PGDM (IB), 2017

Management Science

IB 306

Trimester – III, End-Term Examination: March 2017

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

Question 2 CarpetPlus sells and installs floor covering for commercial buildings. Brad Sweeney, a CarpetPlus account executive, was just awarded the contract for five jobs. Brad must now assign a CarpetPlus installation crew to each of the five jobs. Because the commission Brad will earn depends on the profit CarpetPlus makes, Brad would like to determine an assignment that will minimize total installation costs. Currently, five installation crews are available for assignment. Each crew is identified by a color code, which aids in tracking of job progress on a large white board. The following table shows the costs (in hundreds of dollars) for each crew to complete each of the five jobs.

		Job				
		A	**B**	**C**	**D**	**E**
	Red	30	44	38	47	31
	White	25	32	45	44	25
Crew	**Blue**	23	40	37	39	29
	Green	26	38	37	45	28
	Brown	26	34	44	43	28

Obtain the optimal allocation so as to maximize the total profit.

Question 3 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 4 Find the dual of the following Primal LP:

Maximize $Z = 50X_1 + 80X_2$

Subject to the constraints,

$$3X_1 + 5X_2 \leq 45$$
$$4X_1 + 2X_2 \leq 16$$
$$6X_1 + 6X_2 \leq 30$$
$$X_1 , X_2 \geq 0$$

Question 5

ACTIVITY	DISCRIPTION	IMMEDIATE PREDECESSOR	TIMES (WEEKS)		
			To	Tp	Tm
A	Plan topic	-	1.5	2.0	2.5
B	Obtain speakers	A	2.0	2.5	6.0
C	List meeting locations	-	1.0	2.0	3.0

45

D	Select locations	C	1.5	2.0	2.5
E	Finalize speaker travel plans	B , D	0.5	1.0	1.5
F	Make final check with speakers	E	1.0	2.0	3.0
G	Prepare and mail brochure	B , D	3.0	3.5	7.0
H	Take reservations	G	3.0	4.0	5.0
I	Handle last – minute details	F , H	1.5	2.0	2.5

Show the network for this project. What are the critical path activity and the expected project completion time?

Section B

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

Question 1 A conservative investor has $100,000 to invest. The investor has decided to use three vehicles for generating income: municipal bonds, a certificate of deposit (CD), and a money market account. After reading a financial newsletter, the investor has also identified several additional restrictions on the investments:

1. No more than 40 percent of the investment should be in bonds.
2. The proportion allocated to the money market account should be at least double the amount in the CD.

The annual return will be 8 percent for bonds, 9 percent for the CD, and 7 percent for the money market account. Assume the entire amount will be invested.

Formulate the LP model for this problem, ignoring any transaction costs and the potential for different investment lives. Assume that the investor wants to maximize the total annual return.

Question 2 An organization was investigating relocation its corporate headquarters to one of the three possible cities. The pair wise comparison matrix shows the president's judgment regarding the desirability for the three cities.

	City 1	City 2	City 3
City 1	1	6	5
City 2	1/6	1	3
City 3	1/5	1/3	1

Determine the priorities for the three cities. Is the President consistent in terms of the judgment provided? Explain.

Question 3 The Hardrock Concrete Company has plants in three location and is currently working on three major construction project, each located at a different site. The shipping cost per truckload of concrete, daily plant capacities and daily project requirement are provided in the table below.

Formulate an initial feasible solution to Hardrock's transportation problem using the northwest corner rule. Then evaluate each unused shipping route by computing all improvement indices. Is this solution optimal? Why?
Is there more than one optimal solution to this problem? Why?

To	Project A	Project B	Project C	Plant Capacities
From				
Plant 1	$10	$4	$11	70
Plant 2	$12	$5	$8	50
Plant 3	$9	$7	$6	30
Project Requirements	40	50	60	150

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					
Chemical	Ingredient				Requirement
	A	B	C	D	
X	3	4	8	10	$\geq$ 280 units
Y	5	3	6	6	$\geq$ 200 units
Z	10	25	20	40	$\leq$ 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
	min req					
F5	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?