

PGDM (IBM), 2017

Data Analytics

INS-307

Trimester – III, End Term Examination: March, 2019

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 .

Question1: Describe the computational procedure of the optimality test in a transportation problem. What is an assignment problem? Give two applications.

Question 2 How can the concept of duality be useful in managerial decision- Making?

Suppose that in a product-mix problem  $x_1, x_2, x_3,$  and  $x_4$  indicate the units of products 1, 2, 3, and 4, respectively, and we have

$$\text{Max } 4x_1 + 6x_2 + 3x_3 + 1x_4$$

s.t.

$$1.5x_1 + 2x_2 + 4x_3 + 3x_4 \leq 550 \quad \text{Machine A hours}$$

$$4x_1 + 1x_2 + 2x_3 + 1x_4 \leq 700 \quad \text{Machine B hours}$$

$$2x_1 + 3x_2 + 1x_3 + 2x_4 \leq 200 \quad \text{Machine C hours}$$

$$x_1, x_2, x_3, x_4 \geq 0$$

Formulate the dual to this problem.

Question3: An established company has decided to add a new product to its line. It will buy the Product on a manufacturing concern, package it, and sell it to a number of distributors that have been selected on a geographical basis. Market research has already indicated the volume expected and the size of sales force required. The steps shown in the following table are to be planned.

Activity	Description	Predecessors	Duration
A	Organize sales office - 6	-	6
B	Hire salesmen	A	4
C	rain salesmen	B	7
D	Select advertising campaign	A	2
E	Plan advertising campaign	D	4
F	Conduct advertising campaign	E	10
G	Design package	-	2
H	Setup package facilities	G	10
I	package initial stocks J	J,H	6



J	Order stock from manufacturer	-	13
K	Select distributors	A	9
L	Sell to distributors	C,K	3
M	Ship stocks to distributors	I,L	5

Draw a network and indicate the critical path.

Question 4 A national truck rental service has a surplus of one truck in each Of the cities, 1, 2, 3, 4, 5, and 6; and a deficit of one truck in Each of the cities 7, 8, 9, 10 11 and 12. The distances (in km) between the cities with a surplus and cities with deficit are displayed in the table below:

		To					
		7	8	9	10	11	12
From	1	31	62	29	42	25	41
	2	12	19	39	55	71	40
	3	17	29	50	41	22	22
	4	35	40	38	42	27	33
	5	19	30	29	16	20	23
	6	72	30	30	50	41	20

How should the trucks be displayed so as to minimize the total distance travelled?

Question 5 The ABC Company has been a producer of picture tubes for television sets and certain printed circuits for radios. The company has just expanded into full scale production and marketing of AM and AM-FM i radios. It has built a new plant that can operate 48 hours per week. Production of an AM radio in the new plant wi require 2 hours and production of an AM-FM radio will require 3 hours. Each AM radio will contribute Rs. 40 to profits while an AM-FM radio will contribute Rs. 80 to profits. The marketing department, after extensive research has determined that a maximum of 15AM radios and 10 AM-FM radios can be sold each week. Formulate and solve a linear programming model to determine the optimum production mix of AM and FM radios that will maximize profits.

### Section – B

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

Question 1 The following table provides all the necessary information on the availability to each warehouse, the requirement of each market, and the unit transportation cost (in Rs) from each warehouse to each market.

		Market				
		p	Q	R	S	Supply
Warehouse	A	6	3	5	4	22
	B	5	9	2	7	15
	C	5	7	8	6	8
	Demand	7	12	17	9	45



The shipping clerk of the shipping agency has worked out the following schedule, based on his own experience: 12 units from A to Q, 1 unit from A to R, 8 units from A to S, 15 units from B to R, 7 units from C to P and 1 unit from C to R.

- Check and see if the clerk has the optimal schedule.
- Find the optimal schedule and minimum total transport cost.
- If the clerk is approached by a carrier of route C to Q, who offers to reduce his rate in the hope of getting some business, by how much should the rate be reduced before the clerk would offer him the business.

Question 2 A small project is composed of 7 activities, whose time estimates are listed in the table below. Activities are identified by their beginning (i) and ending (j) node numbers.

Activity (i-j)	Estimated Duration (weeks)		
	Optimistic	Most Likely	Pessimistic
1-2	1	1	7
1-3	1	4	7
1-4	2	2	8
2-5	1	1	1
3-5	2	5	14
4-6	2	5	8
5-6	3	6	15

- Draw the network diagram of the activities in the project.
- Find the expected duration and variance for each activity. What is the expected project length?
- Calculate the variance and standard deviation of the project length. What is probability that the project will be completed?
  - At least 4 weeks earlier than expected time.
  - No more than 4 weeks later than expected time.
  - If the project due date is 19 weeks, what is the probability of not meeting the due date.

Given:	Z	0.50	0.67	1.00	1.33	2.00
	Prob.	0.3085	0.2514	0.1587	0.0918	0.0228

Question 3 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	4	6
City 2	1/4	1	7
City 3	1/6	1/7	1

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



**Section - C**

**Compulsory Case Study (15 Marks)**

Bluegrass Farms, located in Lexington, Kentucky, has been experimenting with a special diet for its racehorses. The feed components available for the diet are a standard horse feed product, a vitamin-enriched oat product, and a new vitamin and mineral feed additive. The nutritional values in units per pound and the costs for the three feed components are summarized in the following Table; for example, each pound of the standard feed components contains 0.8 unit of ingredient A, 1 unit of ingredient B, and 0.1 unit of ingredient C. The minimum daily diet requirements for each horse are three units of ingredient A, six units of ingredient B, and four units of ingredient C. In addition, to control the weight of the horses, the total daily feed for a horse should not exceed 6 pounds. Bluegrass Farms would like to determine the minimum-cost mix that will satisfy the daily diet requirements.

**Table: Nutritional Value and Cost Data for the Bluegrass Farms Problem.**

Feed Component	Standard	Enriched Oat	Additive
Ingredient A	0.8	0.2	0.0
Ingredient B	1.0	1.5	3.0
Ingredient C	0.1	0.6	2.0
Cost per pound	\$0.25	\$0.50	\$3.00

**Microsoft Excel Sensitivity Report**

**Adjustable Cells**

Cell	Name	Final Value	Reduced Cost	Objective Coefficient	Allowable Increase	Allowable Decrease
\$C\$3	S	3.514	0.000	0.25	1E+30	0.642857143
\$D\$3	E	0.946	0.000	0.5	0.425	1E+30
\$E\$3	A	1.541	0.000	3	1E+30	1.47826087

**Constraints**

Cell	Name	Final Value	Shadow Price	Constraint R.H. Side	Allowable Increase	Allowable Decrease
\$F\$7		3.000	1.216	3	0.368421053	1.857142857
\$F\$8		9.554	0.000	6	3.554054054	1E+30
\$F\$9		4.000	1.959	4	0.875	1.9
\$F\$10		6.000	-0.919	6	2.478260869	0.4375

- Formulate the model.
- Why all reduced costs for this problem are zero?
- Interpret the shadow price of the constraints table.
- Explain the range of the Adjustable cells table.