



STRATHMORE BUSINESS SCHOOL
BACHELOR OF SCIENCE IN SUPPLY CHAIN AND OPERATIONS MANAGEMENT
END OF SEMESTER EXAMINATION
SCM 3202: SUPPLY CHAIN MODELLING, OPTIMIZATION, SIMULATION AND
GAMING

DATE: Monday, 16th December 2024

TIME: 15:30 – 17:30

Instructions

1. This examination consists of **FIVE** questions.
2. Answer **Question ONE (COMPULSORY)** and any other **TWO** questions.

Question One

(a)

- (i) Briefly explain the decision making environments. **(4 marks)**
- (ii) Outline the inventory costs. **(4 marks)**
- (iii) A company purchases raw materials from an outside supplier at a cost of Sh. 7 per unit. The total annual demand for this product is 9,000 units. The holding cost is Sh. 4 per unit and the ordering cost is Sh.5 per unit. A quantity discount of 3% of the purchase price is available for orders in excess of 1,000 units.

Required:

Should the company order in the batches of 1,000 units and take advantage of the quantity discount? **(5 marks)**

- (b) A public relations director for a homeopathic is seeking to advertise her company's products on two different websites - one is a medical parts supplier and the other is a fitness e-zine (a web-based magazine). The medical parts supplier website receives, on average, about 1,200,000 hits per day per page, while the fitness e-zine receives about 2,000,000 hits per day per page. The daily cost to advertise is Sh.1,100 per advertisement and Sh.1,600 per advertisement, respectively. The director would like at least 15 ads and is able to allocate up to Sh.50,000 for advertising. At least 3 ads should be placed on each website.

Required:

Formulate the linear programming model for the number of ads that should be placed on each website to maximize the potential number of readers (even if some viewers see the ad on different pages of the website)? Do not solve the model. **(5 marks)**

- (c) The following pay-off matrix shows the potential profits in millions of shillings which are expected to arise from launching four products: S1, S2, S3 and S4 for each level of demand; low, moderate or high.

Pay-off matrix			
Demand			
Product	Low	Moderate	High
S1	15	22	29
S2	22	24	28
S3	32	23	34
S4	35	22	33

Required:

Assuming that the products are mutually exclusive, evaluate the optimal decision using:

- (i) Maximax criterion. **(3 marks)**
- (ii) Maximin criterion. **(3 marks)**
- (iii) Salvage criterion **(4 marks)**
- (iv) Laplace criterion **(2 marks)**

(TOTAL: 30 MARKS)

Question Two

- (a) The management of a wall paint manufacturing company is faced with the problem of choosing one of three products to add to its existing product line. The potential demand for each product may turn out to be good, moderate or poor with probabilities estimated as 0.75, 0.15 and 0.10 respectively. The estimated profit or loss under the three states of demand with respect to each product is outlined below:

Product	Type of Demand		
	Good	Moderate	Poor
Silk	70,000	55,000	(10,000)
Matt	100,000	40,000	(6,000)
Gloss	120,000	50,000	(40,000)

Required:

- (i) Advise the management on the choice of product based on the expected monetary value (EMV) criterion. **(4 marks)**
- (ii) Compute the expected opportunity loss for each decision. Give your recommendation. **(5 marks)**
- (iii) Compute the value of perfect information. **(4 marks)**

- (b) Highlight the decision making steps. **(7 marks)**
- (TOTAL: 20 MARKS)**

Question Three

A firm manufactures two models of bicycles; mountain bike and BMX. The firm earns profit of Sh.5,000 and Sh.6,000 on mountain bikes and BMX respectively. Both models are produced in three departments; assembly, fitting and painting. The time required per model produced and the time available per week (in hours) are given in the table below:

Departments	Required time		Available time
	Mountain bike	BMX	
Assembly	2	3	180
Fitting	2	1	120
Painting	3	3	240

Required:

- (i) Formulate the problem above as a linear programming problem in order to maximize profit. **(4 marks)**
 - (ii) Using the simplex method show how the manufacturer should schedule his production to maximize profit. **(12 marks)**
 - (iii) Compute and interpret the slack value for the painting department. **(4 marks)**
- (TOTAL: 20 MARKS)**

Question Four

Jane Cherop was employed by Golden Houses Limited as a sales agent last year. During the year, she was able to sell a maximum of 6 houses in a month. Due to good performance in the past year, the company has offered Jane Cherop one of the following three salary plans for the next year:

Plan A: A 25% salary increment to Sh.50,000 per month.

Plan B: A fixed monthly salary of Sh. 20,000 per month plus a commission of Sh.12,000 per house sold.

Plan C: No monthly salary but a commission of Sh.20,000 per house sold.

Required:

- (i) The pay-off table for the above information. **(6 marks)**
- (ii) The optimal salary plan for Jane Cherop based on the maximin criterion. **(4 marks)**
- (iii) The optimal salary plan for Jane Cherop based on the minimax regret criterion. **(5 marks)**
- (iv) Assume that during the past year, the distribution of the houses sold by Jane Cherop for the 12 months was as follows:

Number of houses sold	0	1	2	3	4	5	6
Number of months	1	2	1	2	1	3	2

- Advise Jane Cherop on the optimal salary plan based on the expected value criterion. **(5 marks)**
- (TOTAL: 20 MARKS)**

Question Five

- (a) Mary Mumbi has recently acquired a water pump which has a useful life of 10 years. It is estimated that the pump is likely to have periodic failures over its useful life. Past data of similar pumps indicate a probability distribution of failures as follows:

<u>Number of failures</u>	<u>Probability</u>
0	0.75
1	0.20
3	0.04
4	0.01

Required:

Simulate the average annual failure rate of the pump using the random numbers:

65,80,30,15,50,90,52,73,62,92

(10 marks)

- (b) A flower vendor buys valentine flowers at Sh.400 per flower and sells at Sh.520 each. If the flower is not sold on 14th Feb each year, it can be disposed of through other channels at Sh.60 per flower. From the previous experience, the following information has been gathered by the flower vendor:

No. of flowers	No. of days
140	5
150	10
160	20
170	35
180	20
190	5
200	5

Required:

Recommend the best level of flowers to stock on 14th Feb 2011 so that the vendor can maximize his profit.

(10 marks)

(TOTAL: 20 MARKS)