EASTERN UNIVERSITY, SRI LANKA
Faculty of Commerce and Management
Third Year 2nd Semester Examination in Bachelor of Business
Administration 2004/2005 (November - 2006)
(Proper/Repeat)
MGT 3053 Management Science

Answer all five (5) questions   **Time: 03 hours**

Q1. (a) Define the following terms:

   (i)   Stochastic model   (iv)   Model
   (ii)   Deterministic model   (v)   Mathematical model
   (iii) Feasible solution

(05 marks)

(b) A steel company is concerned with the problem of distributing imported input from four ports to eight steel factories situated throughout the Sri Lanka.

The general manager of that 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 following information:

The supplies of input arriving at ports are:

Port	Tons per week
A	20,000
B	38,000
C	9,500
D	16,000

Demands at the steel factories are:

Steel factory	Tons per week	Steel factory	Tons per week
I	4,500	V	1,000
II	10,000	VI	22,000
III	2,000	VII	24,000
IV	18,000	VIII	1,500

Transportation cost is Rs 0.05 per ton per mile. The distances between the ports and the steel factories are given in the following table (in miles).

	I	II	III	IV	V	VI	VII	VIII
A	80	50	50	60	40	100	50	76
B	60	80	60	40	30	70	50	70
C	60	70	80	90	40	60	65	68
D	70	90	80	70	60	30	50	59

After consulting an OR analyst and other executives of the company, the shipping manager decides to select the factories II, IV, VI and VII and Ports A, B and D.

You are required to calculate the transportation plan which will minimize input distribution costs for the steel company. Compute the optimum cost of this distribution plan.

(15 marks)
(Total 20 marks)

Q2. (a) Consider the activities shown in the following table in a construction project with associated times, costs and preceding activities.

Activity	Preceding activities	Normal		Crash	
		Time (days)	Cost (Rs)	Time (days)	Cost (P-
H	F, G	6	4,000	3	5
A	-	7	6,500	4	8,000
F	C, D	12	13,500	9	16,500
C	-	5	7,000	5	7,000
G	D, E	14	12,750	10	17,750
E	B, C	9	14,000	6	18,000
B	-	10	8,000	7	10,000
D	A,B	8	12,000	5	15,000

The crash information represents the minimum time in which the activity could be completed and the associated cost is the best estimate of the total cost of completing the activity within the shorter time. The choice is between normal time and cost, or crash time and cost, i.e. it is not possible to save one day on a particular activity for a proportionate increase in cost. In addition to the costs for each activity there is a site cost of Rs. 750 per day.
You are required to:
(i) Calculate the normal time and associated minimum cost.

(05 marks)

(ii) Calculate the minimum time and associated minimum cost;

(06 marks)

(iii) Calculate the minimum cost and associated minimum time.

(06 marks)

(iv) Explain two practical problems which may arise when attempting to use this planning tool.

(03 marks)

(Total 20 marks)

Q3. (a) ABC manufacturing Co.Ltd is introducing three products into the market. They have five plants in which these products could be manufactured. The distributors have offered to take 600, 400 and 700 of these products, which cost different amounts to produce in the different plants. In addition, the fourth and fifth plants cannot produce the third product. All plants can manufacture the second product which cost Rs.50, 60, 55, 65, and 52 per unit to manufacture in all the five plants, respectively. The cost of manufacturing the first product in all plants are Rs. 60, 65, 55, 65and 60 in the five plants, respectively. The costs of manufacturing the third product in the first three plants which can manufacture it, are Rs. 80, 85 and 75 respectively. The plants do not have equal capacity. For the purpose of capacity planning, the products can be considered to require the same capacity. The total numbers of units that can be produced in the five plants (no matter what kind of units) are 400, 800, 400, 1000 and 700. All capacities and demands are in units per month.

What is the optimum assignment of manufacturing for the five plants?

(16 marks)

(b) Consider the following data:
1. Objective of the producer is to Maximise the profit
2. Price of the product (Sigma) is Rs. 10/=
3. To produce one unit of Sigma 10 hours of labour is required
4. Limiting factor of the production is labour hours
5. Use "X" to indicate production quantity or required labour hours to produce one unit of Sigma.
6. Maximum availability of labour hours are 55 hours and
7. Consider non negativity assumption($X \geq 0$).

Trial- and - Error Solution Table for the above production model is given:

Decision Alternative (Production Quantity) X	Projected Profit (in Rs)	Total Hours of production	Feasible Solution?
0			
2			
4			
5			
6			

(i) Determine the optimal production unit.
(ii) What is the value of *used* and *unused* production hours in the optimum production level?

(iii) How many additional hours are need to achieve Rs. 250/= as a total projected profit?

(iv) If the capacity is increased by 5 hours what is the value of total profit?

(04 marks)

(Total 20 marks)

Q4. (a) A company machines and drills two castings, X and Y. The time required are:

Casting	Machine hours per casting	Drilling hours per casting
X	4	2
Y	2	5

There are two lathes and three drilling machines, and the working week is 40 hours. Variable costs for both castings are Rs. 6 per unit, and total fixed costs amount to Rs. 50 per week. The selling price of casting X is Rs. 15 per unit, and that of Y is Rs. 18 per unit. How many of each of X and Y should be made in order to maximise profits?

(10 marks)

(b) Consider the following profit maximization problem

$Maximise\ Z = 4X_1 + 5X_2 + 8X_3$

$subject\ to:\ 2X_1 + 2X_2 + 3X_3 \le 240,$

$\qquad\qquad -3x_1 + 9X_2 + 3X_3 \le 300\ and$

$\qquad\qquad\qquad X_1, X_2, X_3 \ge 0,$

Where X_1, X_2 and X_3 are the amounts to be produced from the three products P_1, P_2 and P_3 respectively.

(i) Develop the initial table of the above problem, and state the initial solution.

(03 marks)

(ii) What is the first product that you wish to include in the basic, when applying the Simplex method? Give reasons, so that anybody would understand your answer.

(02 marks)

(iii) Using simplex method construct the final table to get the optimal solution.

(05 marks)

(Total 20 marks)

Q5. (a) XYz is a manufacturer of personal computers. All its personal computers use a 3.5" high-density floppy disk drive purchased from Ynos. XYz operates its factory 52 weeks per year, which requires assembling 100 of these floppy disk drives into computers per week. XYz's annual holding cost rate is 20% of the value of the inventory. Regardless of order size, the administrative cost of placing an order with Ynos has been estimated to be Rs.50. A quantity discount is offered by Ynos for large orders as shown below:

Discount Category	Quantity Purchased	Price (per disk drive)(in Rs)
1	1 to 99	100
2	100 to 499	95
3	500 and more	90

(i) Determine the optimal order quantity according to the EOQ model with and without quantity discounts.

(03 marks)

(ii) What is the resulting total variable inventory cost per year?

(03 marks)

(iii) With this order quantity, how many orders need to be placed per year?

(03marks)

(iv) Determine the time interval between orders.

(03 marks)

(v) How does the ABC control method categorise the products in inventory?

(03 marks)

(b) Draw the diagram representing the curves – Total cost, Purchasing cost, Total ordering cost and Total handling cost.

(05 marks)
(Total 20 marks)