

**EASTERN UNIVERSITY, SRI LANKA**  
**FACULTY OF COMMERCE AND MANAGEMENT**  
**Second Year Second Semester Examination in Bachelor of Business**  
**Administration Honours/Bachelor of Commerce Honours- 2021/2022**  
**[Proper/Repeat] (February/March 2024)**  
**MGT 2053 Management Science**

Calculator is allowed.

Answer All Five Questions.

Time: 03 Hours

Q1.

A steel company is concerned with the problem of distributing imported metal from three ports to four steel mills situated throughout the country.

The supplies of metal arriving at ports are:

<i>Port</i>	<i>Tons per week</i>
<b>P1</b>	20,000
<b>P2</b>	38,000
<b>P3</b>	16,000

Demands at the steel mills are:

<i>Steel Mill</i>	<i>Tons per week</i>
<b>A</b>	10,000
<b>B</b>	18,000
<b>C</b>	22,000
<b>D</b>	24,000

Transportation costs are \$ 0.05 per ton mile. The distances between the ports and the steel mills are given in the following Table.

	<b>A</b>	<b>B</b>	<b>C</b>	<b>D</b>
<b>P1</b>	50	60	100	50
<b>P2</b>	80	40	70	50
<b>P3</b>	90	70	30	50

- (a) *Find* the total minimum transportation cost for initial allocation using the **Least Cost Method**.
- (b) *Find* the total minimum transportation cost for initial allocation using the **North-West Corner Rule Method**.
- (c) Based on the initial feasible solution of **North-West Corner Rule Method**, *find* the total optimum transportation cost using the **MODI** method.

(Total 20 Marks)

Q2.

- (a) Six contractors have submitted tenders to take up six projects advertised. It is noted that one contractor can be assigned only one project. The estimates of cost in thousand rupees given by each of them are indicated below:

Contractor	Project					
	1	2	3	4	5	6
A	41	72	39	52	25	51
B	22	29	49	65	81	50
C	27	39	60	51	32	32
D	45	50	48	52	37	43
E	29	40	39	26	30	33
F	82	40	40	60	51	30

**Required:**

*Find out* the optimal assignment plan such that the total cost of completing the projects is minimum. *What* is the minimum cost?

(10 Marks)

- (b) You are given the following payoff table (in units of thousands of rupees) for a decision analysis problem:

Alternative	State of Nature		
	S <sub>1</sub>	S <sub>2</sub>	S <sub>3</sub>
A <sub>1</sub>	220	170	110
A <sub>2</sub>	200	180	150
Prior Probability	0.6	0.3	0.1

- (i) *Which* alternative should be chosen under the **maximax** criterion?  
(ii) *Which* alternative should be chosen under the **maximin** criterion?  
(iii) *Which* alternative should be chosen under the **maximum likelihood** criterion?

(05 Marks)

- (c) A second year-second semester student of BBA Honours study program of Faculty of Commerce and Management has to make a key decision regarding his/her specialization before the commencement of the third year of study. Assume that the particular student is eligible to choose three specializations such as BBA Honours, BBA Honours in HRM and BBA Honours in Marketing Management. In considering this situation, answer the following questions:

- (i) *List out* at least two key **quantitative** factors/variables influencing on this decision.  
(ii) *List out* at least two key **qualitative** factors/variables influencing on this decision.  
(iii) Can you *apply* any of the decision making techniques of Management Science to make effective decision in the context of specialization selection? If your answer is Yes/Can, *indicate* the appropriate decision making technique(s) of Management Science.

(05 Marks)

(Total 20 Marks)

Q3.

The following activities, with associated costs and times, represent those necessary for the completion of a project to be started by an organization next month. Fixed costs associated with the project are estimated at Rs. 250 per day.

Activity	Preceding Activity	Normal		The times of some of the activities could be reduced, the new times and costs being as follows:	
		Cost (Rs.)	Time (Days)	Time (Days)	Cost (Rs.)
A	-	400	2	1	800
B	A	0	1	1	0
C	B	200	4	2	450
D	B	450	6	2	1150
E	D	700	3	1	1200
F	C, E	200	3	1	600
G	F	600	4	1	1000
H	D	0	2	2	0
I	D	250	3	2	450
J	H, I	600	8	4	950
K	G, J	450	2	1	700
L	K	200	2	1	350

Note:

*In each activity can only be done in the original time or in the new time.*

You are required to *draw* the network diagram and *calculate*:

- (i) The normal duration and normal cost of the project.
- (ii) The minimum duration and associated cost of the project, and
- (iii) The minimum cost of completion and the associated duration of the project.

(Total 20 Marks)

Q4.

- (a) A company works 50 weeks in a year. For a certain part, included in the assembly of several products, there is an annual demand of 10,000 units. The part may be obtained from either an outside supplier or a subsidiary company.

The data set out in the following Table relating to the part are given.

	From outside supplier	From subsidiary company
Purchase price, per unit	Rs. 12	Rs. 13
Storage and all carrying costs, including Capital cost per unit per annum	Rs. 2	Rs. 2
Cost of placing an order	Rs. 10	Rs. 10
Cost of receiving an order	Rs. 20	Rs. 15
Delivery time, certain	10 weeks	5 weeks

You are required to:

- (i) *Calculate* the minimum cost (including purchasing) for a year using the outside supplier.
- (ii) *Calculate* the minimum cost (including purchasing) for a year using the subsidiary company.
- (iii) In considering total cost, *which* option is good for the company? And *Justify* your answer.

(10 Marks)

- (b) A firm is able to obtain quantity discounts on its orders of material as shown in following Table.

Price per ton (Rs.)	Tons bought
6.0	less than 250
5.9	250 and less than 800
5.8	800 and less than 2000
5.7	2000 and less than 4000
5.6	4000 and over

The annual demand for the material is 4000 tons. Stock-holding costs are 20 per cent per year of material cost. The delivery cost per order is Rs. 6. **Calculate** the best quantity order and **explain** why you consider the particular quantity as the best quantity.

(10 Marks)

(Total 20 Marks)

Q5.

- (a) **Solve** the following Linear Programming problem through simplex method and **interpret** the solutions.

**Profit Maximization:**  $P = 7X_1 + 5X_2 + 2X_3$

Subject to:

$$3X_1 + 5X_2 + X_3 \leq 150 \text{ (machine A time)}$$

$$5X_1 + 3X_2 + 2X_3 \leq 100 \text{ (machine B time)}$$

$$X_1 + 2X_2 + X_3 \leq 160 \text{ (machine C time)}$$

$$X_1, X_2, X_3, \geq 0 \quad \text{Non-negativity}$$

(10 Marks)

- (b) A company possesses two manufacturing plants, each of which produces three products from a common raw material. However, the proportions in which the products are produced are different in each plant and so are the plants' operating cost per hour. Data on production and costs are summarised in the following Table together with the current orders on hand for each product.

	Product I (units)	Product II (units)	Product III (units)	Operating Cost (Rs./hour)
Plant A	2	4	3	9
Plant B	4	3	2	10
Orders on hand (units)	50	24	60	

Consider the above linear programming problem as a standard minimization problem.

**You are required to:**

- (i) use the simplex method to **find** the number of production hours needed to fulfil the orders on hand at minimum cost.
- (ii) **interpret** the main features of the final solution.

(10 Marks)

(Total 20 Marks)