

P.G.D.O.R.M (Part-II)

Aug
2019

Adv. OR - (I)

p3-D-upq-2019-IDOL 2019-147

Con. 351-19.

(For Finance Marketing and Production) MV-7175
(3 Hours) [Total Marks : 100]

- N.B. :**
- (1) Answer any **FIVE** questions.
 - (2) **Figure** on the **RHS** indicates **full marks**.
 - (3) **Support** your answers with **diagrams** illustrations and assumptions if **necessary**.
 - (4) Use of **non-programmable scientific calculator** and **statistical tables** is **permitted**.
 - (5) **Graph paper** will be given if required.

1. (a) Find dual from primal conversion: 10

$$\text{MAX } Z = X_1 - X_2 + 3X_3$$

subject to

$$X_1 + X_2 + X_3 \leq 10$$

$$2X_1 - X_2 - X_3 \leq 2$$

$$2X_1 - 2X_2 - 3X_3 \leq 6$$

$$\text{and } X_1, X_2, X_3 \geq 0.$$

(b) Solve the following using Simplex Method : 10

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

subject to

$$-X_1 + 2X_2 \leq 4$$

$$3X_1 + 2X_2 \leq 14$$

$$X_1 - X_2 \leq 3$$

$$X_1, X_2 \geq 0$$

2. (a) Explain the following with illustrations if necessary : 10

1. Cutting Plane Algorithm to solve an LPP.

2. Infeasible solution of an LPP.

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(b) The table below defines the activities within a small project.

10

Activity	Completion time (weeks)	Immediate predecessor activities
A	2	—
B	3	—
C	4	A
D	3	B, A
E	8	D, C
F	3	C
G	2	E
H	3	F, G

Draw the network diagram.

Calculate the minimum overall project completion time and identify which activities are critical.

3. (a) A project consists of 8 activities. The activity completion times and the precedence relationships are as follows

10

Activity	Completion time (days)	Immediate predecessor activities
A	5	—
B	7	—
C	6	—
D	3	A
E	4	B, C
F	2	C
G	6	A, D
H	5	E, F

Draw the network diagram and find the total float and free float.

(b) Solve using the Graphical method the following problem:

10

$$\begin{aligned}
 &\text{Maximize} && Z = 3X + 2Y \\
 &\text{subject to:} && 2X + Y \leq 18 \\
 &&& 2X + 3Y \leq 42 \\
 &&& 3X + Y \leq 24 \\
 &&& X \geq 0, Y \geq 0
 \end{aligned}$$

4. (a) A furniture manufacturer makes two types of furniture - chairs and sofas. The production of the sofas and chairs requires three operations - carpentry, finishing, and upholstery. Manufacturing a chair requires 3 hours of carpentry, 9 hours of finishing, and 2 hours of upholstery. Manufacturing a sofa requires 2 hours of carpentry, 4 hours of finishing, and 10 hours of upholstery. The factory has allocated at most 66 labor hours for carpentry, 180 labor hours for finishing, and 200 labor hours for upholstery. The profit per chair is 90 and the profit per sofa is 75. How many chairs and how many sofas should be produced each day to maximize the profit? Use the Graphical method. 10

(b) Solve Using Dual- Simplex Method. 10

$$\text{Min } Z = 2X_1 + X_2$$

S.t.

$$3X_1 + X_2 \geq 3$$

$$4X_1 + 3X_2 \geq 6$$

$$X_1 + 2X_2 \leq 3$$

$$X_i \geq 0$$

5. Maximize $Z = X_1 + 4X_2$ 20

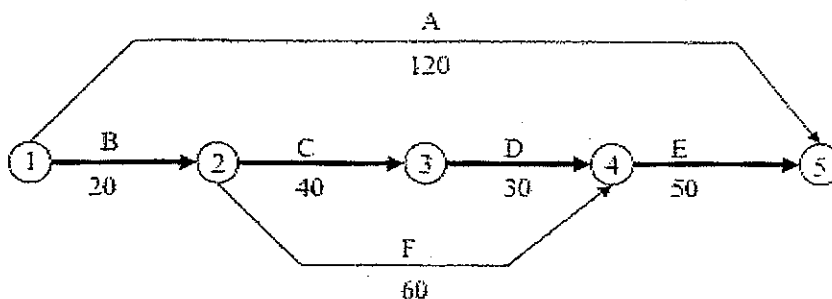
subject to

$$2X_1 + 4X_2 \leq 7$$

$$5X_1 + 3X_2 \leq 15$$

$$X_1, X_2 \text{ are integers } \geq 0$$

6. The network and durations given below shows the normal schedule for a project. You can decrease (crash) the durations at an additional expense. The Table given below summarizes the time-cost information for the activities. The owner wants you to finish the project in 110 days. Find the minimum possible cost for the project if you want to finish it on 110 days. 20



