

PGDORM SEM II
ASSIGNMENTS
Academic Year 2020-21

Please follow the instructions and submit the assignment in the given time.

1. Assignment is compulsory.
2. Last date to submit this assignment is 20th April, 2021.
3. Assignment should be in written format. You can write the assignment in the Assignment sheet that you received from the Institute or can use single line A4 size papers.
4. No typed assignment or Xerox will be accepted.
5. Mention your details on the front page:
 - a) Full Name
 - b) Application ID No.
 - c) Name of the Subject
6. Do not forget to write the page number on each and every page at the top right hand side of the page.
7. Scan and submit the assignment in PDF format.

ADVANCED LINEAR PROGRAMMING

(20 Marks)

- 1) A firm is producing two products **BETA** and **GAMA** which yield unit profit of Rs 35 and Rs. 40 respectively. The two products are known to need 4 kg and 3 kg of raw material, respectively, per unit and 5 and 4 labour hours respectively. 96 kg of raw material and 120 labour hours are available. The problem is represented as follows

$$\text{Maximize } Z = 35X_1 + 40X_2$$

$$\text{Subject to } 4X_1 + 3X_2 \leq 96 \dots\dots\dots(\text{Resource 1})$$

$$4X_1 + 5X_2 \leq 120 \dots\dots\dots(\text{Resource 2})$$

The max profit obtainable is Rs. 1005/- But the Manager wants to set a **Goal** to achieve a profit of Rs. 1400/-

Can you help him? Explain Mathematically.

(04 Marks)

- 2) Explain the following term with illustrations (**any 2**)

1) Gomory's Cutting Plane Algorithm for Integer LPP

2) Dynamic Programming

3) Non Linear Programming

(04 Marks)

- 3) Solve the given LPP by Simplex only. Find an Optimum Solution. Check if the same solution can be called as Optimum Solution to IPP. If not iterate till you get Integral Values for the Basis.

$$\text{Maximize } Z = 95X_1 + 85X_2$$

(04 Marks)

Subject to

$$1) 3X_1 + 4X_2 \leq 72 \dots(R1)$$

$$2) 6X_1 + 3X_2 \leq 90 \dots(R2)$$

$$X_1, X_2, \geq 0$$

- 4) Solve the following as Parametric Problem:

$$\text{Maximize } Z = 3X_1 + 2X_2$$

$$\text{Subject to, } 1. X_1 + 2X_2 \leq 10 - 4t$$

$$2. 4X_1 - X_2 \leq 8 + 4t,$$

$$\text{for } X_1, X_2 \text{ and } t \geq 0$$

(04 Marks)

- 5) Solve the following as Parametric Problem:

$$\text{Maximize } Z = (8 - 2t) X_1 + (6 + t) X_2$$

$$\text{Subject to, } 1. 5X_1 + 3X_2 \leq 60$$

$$2. 4X_1 + 6X_2 \leq 72$$

$$\text{for } X_1, X_2 \text{ and } t \geq 0$$

(04 Marks)

OPTIMIZATION MODELS -2

(20 Marks)

1. As the Project Manager of Quick Construction Company, you are involved in drawing a network for laying the foundation of a new art museum. The relevant information for all the activities of this project is given in the following table:

Activity	Time estimates (in weeks)			Normal cost for expected duration(Rs.)	Crash cost(Rs.)	Immediate predecessors
	t_o	t_m	t_p			
A	2	3	4	6000	8000	-
B	4	5	6	12000	13500	A
C	3	5	7	16000	22000	A
D	2	4	6	8000	10000	A
E	1	2	3	6000	7500	C,D
F	1	3	5	14000	20000	B,E

(i) Construct the network for the project and perform CPM analysis in detail giving all slacks and floats.

