THE QUESTIONS

### QUESTION 1

[85 MARKS]

Acme Company manufactures a component that is used in the assembly process of an electronic product. They supply to four different electronic manufacturers (EM1, EM2, EM3 & EM4) from two plants. The monthly plant capacities are as follows:

#### Plant capacities (monthly)

Plant	Capacity (number of components)
P1	500
P2	1 000

Currently all components are distributed to the electronic manufacturers directly from the plants. Acme uses small warehouses at the plants at a total monthly rental cost of R795 000 per month. However, Acme's management believes that distribution costs can be reduced by incorporating two warehouses at optimal locations. They have the option of renting any two of three warehouses (W1, W2 & W3) in optimal locations in terms of the electronic manufacturers and the plants. Note that if Acme uses these warehouses they can terminate the rental of the plant warehouses. The warehouse capacities are as follows:

#### Warehouse capacities (monthly)

Warehouse	Capacity (number of components)
W1	800
W2	700
W3	600

The monthly rental costs associated with these warehouses are as follows:

Warehouse	Monthly rental cost (Rand)
W1	R490 000
W2	R430 000
W3	R390 000

The logistics manager at Acme estimates the transport rates as follows (note that the transport rates take the distance into account):

#### Transport rates (Rand/component) – Plant to electronic manufacturer

	EM1	EM2	EM3	EM4
P1	14	15	20	17
P2	18	19	16	21

#### Transport rates (Rand/component) – Plant to warehouse

	W1	W2	W3
P1	2	13	14
P2	7	9	8

#### Transport rates (Rand/component) – Warehouse to electronic manufacturer

	EM1	EM2	EM3	EM4
W1	3	4	5	12

W2	6	1	11	10
W3	5	2	12	9

The demands at the electronic manufacturers vary and need to be estimated in association with the electronic manufacturer. The demand estimations at EM1 and EM2 have been finalized and are given below:

Manufacturer	Monthly Demand (units)
EM1	300
EM2	250

Demand at EM3 and EM4 have not been estimated, but the following information is available:

Acme's analysts have applied a number of forecasting techniques to EM3's demand information and the following results are available.

#### Demand forecasts (next month)

Technique	Forecast (units)	MAD
3-month moving average	430	18.7
exponential smoothing ( $\alpha = 0.3$ )	425	16.1
exponential smoothing ( $\alpha = 0.4$ )	439	19.3
regression analysis	450	15.9

Analysts have struggled to find an appropriate forecasting method to forecast demand at EM4. However, the following historical monthly demand information is available:

Demand
163
255
148
239
153
253
306
280
295
338

In addition, the analysts believe that the sales of the electronic product and the selling price of the electronic product may influence demand of the component. To this end the following information was obtained:

Month	Sales	Price
1	1045	475
2	1610	490
3	860	520
4	1211	420
5	975	410
6	1117	370

7	1066	350
8	1310	300
9	1517	280
10	1246	250
11	1200	373

If minimum cost is Acme's objective, which distribution network would you recommend?

**Note: Use the demand information for next month. (Round forecast to exclude decimals).**

## QUESTION 2

**[50 MARKS]**

Simkins Hardware sells various building related products. However, Simkins is particularly concerned with the profits of Allweather roof paint (5 litres). Each 5 litre size of paint costs Simkins R75 and is sold for R125. Simkins wants to maximize total profits while taking inventory carrying, stockout and transport costs into account.

The profit is dependent on the inventory and the demand. To this end Simkins decided to find the best inventory policy taking into account the monthly demand.

The following two inventory policies (as per the supplier) are available to Simkins and should be investigated:

### Inventory policy A

Simkins receives monthly deliveries (80 units) from its supplier at the beginning of each month. Inventory carrying cost is R5 per unit (5 litres) and a cost of R30 for a stockout is assigned. Starting stock = 100 units. (Delivery starts in month 2).

### Inventory policy B

Simkins receives deliveries (160 units) every second month from its supplier at the beginning of the month. Inventory carrying cost is R5 per unit (5 litres) and a cost of R30 for a stockout is assigned. Starting stock = 100 units. (Delivery starts in month 2).

Simkins expects demand to remain the same as in the past (57% probability) or increase (43% probability). The following demand information is relevant if demand remains the same:

Monthly demand (units)	Probability
70	0.10
80	0.20
90	0.25
100	0.25
110	0.15
120	0.05

Simkins has estimated the monthly profits associated with this demand distribution as follows:

Inventory policy A	R3 110
Inventory policy B	R3 175

The demand increase is expected to be as follows:

Monthly demand (units)	Probability
80	0.05
90	0.15
100	0.20
110	0.25
120	0.25
125	0.10

The supplier normally charges a transport rate of R5/unit. However, the supplier is prepared to supply the paint to Simkins at a cost of R3/unit, but a minimum of 100 units need to be ordered at a time.