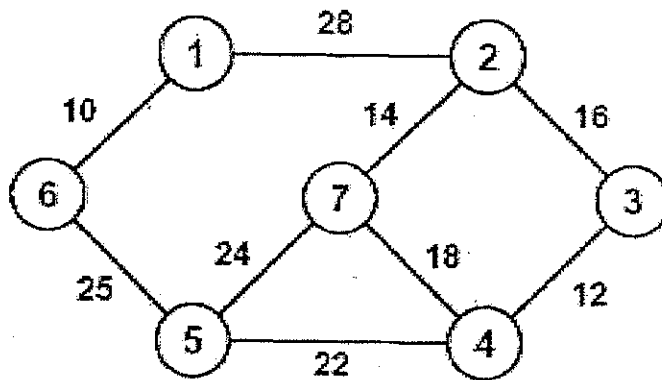
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Activity	Normal Duration (days)	Crash Duration (days)	Normal Cost	Crash Cost
A	120	100	12000	14000
B	20	15	1800	2800
C	40	30	16000	22000
D	30	20	1400	2000
E	50	40	3600	4800
F	60	45	13500	18000

7. (a) (1) Discuss different cases of sensitivity analysis for Simplex LPP solution. 5
 (2) Explain the critical path method for a project with one example. 5
 (b) 10

Maximize
 $P = 2X_1 + X_2$
 subject to
 $X_1 + X_2 \leq 10$
 $-X_1 + X_2 \geq 2$
 $X_1, X_2 \geq 0$

8. Using Kruskal's algorithm find the minimum path length in for the network shown below starting at node 1 and termination at node 7. 20



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[Total Marks : 100

N.B. : (1) Answer any FIVE questions.

(2) Figure on the RHS indicates full marks.

(3) Support your answers with diagrams illustrations and assumptions if necessary.

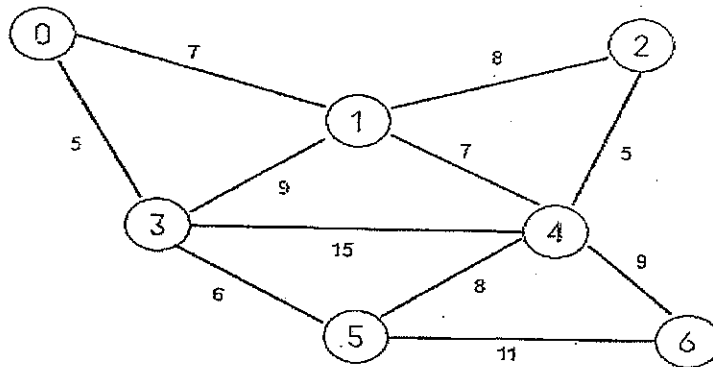
(4) Use of non-programmable scientific calculator and statistical tables is permitted.

(5) Graph paper will be given if required.

1. (a) Find the minimum of $C = 3u + 4v$ 10
 subject to $u + v \geq 4, 2u + v \geq 5, u + 3v \geq 6, u \geq 0, v \geq 0.$

(b) Explain free float, interfering float, head and tail slack in a network. 10

2. Use Kruskal's algorithm to find the length of the optimal path connecting all the nodes in the following network : 20



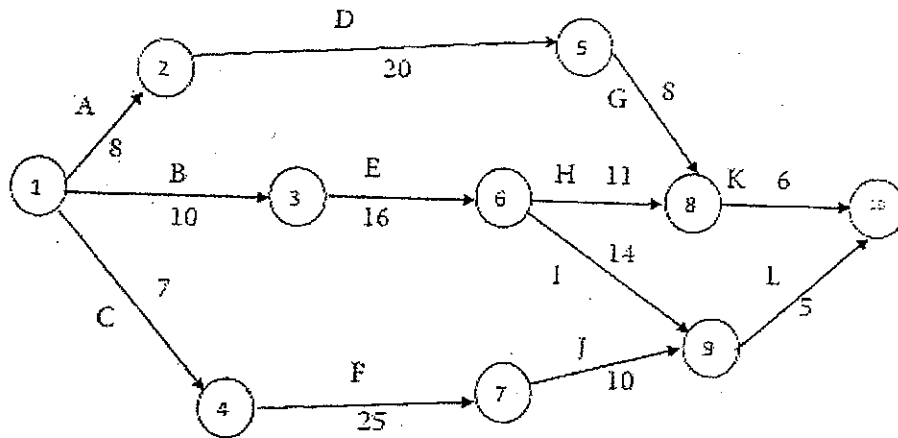
3. (a) Solve the following using Simplex Method : 10

