



UNIVERSITY
OF
JOHANNESBURG

MODULE : Logistics Management Systems A
CODE : LBS3A01 / LMS13A3
DATE : 09 JUNE 2014 EXAMINATION
DURATION : 3 HOURS
TIME : 12:30 – 15:30
TOTAL MARKS : 180

EXAMINER : Dr S Carstens
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**[26 MARKS]**

The Grand Prix Automobile Company manufactures motor cars at three plants and then ships them to four regions in the country. The plants can supply the following number of cars monthly:

Plant	Monthly capacity
Plant 1	450
Plant 2	600
Plant 3	500

The unit cost (Rand/unit) of shipping cars from each plant to each region is as follows:

Plant	Region 1	Region 2	Region 3	Region 4
Plant 1	131	218	266	120
Plant 2	250	116	263	278
Plant 3	178	132	122	180

The company has not established the regional demand, but the following historical demand information for each region is available:

Month	Region 1	Region 2	Region 3	Region 4
Month 1	398	210	320	297
Month 2	410	197	309	305
Month 3	435	201	298	308
Month 4	445	198	301	298
Month 5	455	202	299	294

Use this information (and the demand for month 6) to **formulate** a linear programming model that would enable the automobile company to minimize transport cost. (**Do not solve the problem**).

Hint: Use a two-month moving average forecast for demand in month 6 for regions 1, 2 and 3. For Region 4 use either a three-month moving average or exponential smoothing forecast for demand in month 6 ($F_1 = 290$).

QUESTION 2**[24 MARKS]**

Ace Widgets makes two models of widgets – regular and deluxe. Both models are assembled from an identical frame. The regular model differs from the deluxe model only in terms of the finish work, which takes 5 hours of labour on the regular model and 8 hours of labour on the deluxe model.

In planning the current month's production, Ace's foreman finds that only 12 frames and 80 hours of finishing labour are available. The supply of all other required materials and labour is unlimited. Any number of widgets can be sold at a profit: R10 per regular widget and R15 per deluxe widget. The foreman wants to produce quantities that will maximize company profits.

- Formulate and solve the foreman's problem. (11)
- Define the marginal value of a resource. Use the information in (a) to calculate the marginal value of the frames. (13)

QUESTION 3**[28 MARKS]**

- a) Demand (sales) can be classified as a time series and as such, includes various components. Discuss these components. (8)
- b) Discuss the characteristics of forecasting techniques. (8)
- c) Briefly discuss the various forecast areas. (6)
- d) Consider the following two data sets, A and B.

x	A	B
1	4	5
2	7	6
3	5	7
4	7	8
5	9	8.5
6	8	9
7	8	9
8	11	9
9	8	8.5
10	10	8

The calculated correlation coefficient for both data sets (x & A; x & B) is 0.81. For which data set would you use simple linear regression analysis to estimate the relationship between the variables? (6)

QUESTION 4**[26 MARKS]**

A Public Service Electric Company has experienced the following monthly demand for electricity:

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. (10)

QUESTION 5**[24 MARKS]**

Hudson Corporation is considering three options for managing its data processing operation: continuing with its own staff, hiring an outside supplier to do the managing or using a combination of its own staff and the supplier.

The cost of the operation depends on future demand. The annual profit of each option (in R1000) depends on demand as follows:

Staffing option	Demand		
	High	Medium	Low
Own staff	650	650	600
Outside supplier	900	600	300
Combination	800	650	500

- Determine the optimal decision using the maximax, maximin, minimax regret, Hurwicz ($\alpha = 0.6$) and equal likelihood decision criteria. (15)
- Hudson performed an economic analysis which enabled them to calculate the following probability assessments: $P(\text{High demand}) = 0.2$, $P(\text{Medium demand}) = 0.5$ and $P(\text{Low demand}) = 0.3$. Use a decision tree to assist Hudson in making the optimum decision. (9)

QUESTION 6**[52 MARKS]**

- Simulation models are mathematical models used for replicating real-world problems. Although simulation is applied widely this type of approach has certain limitations e.g. simulation does not provide an optimal solution. Discuss the areas of application of simulation, as well as the other limitations of simulation. (22)
- Ace is a retailer that distributes various products. However, Ace is particularly concerned with the inventory and transport cost of the gadget. Each gadget costs R75 and sells for R125. Ace wants to minimize total costs (inventory carrying, stockout and transport costs) associated with the gadget.

To this end Ace decided to investigate a specific inventory policy based on monthly demand and the associated least transport cost. The following inventory policy information is available and should be investigated:

Inventory policy

Ace receives monthly deliveries (80 units) from the supplier at the beginning of each month. Inventory carrying cost is R15 per gadget and a cost of R30 for a stockout is assigned. Starting stock = 100 gadgets.

Ace has gathered the demand information for the past 20 months:

120 70 100 90 80 110 100 90 70 80
100 90 110 80 100 110 80 90 100 90

The supplier normally charges a transport rate of R5/gadget. Use this information for five weeks to calculate the average weekly profit. (30)

ANNEXURE/BYLAE

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

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

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

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

$$r = \frac{n \sum xy - \sum x \sum y}{\sqrt{(n \sum x^2 - (\sum x)^2)(n \sum y^2 - (\sum y)^2)}}$$

Random Numbers / Ewekansige getalle

0.104102

0.571916

0.003166

0.299742

0.976173

0.206104

0.354437

0.140915

0.138704

0.425701