Which inventory policy should Simkins implement?

### QUESTION 3

**[45 MARKS]**

Widgecor is a company that distributes widgets from two depots (D1 and D2) to four warehouses in a certain area. Each warehouse services a different customer base and as such has experienced different degrees of growth over the past number of years. Widgecor would like to estimate the minimum total transport cost from the two depots to the warehouses for next year (2014).

The table below shows the demand at two of the warehouses over the last 10 years.

#### Annual demand

Year	Warehouse A	Warehouse B
2004	4500	4700
2005	4000	5000
2006	4100	5100
2007	3700	4980
2008	3650	5500
2009	3480	5890
2010	4300	5300
2011	3900	5700
2012	5600	6230
2013	5200	6450

The company believes that the demand at Warehouse A for 2014 may be estimated with either a 4-year moving average forecast or an exponential smoothing forecast ( $\alpha = 0.8$ ). The 2014 demand at Warehouse B may be estimated with either a 4-year moving average forecast or a trend regression forecast.

Management has estimated the demand for 2014 at the other two warehouses as follows:

#### Estimated annual demand

Year	Warehouse C	Warehouse D
2014	10 500	3 450

Depot D1 has a maximum annual capacity of 15 000 widgets and depot D2 has a maximum capacity of 12 000 widgets.

The table below contains the transport rates from each depot to the warehouses:

**Transport rates (Rand/widget)**

Depot	Warehouse A	Warehouse B	Warehouse C	Warehouse D
D1	3.50	5.21	2.57	7.81
D2	3.45	4.89	-	8.21

The minimum transport cost of the existing logistics network for 2014 is R103 419.

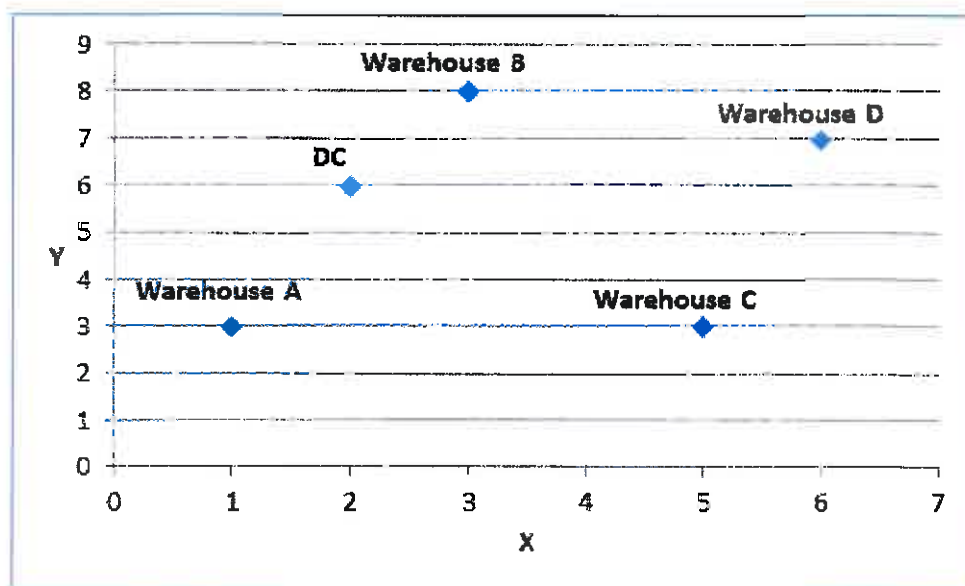
A third-party logistics company, ThirdPL, has approached Widgecor with a proposal to take over the supply depots and the transport of supplies to each of the warehouses. ThirdPL has a distribution centre (DC) available with sufficient capacity to store the stock currently kept at the two depots. The idea is to consolidate the stock from the two depots at the DC and supply each warehouse from the DC.

ThirdPL has proposed the following transport rates from the DC to each warehouse:

**Proposed transport rates (cents/widget/km)**

	Warehouse A	Warehouse B	Warehouse C	Warehouse D
DC	13	12	19	18

A plot of the geographical dispersion of these facilities is as follows:



Note: 1 map unit = 10 km

Would you recommend that Widgecor accept the proposal from ThirdPL, based on transport cost only? Is the DC situated in an optimum location with regards to the warehouses? Assume that the transport cost to supply the two depots (status quo) is the same as the DC supply cost.

Note: Show all your calculations

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## Annexure

### Question 1: Random Numbers

0.65

0.77

0.46

0.27

0.57

0.61

0.67

0.06

0.78

0.72

### Question 2: Random Numbers

0.83

0.67

0.2

0.67

0.26

0.47

0.41

0.07

0.14

0.49

### Question 3: Random Numbers

0.23

0.68

0.34

0.3

0.92

0.47

0.47

0.84

0.88

0.07