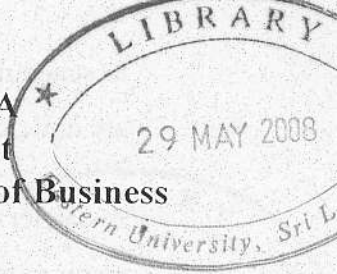


**EASTERN UNIVERSITY, SRI LANKA**  
**Faculty of Commerce and Management**  
**Special Examination for Final Year in Bachelor of Business**  
**Administration 2005/2006**  
**(February 2008)**  
**MGT 3054 Management Science**



**Answer all five (5) questions**

**Time: 03 hours**

**Q1.**

The production manager of a manufacturing company requests the marketing manager to find out the relevant details about the existing markets in certain cities of Sri Lanka in order to improve the present set up.

After conducting a pilot survey, the Marketing manager obtains the requirements of each market (in 000's) and in addition, other relevant information such as the available supply (in 000's) in each warehouse and the unit transportation cost in rupees from each warehouse to each market. All the information collected are given in the following table.

		CO	BT	AM	JF	KY	MR	HB	
		I	II	III	IV	V	VI	VII	Supply (units)
		Rupees/unit							
Warehouses	A	5	2	21	18	4	3	4	22
	B	4	8	15	14	1	6	2	15
	C	4	6	13	15	7	5	1	8
Requirement (units)		7	12	6	4	17	9	5	

(Abbreviations: CO- Colombo, BT- Batticaloa, AM- Ampara, JF- Jaffna, KY-Kandy, MR- Matara, HB-Hambantota). Warehouses (A, B, C) of the company are located in three different provinces.

The transport manager working in the company who is in charge of scheduling activities has to consider all possible constraints in the system and the environment in the country. He then selects some of the possible markets

to schedule the supply in the best possible way. Further, the following changes are anticipated in the future.

A carrier of some route may offer to reduce his rate in the hope of getting some more business. Accordingly, the transport manager will be interested in finding the acceptable amount of reduction so that he can give some more business to that transportation company.

The supply from warehouses may change due to changes in the resources in the company and at the same time requirements of the market may also change due to environmental changes etc.

After consulting the Management Science analyst and other executives of the company, the transport manager decides to select the markets I, II, V and VI (CO, BT, KY and MR respectively).

- (a) Construct this as a transportation model in the usual table format. (06 marks)
- (b) Find the initial solution using the least cost method and evaluate the total cost. (06 marks)
- (c) Starting from the initial solution obtained in (b) arrive at the optimal solution. (06 marks)
- (d) Will there be any change in the optimal solution obtained in (c) if the supply of warehouse B is increased by 1 unit and simultaneously the demand of market V is also increased by 1 unit? Justify your answer. (06 marks)

**(Total marks 24)**

**Q2.** Consider the following Linear Programming problem, for which there are 2 constraints and 3 variables representing A, B and C and unit amounts to be produced denoted by  $X_1$ ,  $X_2$  and  $X_3$  respectively.

Problem in the usual standard form is given as follows:

$$\text{Maximize: } Z=3X_1 + 2X_2 +4X_3$$

$$\text{Subject to: } 2X_1+X_2+X_3 \leq 8$$

$$X_1+X_2+2X_3 \leq 10$$

$$X_1, X_2, X_3 \geq 0$$



- (a) Construct the corresponding dual of this problem. (05 marks)
- (b) Draw to scale the feasible region of the dual problem using the graphical method (06 marks)
- (c) Determine the optimal value of the dual variables, which minimize the corresponding dual objective function. (06 marks)
- (d) After evaluation the optional solution of the dual problem (including surplus or slack), and using relevant duality theorems, determine the unit amounts to be produced from the three products in order to maximize the original Linear Programming problem. (06 marks)
- (e) Verify the duality theorem, which states that objective function values of the Primal and Dual problems are the same at optimality. (02 marks)

(Total marks 25)

- Q3. (a) "EOQ is always determined where annual total ordering cost equals annual total handling cost." Do you agree with this statement? Explain. (03 marks)
- (b) Brainpower Pvt Ltd purchases 25, 000 units of a material each year from a supplier. At the moment, the company obtains the material in batch size of 800 units. The material cost Rs. 16 per units; the cost of ordering a new batch

from the supplier is Rs.32 and the cost of holding one unit in stock due to certain storage difficulties, is Rs. 5 per annum plus an interest cost equal to 16% of the purchase price of the material.

Required:

- (i) Calculate the economic order quantity (EOQ) and the annual saving which would be obtained if this order quantity replaced the current order size of units.

(05 marks)

- (ii) The supplier has agreed to offer a discount on order beyond a certain size. He has offered the following price structure:

Order size (units)	Unit cost (Rs)
0 – 499	16
500 – 999	15.20
1, 000 & above	14.80

How does this affect the optimal order quantity and what would be the annual savings compared to the inventory costs with EOQ you calculated in (i)?

(09 marks)

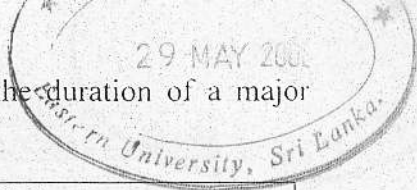
- (c) State the effect on the economic order quantity in (i) if the unit cost is reduced by 10%.

(03 marks)

(Total 20 marks)

- Q4. (a) Nanda, Managing Director of Project Management Service of ABC Ltd. ABC Ltd, a software development company obtained a project that had seven major activities to be carried in the order given in the following table.

Activity	Preceding Activities
A	-
B	A
C	A
D	B
E	C
F	C
G	D, F



Nanda has compiled the following information on the duration of a major activities of that project:

Activity	Duration (Weeks)		
	Optimistic	Most Likely	Pessimistic
A	1	2	3
B	3	5	11
C	5	7	9
D	5	7	12
E	1	2	3
F	7	9	11
G	2	3	4

Given the above information:

- (a) Draw its network diagram. (04 marks)
- (b) What are the critical activities? (02 marks)
- (c) What is the shortest time in which the project can be completed? (02 marks)

**(Total 08 marks)**

(b) The direct costs of that project handled by an ABC organisation are estimated to be Rs. 450. In addition to the above costs, other indirect costs are estimated to be Rs. 400 for the entire 12 week duration of the projects. In the opinion of the CEO of the organisation, the duration was too long and the project manager was asked to investigate possibility of reducing its duration. The project manager found that while there would be a saving of indirect costs at a rate of Rs. 50 per week with the reduction of the duration, the direct cost were sure to increase due to addition resources and overtime working.

According to him, the normal and crash times and direct cost of activities are as follows:

Activity	Normal Time (weeks)	Normal Cost (in Rs.)	Crash Time (weeks)	Crash Cost (in Rs.)
A	3	50	2	70
B	6	80	4	160
C	10	60	9	90
D	11	50	7	150
E	8	100	6	160
F	5	40	4	70
G	6	70	6	70

What would be the minimum duration and its associated cost of the project?

(12 marks)

**(Total 20 Marks)**

**Q5.**

- (a) PQ. Corporation has four plants each of which can manufacture any one of the four products. Product costs differ from one plant to another as follow:

Plant	Product			
	1	2	3	4
A	33	40	43	32
B	45	28	31	23
C	42	29	36	29
D	27	42	44	38

**You are required:**

- (i) to obtain which product each plant should produce to minimize cost,  
(05 marks)
- (ii) to formulate the Linear Programming model for the given assignment problem.

(06 marks)

**(Total 11 marks)**