PGDM,2016

Advanced Management Science

DM204A

Trimester – II, End-Term Examination: Dec 2016

Time allowed: 2 hrs 30 min | Max 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 3 out of 5 questions from this section. Each question carries 5 marks .

Question 1 It is important to understand the assumptions underlying the use of any quantitative analysis model. What are assumptions and requirements for an LP model to be formulated and used?

Question 2 What is element dominance in AHP? How can you overcome it?

Question 3 Under what conditions is it possible for an LP problem to have more than one optimum solution?

Question 4 Discuss the process of getting the weights using eigen value method of a multi criteria decision making problem.

Question 5. Prove that an optimal solution to a Linear Programming problem is attained at vertex of the feasible region.

Section - B

Attempt any 2 out of 3 questions from this section. Each question carries 10 marks.

Question 1 First American Bank issues five types of loans. In addition, to diversify its portfolio, and to minimize risk, the bank invests in risk-free securities. The loans and the risk-free securities with their annual rate of return are given in Table.

Type of Loan or Security	Annual Rate of Return (%)
Home mortgage (first)	6
Home mortgage (second)	8
Commercial loan	11
Automobile loan	9
Home improvement loan	10
Risk-free securities	4

The bank's objective is to maximize the annual rate of return on investments subject to the following policies, restrictions, and regulations:

a. The bank has $90 million in available funds.
b. Risk-free securities must contain at least 10 percent of the total funds available for investments.
c. Home improvement loans cannot exceed $8,000,000.
d. The investment in mortgage loans must be at least 60 percent of all the funds invested in loans.
e. The investment in first mortgage loans must be at least twice as much as the investment in second mortgage loans.
f. Home improvement loans cannot exceed 40 percent of the funds invested in first mortgage loans.

g. Automobile loans and home improvement loans together may not exceed the commercial loans and Commercial loans cannot exceed 50 percent of the total funds invested in Mortgage loans.

Formulate the model.

Question 2 Write the dual of the following LP:

Maximize $Z = 50X_1 + 80X_2 + 30X_3$

Subject to the constraints,

$$3X_1 + 6X_2 + 5X_3 = 45$$
$$6X_1 + 7X_2 + 6X_3 >= 30$$
$$2X_1 + 3X_2 + 4X_3 <= 30$$
$$X_1 \geq 0$$

Question 3 Formulate an AHP problem as an LP model. When it is required to solve an AHP problem as LP problem

Section - C

Compulsory Case Study (15 Marks)

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

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

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

a. Formulate LP as minimization of cost.

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?