UNIVERSITY OF JOHANNESBURG

MODULE	:	**LOGISTICS MANAGEMENT SYSTEMS A**
CODE	:	**LMS13A3/LBS3A01**
DATE	:	**24 MAY 2017**
DURATION	:	**3 HOURS**
TOTAL MARKS	:	**180**

EXAMINER	:	**DR S CARSTENS**
MODERATOR	:	**DR N JACOBS**
NUMBER OF PAGES	:	**5 PAGES**

INSTRUCTIONS TO CANDIDATES:

- Answer all the questions
- 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.

QUESTION 1 **[19 MARKS]**

Irwin Textiles produces two types of cloth – denim and corduroy. Corduroy is a heavier grade of cotton cloth and requires 7.5 kg of raw cotton per metre, whereas denim requires 5 kg of raw cotton per metre. A metre of corduroy requires 3.2 hours of processing time; a metre of denim requires 3 hours. Although the demand for denim is practically unlimited, the maximum demand for corduroy is 510 metres per month. The manufacturer has 6500 kg of cotton and 3000 hours of processing time available each month.

The manufacturer makes a profit of R2.25 per metre of denim and R3.10 per metre of corduroy. Irwin Textiles wants to know how many metres of each type of cloth to produce to maximize profits.

QUESTION 2 **[15 MARKS]**

Consider the following linear programming model:

Minimise C = 3x – 2y
Subject to

$$5x + 5y \geq 25 \quad \text{(Resource A)}$$
$$2x \leq 20 \quad \text{(Restriction B)}$$
$$y \leq 3 \quad \text{(Restriction C)}$$
$$3x + 9y \leq 36 \quad \text{(Resource D)}$$
$$x,y \geq 0$$

The Solver Sensitivity results for this problem are as follows:

Variable Cells

Cell	Name	Final Value	Reduced Cost	Objective Coefficient	Allowable Increase	Allowable Decrease
A2	x	2	0	3	1E+30	3
B2	y	3	0	-2	5	1E+30

Constraints

Cell	Name	Final Value	Shadow Price	Constraint R.H. Side	Allowable Increase	Allowable Decrease
C5	LH	25	0.6	25	5	10
C6	LH	4	0	20	1E+30	16
C7	LH	3	-5	3	0.5	3
C8	LH	33	0	36	1E+30	3

a) What is the optimal solution to this problem? (3)
b) Interpret the sensitivity analysis results on the constraints. (12)

QUESTION 3 **[13 MARKS]**

WD is a company that makes widgets in three plants throughout the world. The plants supply four company-owned warehouses that distribute the widgets directly to widget shops. Depending on which mode is cheaper, the product is air-freighted or trucked from the plants to the warehouse.

The monthly plant capacities in terms of the number of widgets are as follows:

Plant	Capacity
Johannesburg	100
Hong Kong	300
Cairo	200

The warehouse demand requirements are as follows:

Warehouse	Demand
Bonn	150
Manhattan	100
Denver	200
Tokyo	150

The shipping costs ($) per widget are as follows:

	To warehouse			
From plant	Bonn	Manhattan	Denver	Tokyo
Johannesburg	19	7	3	21
Hong Kong	15	21	-	6
Cairo	11	14	15	22

Formulate a linear programming model to determine how many widgets should be shipped from each plant to each warehouse. ***Do not solve the problem.***

QUESTION 4 **[30 MARKS]**

The demand for a specific product is dependent on three variables A, B and C to different degrees. The table below contains the demand, as well as the associated information for these variables for 6 months.

Month	Demand	A	B	C
1	36	9	5	2
2	44	10	9	13
3	48	13	12	18
4	63	15	19	15
5	70	18	21	17
6	45	13	17	24

a) Forecast the demand for month 7 using a 3-month weighted moving average with weights of 60%, 30% and 10% starting at the most recent month. (4)

b) Forecast the demand for month 7 using exponential smoothing ($\alpha = 0.3$). (5)

b) The correlation coefficient between demand and A is 0.95. Between demand and B it is 0.88 and between demand and C it is 0.39.
Use linear regression to forecast the demand in month 7 (independent variable value = 15) by selecting the appropriate variable. Give reasons for your choice of variable. (7)

c) Forecast the demand for month 7 using a 3-month moving average. (4)

d) Determine which forecasting technique provides the most accurate forecast for month 7. (Show your calculations). (10)

QUESTION 5 **[42 MARKS]**

Strategic planning requires forecasts of future demand for products and markets for long-term competitiveness and success.

a) Discuss the components of demand. (12)

b) Discuss the factors that could influence demand. (16)

c) Discuss the characteristics of forecasting techniques. (8)

d) Explain the difference between causal forecasting techniques and time series methods. (6)

QUESTION 6 [20 MARKS]

Lawson's Department Store faces a buying decision for a seasonal product for which demand can be high, medium and low. The purchaser at Lawson's can order 1, 2 or 3 lots of the product before the season begins, but cannot reorder later. Profit projections (R1000) are as follows:

Order size	Demand		
	High	Medium	Low
Order 1 lot	65	60	50
Order 2 lots	85	80	30
Order 3 lots	100	70	10

a) Determine the optimal decision using the maximax, maximin, minimax regret, Hurwicz (α = 0.3) and equal likelihood decision criteria. (14)

b) Construct a sequential decision tree and find the best decision if the following probabilities can be assigned to the future demand conditions:

High	0.3
Medium	0.3
Low	0.4

(6)

QUESTION 7 [41 MARKS]

Simulation models are mathematical models used for replicating real-world problems.

a) Discuss the common applications of simulation. (14)

b) The PC Warehouse distributes laptop computers, which it orders from a supplier in Japan. Because of shipping and handling costs each order must be for five laptops. It costs R100 to place an order and it costs the warehouse R400 in lost sales when a customer asks for a laptop and it is out of stock. (The customer does not backorder or wait for a laptop). It costs R40/week to keep each laptop stored in the warehouse.

The following probability distribution for the weekly demand for laptops has been determined:

Demand per week	Probability
0	0.04
1	0.08
2	0.28
3	0.40
4	0.16
5	0.02
6	0.02

The warehouse presently has five laptops in stock. Use this information for five weeks to calculate the average weekly cost. The PC Warehouse intends to receive orders in weeks 3 and 5 of this period and orders are always received at the beginning of the week. (27)

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ANNEXURE

$$a = \bar{y} - b\bar{x}$$

$$b = \frac{\sum xy - n\bar{x}\bar{y}}{\sum x^2 - n\bar{x}^2}$$

$$b = \frac{\sum (x_i - \bar{x})(y_i - \bar{y})}{\sum (x_i - \bar{x})^2}$$

$$\rho = \frac{\sum_{i=1}^{n} (x_i - \bar{x})(y_i - \bar{y})}{\sqrt{\sum_{i=1}^{n} (x_i - \bar{x})^2 \sum_{i=1}^{n} (y_i - \bar{y})^2}}$$

Random Numbers

45
90
84
17
74