

# UNIVERSITY OF COLOMBO, SRI LANKA

## FACULTY OF MANAGEMENT AND FINANCE

**Bachelor of Business Administration (Level II- Semester V) Examination 2017**

### **HLM 2307- Management Science Applications**

**Three (03) Hours**

**Answer All Questions**

**Use of Calculators is allowed**

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1. i. Describe the methodology applied in Management Science Applications (MSA)?  
(04 Marks)
- ii. Describe the role of Management Science Applications in Business Decision Making.  
(03 Marks)
- iii. What are the limitations of Management Science Applications?  
(03 Marks)
- iv. A manufacturer mix four types of raw materials to produce three products named product L, product M and product N. He wishes to determine the optimal mix of the four types of raw materials that will maximize profit. The available maximum quantities of each raw material and the cost per kilogram are as follows.

Types of raw material	Maximum kilogram available	Cost of a kilogram
A	600	15
B	730	16
C	830	18
D	450	12

In order to ensure the proper mix of raw materials, following specification and selling price of each product are given:

Product	Raw material specifications	Selling price
Product L	Not less than 30% of A	40
	Not more than 25% of B	
	Not less than 20% of C	
Product M	Not less than 30% of A	45
	Not less than 40% of C	
Product N	Not more than 40% of A	50
	Not less than 15% of B	

Develop the Linear Program model.

(10 Marks)

**(Total 20marks)**

2. i. What are the basic requirements in Linear Program models?

(04 Marks)

- ii. Solve the following Linear Program Model by graphical method.

$$\text{Max}Z = 6X_1 + 7X_2 \text{ (Income)}$$

$$\text{St. } 3X_1 + 6X_2 \leq 90 \text{ (Raw Materials)}$$

$$3X_1 + X_2 \leq 30 \text{ (Labor)}$$

$$X_1 \leq 14 \text{ (Demand for } X_1)$$

$$X_1, X_2 \geq 0$$

(06 Marks)

iii.  $MaxZ = 6X_1 + 8X_2$  (Profit)

St.  $4X_1 + 6X_2 \leq 120$  (Raw Materials)

$3X_1 + X_2 \leq 60$  (Labor)

$X_1, X_2 \geq 0$

Solve the problem by Simplex Method.

(10 Marks)

(Total 20marks)

3. A company produces three types of electric bulbs: A, B and C. The number of bulbs produced in each type is given by  $X_1$ ,  $X_2$  and  $X_3$  respectively. The Linear Program Model for the production process is given by.

$Max Z = 6X_1 + 12X_2 + 9X_3$  (income)

St.  $2X_1 + X_2 + 3X_3 \leq 120$  (resource 1)

$X_1 + 2X_2 + X_3 \leq 60$  (resource 2)

$3X_1 + 2X_2 + 3X_3 \leq 90$  (resource 3)

$X_1, X_2, X_3 \geq 0$

Given below is the simplex tableau for the optimal solution

cb	Cj	basis	solution	6	12	9	0	0	0
				X1	X2	X3	S1	S2	S3
0		S1	52	-1	-	-	-	3/4	-5/2
12		X2	22	0	-	-	-	3/4	-1/4
9		X3	15	1	-	-	-	-1/2	1/2
	Zj		520	9	-	-	-	4.5	1.5
	Cj-zj			-3	-	-	-	-4.5	-1.5

- i. Fill in the blanks.

(03 Marks)

- ii. Why product "A" is not produced?

(02 Marks)

- iii. What are the marginal prices of resources 2 and 3? (02 Marks)
- iv. Find the upper and lower limits of "B" product. (04 Marks)
- v. Find the upper and lower limits of resource 2. (04 Marks)
- vi. Management of the company is willing to introduce a new product "D" that needs 3 unit of resource one, 2 units of resource two and 3 units of resource three. The selling price of the product is Rs.15. Advice the management. (05 Marks)
- (Total 20marks)**

4. It is expected to transport finished goods from three factories to three retail stores to fill the demand. The capacity of factories and the demand of retail stores are provided below.

Factories	Capacity	Retail stores	Demand
Colombo	200	Gampaha	300
Kadawatha	300	Kelaniya	200
Malambe	400	Horana	300

Transportation cost (Rs.) for one finished good is provided in the following table.

Factories	Retail stores		
	Gampaha	Kelaniya	Horana
Colombo	22	9	8
Kadawatha	9	12	19
Malambe	7	16	14

- i. Take the initial solution from least cost cell method or Vogel's Approximation Method (VAM).

(05 Marks)

ii. Find the optimum solution.

(15 Marks)

(Total 20 marks)

5. i. The project Management needs to construct the network diagram for a project. Following information is provided.

Activity	Preceding events	a	m	b
A-(1-2)	-	2	3	4
B-(1-4)	-	3	4	5
C-(1-3)	-	4	6	8
D-(2-3)	A	4	5	6
E-(2-5)	A	1	3	5
F-(2-6)	A	2	2	2
G-(3-4)	C, D	1	1	7
H-(3-6)	C, D	5	7	9
I-(4-6)	B, G	6	8	10
J-(4-7)	B, G	1	4	7
K-(5-6)	E	2	3	4
L-(5-7)	E	1	2	3
M-(6-7)	F, H, I, K	1	1	1

a. Construct the network diagram and find the critical path.

(08 Marks)

b. Prepare the time table.

(06 Marks)

ii.. A company has four sales regions and wants to assign sales officers for each region in a way to minimize the total sales cost of the company. The officers and the cost associated with each assignment are given in the following table. Find the optimal allocation.

Sales Executives	Regions			
	1	2	3	4
A	210	90	180	160
B	100	70	130	200
C	175	105	140	170
D	80	65	105	120

(06 Marks)

(Total 20 marks)

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