PGDM (RM), 2020-22

Management Science

RM-202

Trimester – II, End-Term Examination: January 2021

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

SECTION A – (10 marks * 3 questions) = 30 Marks

A1a. What do you mean by a mathematical model of real life situation? Discuss the importance of models in the solution of optimization problems. (CILO 1)

OR

A1b. 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				
		1	**2**	**3**	**4**	**5**
Crew	**Red**	30	44	38	47	31
	White	25	32	45	44	25
	Blue	23	40	37	39	29
	Green	26	38	37	45	28
	Brown	26	34	44	43	28

Use the Hungarian method to obtain the optimal solution.

A2a. What are the assumptions of linear programming? Explain with the help of examples. (CILO2)

OR

A2b. The Krampf Lines Railway Company specializes in coal handling. On Friday, April 13, Krampf had empty cars at the following towns in the quantities indicated:

Town	Supply of Cars
Morgantown	35

Youngstown	60
Pittsburgh	25

By Monday, April16, the following town will need coal cars as follows:

Town	Demand for Cars
Coal Valley	30
Coaltown	45
Coal Junction	25
Coalsburg	20

To	Coal Valley	Coaltown	Coal Junction	Coalsburg
From				
Morgantown	50	30	60	70
Youngstown	20	80	10	90
Pittsburgh	100	40	80	30

Using a railway city to city distance chart, the dispatcher constructs a mileage table for the preceding towns. The result is shown in the table below. Minimizing total miles over which cars are moved to new locations, compute the best shipment of coal cars.

A3a. 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	5	7
City 2	1/5	1	3
City 3	1/7	1/3	1

Determine the priorities for the three cities. Is the President consistent in terms of the judgment provided? Explain. (CILO 3)

OR

A3b. Construct a network for a project having the following activities and activity time:

ACTIVITY	A	B	C	D	E	F	G
PREDECESSOR	-	-	A	A	C , B	C , B	D , E
TIME (MONTH)	4	6	2	6	3	3	5

Find the critical path.

Section - B

Compulsory Case Study (20 Marks) (CILO 1,2 and 3)

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

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

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. 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?