Post Graduate Diploma in Management, 2014-16

Advanced Management Science

DM207B

Trimester-II, End Term Examination, December 2014

Time: 2 Hrs and 30 Minutes Marks: 50

Roll No._____

Instruction: Students are required to write Roll No on every page of the question paper, writing anything except the Roll No will be treated as **Unfair Means.** *In case of rough work please use answer sheet.*

Section A

(Attempt any three 5 x 3=15 marks)

QA1. Write your understanding on 100% rule of Sensitivity Analysis

QA2. Test the consistency of the following pair wise comparison matrix.

$$\begin{pmatrix} 1.000 & 0.500 & 0.200 \\ 2.000 & 1.000 & 0.500 \\ 5.000 & 2.000 & 1.000 \end{pmatrix}$$

QA3. The following are the four goals of the city council of a small city.

Goal 1: $550x_p+35x_f+55x_c+0.75x_g >= 16$

Goal 2: $35x_f <= 0.1(550x_p+35x_f+55x_c+0.75x_g)$

Goal 3: $55x_c <= 0.2(550x_p+35x_f+55x_c+0.75x_g)$

Goal 4: $x_g <= 2$

Develop a LP which minimizes an objective function considering all above four goals when all goals are of equal weight. What do you mean by non preemptive and preemptive method of solving a goal programming problem?

QA4. Write the dual of the following primal problem

Minimize $3x_1-2x_2+x_3$

Subject to

$$2x_1-3x_2+x_3 = 1$$
$$2x_1+3x_2 >= 8$$
$$x_1+ x_2 <= 6$$
$$x_1, x_2 >= 0$$

QA5. Show that the set of all feasible solutions to the linear programming problem is a convex set.

Section B

(Attempt any two 10 x2=20 marks)

QB1. Consider a small company that produces a single product in two plants and serves customers in five different regions. The company has been using a make-to-order policy of producing the product only in the quantities needed to fill the orders that have come in from the various regions. However, because of the problems caused by the sporadic production schedule, management has decided to smooth out the production rate and ship the product to one or more storage warehouses, which then will use inventory to fill the incoming regional orders. Management now needs to decide where to locate the company's new warehouse(s). There are three locations under consideration. For each location, there is a fixed monthly cost associated with leasing and operating the warehouse there. Furthermore, each potential warehouse location has a maximum capacity for monthly shipments restricted primarily by the number of trucking docks at the site. The product costs $400 to produce at plant 1 and $300 to produce at plant 2. The shipping cost from each plant to each potential warehouse location is shown in the first table below. The fixed leasing and operating cost (if open), the shipping costs, and the capacity (maximum monthly shipments) of each potential warehouse location are shown in the second table below. The monthly demand in each of the customer regions is expected to be 200, 225, 100, 150, and 175 units, respectively. Formulate and solve a binary integer programming (BIP) model in a spreadsheet to determine which warehouse(s) should be used and how the product should be distributed from plant to warehouse(s) to customer.

	Shipping Cost (per unit)			*Capacity*
	WH #1	*WH #2*	*WH #3*	*(units/month)*
Plant 1	*$25*	*$50*	*$75*	*500*
Plant 2	*$50*	*$75*	*$25*	*400*

Shipping Costs and Capacity of the Plants

	Fixed Cost	*Shipping Cost (per unit)*					*Capacity*
	(per month)	*Region 1*	*Region 2*	*Region 3*	*Region 4*	*Region 5*	*(units/mo.)*
WH#1	*$50,000*	*$30*	*$70*	*$75*	*$55*	*$40*	*700*
WH#2	*$30,000*	*$55*	*$30*	*$45*	*$45*	*$70*	*500*
WH#3	*$70,000*	*$70*	*$30*	*$50*	*$60*	*$55*	*1000*

Fixed Cost, Shipping Costs, and Capacity of the Warehouses

QB2. Formulate the LP to obtain the priority of the following pair wise comparison matrix.