<p>MAXIMIZE $Z = x_1 + 2x_2 - x_3$ SUBJECT TO :</p> $2x_1 + x_2 + x_3 \leq 14$ $4x_1 + 2x_2 + 3x_3 \leq 28$ $2x_1 + 5x_2 + 5x_3 \leq 30$ $x_1 \geq 0; x_2 \geq 0; x_3 \geq 0$

(b) Explain various special cases of Simplex Method. 10

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4. (a) Find out the completion time and the critical activities for the following project : **10**



(b) Solve by Revised Simplex Method the following : **10**

$$\text{Max } Z = X_1 + 2X_2$$

Subject to

$$X_1 + X_2 \leq 3$$

$$X_1 + 2X_2 \leq 5$$

$$3X_1 + X_2 \leq 6$$

and

$$X_1, X_2 \geq 0$$

5. (a) Solve by Graphical Method

$$\text{Maximize } R = 2X + 3Y$$

Subject to

$$-2X - Y \geq -10$$

$$X + 3Y \geq 6$$

$$X \geq 0$$

$$Y \geq 0$$

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(b) Solve by Graphical Method

10

Minimize $T = 3x + y$

Subject to

$x + 2y \geq 4$

$x + 3y \geq 6$

$x \geq 0$

$y \geq 0$

6. Solve the integer programming problem using Gomory's Cutting Plane Algorithm. 20

Maximize $Z = X_1 + 4X_2$

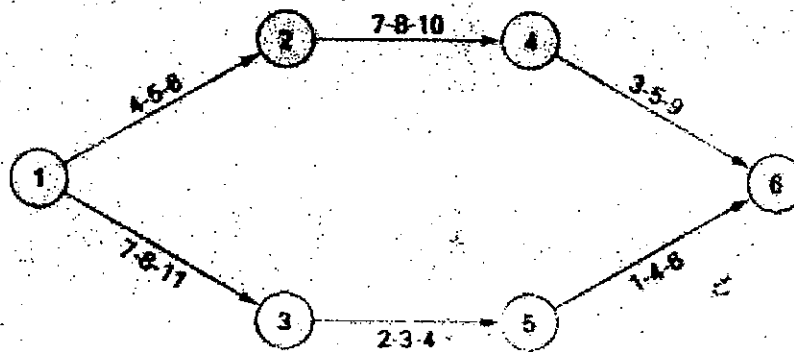
subject to

$2X_1 + 4X_2 \leq 7$

$5X_1 + 3X_2 \leq 15$

X_1, X_2 are integers ≥ 0

7. Given the accompanying network diagram, with times shown in days,
 a. Determine the expected duration of the Project. 20
 b. Compute the probability that ,the project will take at least 18 days.



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(P)

8. The WYNDOR GLASS CO. produces high-quality glass products, including windows and glass doors. It has three plants. Aluminium frames and hardware are made in Plant 1, wood frames are made in Plant 2, and Plant 3 produces the glass and assembles the products. Because of declining earnings, top management has decided to revamp the company's product line. Unprofitable products are being discontinued, releasing production capacity to launch two new products having large sales potential:

- Product 1: An 8-foot glass door with aluminium framing
- Product 2: A 4 X 6 foot double-hung wood-framed window.

Product 1 requires some of the production capacity in Plants 1 and 3, but none in Plant 2. Product 2 needs only Plants 2 and 3. The marketing division has concluded that the company could sell as much of either product as could be produced by these plants. However, because both products would be competing for the same production capacity in Plant 3, it is not clear which mix of the two products would be most profitable. Therefore, an OR team has been formed to study this question.

Formulate the problem as a linear programming problem. Suppose a new constraint $2X_1 + 3X_2 \leq 24$, find the new optimal solution.

