



MODULE : LOGISTICS MANAGEMENT SYSTEMS A
EXAMINATION

CODE : LBS3A01/LMS13A3

DATE : 24 MAY 2018

DURATION : 3 HOURS

TOTAL MARKS : 180

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MODERATOR : DR K LAMBERT

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**[15 MARKS]**

Ace Widgets operates three plants that manufacture widgets. The finished products are shipped to 4 warehouses, based on demand forecasts. The demand forecasts at the warehouses for the next month are as follows:

Warehouse	Demand (number of widgets)
W1	50
W2	150
W3	200
W4	250

The plants are different in size and they are limited in the maximum monthly output. The table below shows the maximum monthly capacity at each of the plants.

Plant	Capacity (number of widgets)
P1	100
P2	250
P3	300

Ace Widgets is facing a distribution problem, because the transportation rates (Rand/widget) differ from each of the plants to the different warehouses and they would like to minimise transportation cost. The table below contains the transportation rates.

Plants	Transportation rate to warehouse (Rand/widget)			
	W1	W2	W3	W4
P1	2	6	4	12
P2	7	-	10	11
P3	5	8	-	13

Use the information to formulate a LP model to assist Ace Widgets to minimise transport costs.

QUESTION 2**[41 MARKS]**

- a) The marketing manager for Widgman, a widget distributor, needs to decide how many TV spots and magazine ads to run during the next quarter. Each TV spot costs R5 000 and is expected to increase the sales by 300 000 widgets. Each magazine ad costs R2 000 and is expected to increase the sales by 500 000 widgets. A total of R100 000 may be spent on TV and magazine ads. However, Widgman wants to spend no more than R70 000 on TV spots and no more than R50 000 on magazine ads. Widgman earns a profit of 5 cents on each widget it sells.

Formulate a LP model for this problem and solve it graphically. (27)

- b) Consider the Solver sensitivity results and constraints for a LP minimisation problem:

Variable Cells

Cell	Name	Final Value	Reduced Cost	Objective Coefficient	Allowable Increase	Allowable Decrease
\$A\$2	X	3750	0	0.18	1E+30	0.06
\$B\$2	Y	7500	0	0.1	0.05	1E+30

Constraints

Cell	Name	Final Value	Shadow Price	Constraint R.H. Side	Allowable Increase	Allowable Decrease
\$B\$5	Resource A	600	0	480	120	1E+30
\$B\$6	Resource B	1200	2.125	1200	600	200
\$B\$7	Resource C	1500	-0.75	1500	300	300

$$0.04X + 0.06Y \geq 480$$

$$0.12X + 0.10Y \geq 1200$$

$$0.10X + 0.15Y \leq 1500$$

$$X, Y \geq 0$$

Write down the optimal solution and explain the shadow price of each of the constraints. (14)

QUESTION 3

[48 MARKS]

A company has experienced the following monthly demand for a product over the past eight months:

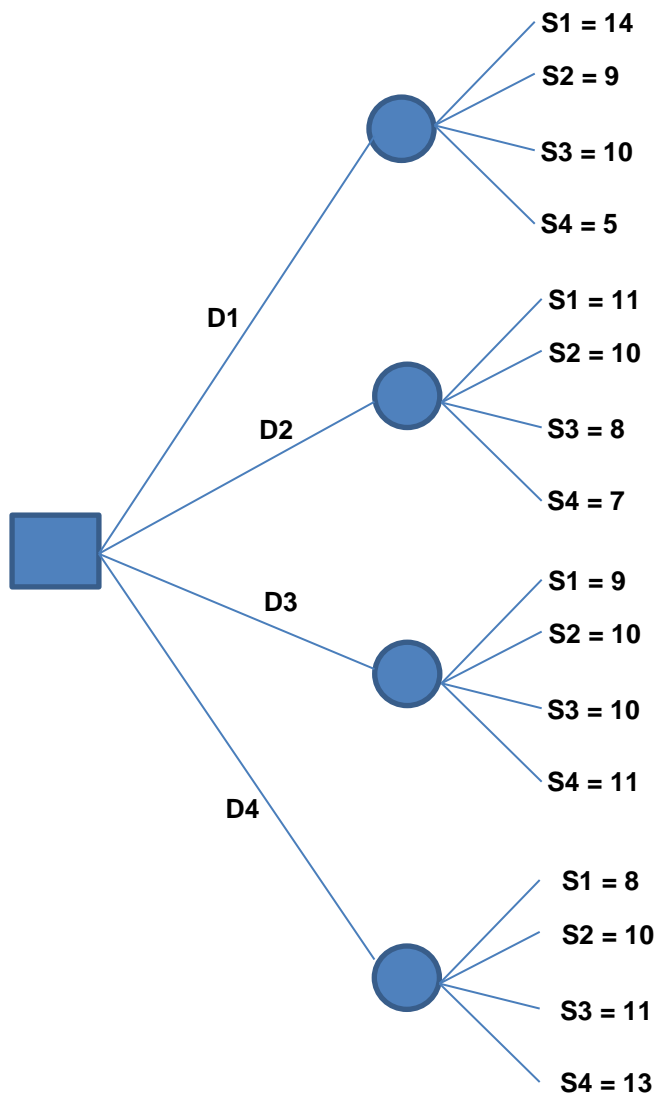
Month	Demand (units)
1	601
2	738
3	686
4	736
5	756
6	498
7	828
8	671

- a) Use a three-month weighted moving average to compute a sales forecast for month 9. (Use weights of 0.4, 0.3 and 0.3 from the most recent month). (3)
- b) Use exponential smoothing ($\alpha = 0.3$ & $\alpha = 0.7$) to compute a sales forecast for month 9. ($F_1 = 610$) (8)
- c) Use trend regression to forecast sales for month 9. (5)
- d) Which of these techniques result in the most accurate forecast for month 9? Explain why the one α - value produces a better forecast than the other. (12)
- e) What are the characteristics of forecasts? (8)
- f) Discuss the component of time series demand. (12)

QUESTION 4

[29 MARKS]

Suppose a decision maker faced with 4 decision alternatives (D1, D2, D3 and D4) and 4 states of nature (S1, S2, S3 and S4) has developed the following decision tree showing the relevant payoffs:



Use the decision tree information and set up a payoff table to determine the best decision using the following decision criteria:

- Maximax
- Maximin
- Minimax Regret
- Hurwicz ($\alpha = 0.6$)
- Equal likelihood

QUESTION 5

[47 MARKS]

- a) Simulation models are mathematical models used for replicating real-world problems to assist in decision making. Discuss the various decisions that can be solved with simulation. (14)
- b) SA Distributors (SAD) distributes various products. However, SAD is particularly concerned with the inventory and transport cost of the widget. Each widget costs R75 and is sold for R125. SAD wants to minimize total costs (inventory carrying, stockout and transport costs) associated with the widget.

The logistics manager was tasked to find the best inventory policy based on monthly demand and decided to investigate the following inventory policy:

Inventory policy

SAD receives monthly deliveries (80 units) from its supplier at the beginning of each month (starting from the second month). Inventory carrying cost is R15 per widget and a cost of R30 for a stockout is assigned. Starting stock = 100 widgets.

The following demand information is supplied:

Monthly demand	Probability
70	0.1
80	0.2
90	0.25
100	0.25
110	0.15
120	0.05

The supplier normally charges a transport rate of R5/gadget. Use this information for five weeks to calculate the average weekly profit. (25)

- c) In your opinion what are the major disadvantages of simulation? (8)

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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

0.11

0.57

0.03

0.30

0.98