$$\begin{pmatrix} 1.000 & 0.500 & 0.200 \\ 2.000 & 1.000 & 0.500 \\ 5.000 & 2.000 & 1.000 \end{pmatrix}$$

QB3. Burn-Off, a manufacturer of diet drinks is planning to introduce a drink that will magically burn away fat. The drink is bit expensive but Burn-Off guarantees that a person using this diet plan will lose up to 50 pounds in just three weeks. The drink is made up of four "*mystery*" ingredients (which we will call A, B, C and D). The plan calls for a person to consume at least 36 ounce per day. Each of the four ingredients contains different levels of three chemical compounds (which we will call X, Y and Z). Health regulations mandate that dosage consumed per day should contain minimum prescribed levels of chemicals X and Y and should not exceed maximum prescribed levels for the third chemical Z. The composition of the four ingredients in terms of the chemical compounds (units per ounce) is shown below along with the unit cost of prices of the ingredients. Burn-Off wants to find the optimal way to mix the ingredients to create the drink, at minimum cost per daily dose. Decision variables: Let A, B, C, and D denote the number of ounces of ingredients A, B, C, and D to use, respectively.

Units of Chemical per Ounce of Ingredient					
	Ingredient				
Chemical	A	B	C	D	Requirement
X	3	4	8	10	≥ 280 units
Y	5	3	6	6	≥ 200 units
Z	10	25	20	40	≤ 1050 units

$ per ounce of ingredient			
0.40	0.20	0.60	0.30

The computer outputs of the sensitivity report for the problem are as follows.

Adjustable Cells

Cell	Name	Final Value	Reduced Cost	Objective Coefficient	Allowable Increase	Allowable Decrease
B3	DVs A	10.25	0	0.4	0.061111111	0.25
C3	DVs B	0	0.06875	0.2	1E+30	0.06875
D3	DVs C	4.125	0	0.6	1.5	0.073333333
E3	DVs D	21.625	0	0.3	0.084615385	1E+30

Constraints

Cell	Name	Final Value	Shadow Price	Constraint R.H. Side	Allowable Increase	Allowable Decrease
F5	min req LHS	36	0.375	36	16.5	1.277777778
F6	X LHS	280	0.0875	280	41	11
F7	Y LHS	205.75	0	200	5.75	1E+30
F8	Z LHS	1050	-0.02375	1050	47.14285714	346

Questions:

a. Formulate LP as maximization of profit.

Based on the sensitivity report answer the followings:

b. What is the impact on cost if Burn-Off insists on using 1 ounce of ingredients B to make the drink?

c. There is some uncertainty in the cost of ingredient C. How sensitive is the current optimal solution?

d. Burn-Off can decrease the minimum requirement for chemical X by 5 units (from 280 to 275) provided the maximum limit allowed for chemical Z is reduced to 1000 units (that is, reduced by 50 units). Is this trade-off cost-effective for Burn-Off to implement?

Section C

(Compulsory: 15 marks)

Five data (number of employees, capital, and deposits, loans and investments) for some banks are given below. Capital is measured by the book value of fixed assets and premises, and deposits are measured by the sum of long-term and saving deposits. Similarly, loans include loans to individuals, real estate loans, and commercial and industrial loans. Investments are measured using the value of all securities, other than those held in a bank's trading accounts. Capital, deposits, loans and investments are measured in appropriate money units (US$).

Banks	Loans	Investments	Employees	Capital	Deposits
1	945	233	520	91	3457
2	85	20	43	8	299
3	1200	323	643	109	4203
4	12	4	21	1	40
5	43	8	19	3	198
6	249	40	112	19	892
7	546	98	286	25	1417
8	325	75	215	20	999
9	1513	387	680	121	4802

Answer the followings:

1. Which of the variables are considered as inputs and which of the variables are considered as outputs? Give your justifications.
2. Write the input oriented DEA (CCR) programs for DMU 8 for estimating the efficiency of Bank.
3. Discuss the process of determining input excess and output shortfall for this bank.

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