(ii) The Director of your company is not impressed by your PERT analysis. He draws your attention that the project must be completed by seven weeks and refers to the penalty clause in the agreement which provides for payment of penalty at the rate of Rs.2500 for every week or part thereof exceeding seven weeks. Your Director also strongly believes that the time duration of various activities of the project can be crashed to their optimistic time estimates with the crashing costs mentioned in the above table. Determine the optimal duration of the project if your objective is to minimize the sum of the project execution cost and the penalty cost.

(10 Marks)

2. Parul Corporation has four plants each of which can manufacture any one of four products. Production costs differ from one plant to another as do sales revenue. Given the revenue and cost data below, obtain which product each plant should produce to maximize profit:

Plant	Sales revenue (Rs. '000s)			
	Product			
	1	2	3	4
A	50	68	49	62
B	60	70	51	74
C	55	67	53	60
D	58	65	54	69

Plant	Production cost (Rs. '000s)			
	Product			
	1	2	3	4
A	49	60	45	61
B	55	63	45	69
C	52	62	49	58
D	55	64	48	66

(10 Marks)

APPLIED STATISTICS FOR MANAGEMENT

(20 Marks)

Q.1 Consider the following population test scores for a class: *(05 Marks)*

99, 100, 62, 75, 81, 68, 74, 86, 79, 91, 77, 82, 96, 84, 71

- a. Find the mean
- b. Find the standard deviation
- c. What is the z -score associated with $X = 82$?

Q.2 The General Ford Motors Corporation (GFMC) is planning the introduction of a brand new SUV—the Vector. There are two options for production. One is to build the Vector at the company's existing plant in Indiana, sharing production time with its line of minivans that are currently being produced there. If sales of the Vector are just moderate, this will work out well as there is sufficient capacity to produce both types of vehicles at the same plant. However, if sales of the Vector are strong, this option would require the operation of a third shift, which would lead to significantly higher costs. A second option is to open a new plant in Georgia. This plant would have sufficient capacity to meet even the largest projections for sales of the Vector. However, if sales are only moderate, the plant would be underutilized and therefore less efficient. This is a new design, so sales are hard to predict. However, GFMC predicts that there would be about a 60% chance of strong sales (annual sales of 100,000), and a 40% chance of moderate sales (annual sales of 50,000). The average revenue per Vector sold is \$30,000. Production costs per vehicle for the two production options depend upon sales, as indicated in the table below.

	<i>Moderate Sales</i>	<i>Strong Sales</i>
<i>Shared Plant in Indiana</i>	16	24
<i>Dedicated Plant in Georgia</i>	22	20

The amortized annual cost of plant construction and other associated fixed costs for the Georgia plant would total \$400 million per year (regardless of sales volume). The fixed costs for adding Vector production to the plant in Indiana would total \$200 million per year (regardless of sales volume).

Construct a decision tree to determine which production option maximizes the expected annual profit, considering fixed costs, production costs, and sales revenues.

(05 Marks)

Q.3 A genetics engineer was attempting to cross a tiger and a cheetah. She predicted a phenotypic outcome of the traits she was observing to be in the following ratio 4 stripes only: 3 spots only: 9 both stripes and spots. When the cross was performed and she counted the individuals she found 50 with stripes only, 41 with spots only and 85 with both. According to the Chi-square test, did she get the predicted outcome? *(05 Marks)*

Q.4 A production manager at a tire manufacturing plant has inspected the number of defective tires in twenty random samples with twenty observations each. Following are the number of defective tires found in each sample:

Sample Number	Number of Defective Tires	Number of Observations Sampled	Fraction Defective
1	3	20	.15
2	2	20	.10
3	1	20	.05
4	2	20	.10
5	1	20	.05
6	3	20	.15
7	3	20	.15
8	2	20	.10
9	1	20	.05
10	2	20	.10
11	3	20	.15
12	2	20	.10
13	2	20	.10
14	1	20	.05
15	1	20	.05
16	2	20	.10
17	4	20	.20
18	3	20	.15
19	1	20	.05
20	1	20	.05
Total	40	400	

Construct a three-sigma control chart ($z = 3$) with this information.

(05 Marks)