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[Total Marks : 100

- N.B. :** (1) Answer any **FIVE** questions.
 (2) **Figure** on the **RHS** indicates **full** marks.
 (3) **Support** your answers with **diagrams** illustrations and assumptions if **necessary**.
 (4) Use of **non-programmable scientific calculator** and **statistical tables** is **permitted**.
 (5) **Graph paper** will be given if **required**.

1. (a) Solve by Revised Simplex Method the following: 10

$$\text{MAX } Z = X_1 + 2X_2$$

subject to

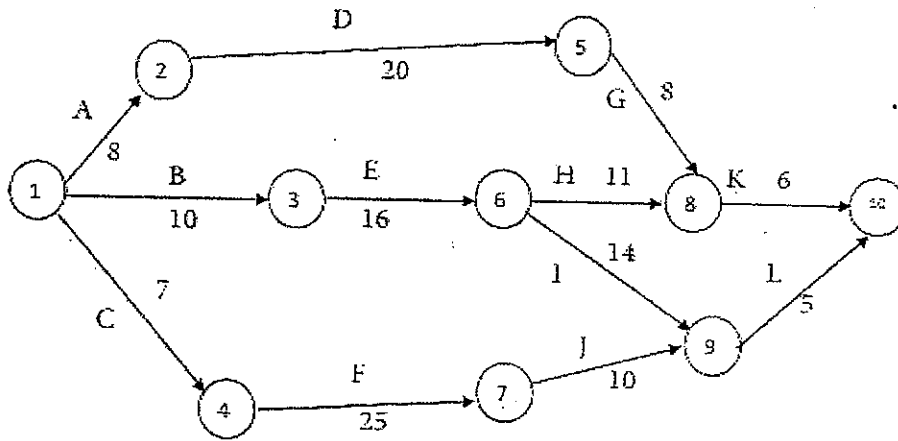
$$X_1 + X_2 \leq 3$$

$$X_1 + 2X_2 \leq 5$$

$$3X_1 - X_2 \leq 6$$

and $X_1, X_2, \geq 0$

(b) Find out the completion time and the critical activities for the following project: 10



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2. (a) Solve by Graphical Method

10

$$\text{Maximize } R = 2x + 3y$$

Subject to

$$-2x - y \geq -10$$

$$x + 3y \geq 6$$

$$x \geq 0$$

$$y \geq 0$$

(b) Solve by Graphical method

10

$$\text{Maximize } T = 3x + y$$

Subject to

$$x + 2y \geq 4$$

$$x + 3y \geq 6$$

$$x \geq 0$$

$$y \geq 0$$

3. Find the minimum possible time of the project and the cost associated with it.

20

Activity	Predecessor activity	Normal time	Crash time	Normal cost	Crash cost
A	—	2	1	10000	15000
B	—	8	5	15000	21000
C	A	4	3	20000	24000
D	B	1	1	7000	7000
E	B	2	1	8000	15000
F	C, D	5	3	10000	16000
G	E	6	2	12000	36000

4. (a) Define the following terms associated with game theory: 10
 Two-player game, Deterministic, Perfect information and Zero-sum.
- (b) Solve the two person zero sum game. 10

-5	-10	-1	-10	2	-1
-1	2	-10	7	-5	20
2	7	-5	-10	-10	7
7	20	-1	-1	-1	2
20	7	-10	7	-1	-10

5. (a) Solve by Simplex Method the following: 10

$$\max Z = 3X_1 + X_2 + X_3$$

$$\text{S.t. } X_1 + X_2 + X_3 \leq 6$$

$$2X_1 - X_3 \leq 4$$

$$X_2 + X_3 \leq 2$$

$$X_1, X_2, X_3 \geq 0$$

- (b) Write short notes on : 10
1. Gomory's cutting plane algorithm
 2. Multiple solutions in LPP

6. (a) Discuss with examples applications of OR Techniques in Marketing. 10

- (b) Use the Dual Simplex Method to solve the following LPP: 10

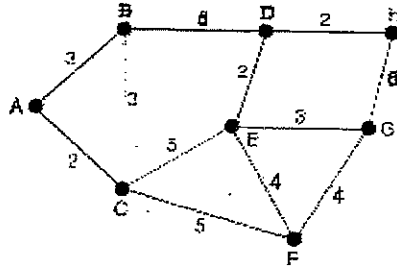
$$\text{Max } Z = -2X_1 - X_2$$

$$\text{s.t. } X_1 + X_2 \geq 5$$

$$X_1 - 2X_2 \geq 8$$

$$X_1, X_2 \geq 0$$

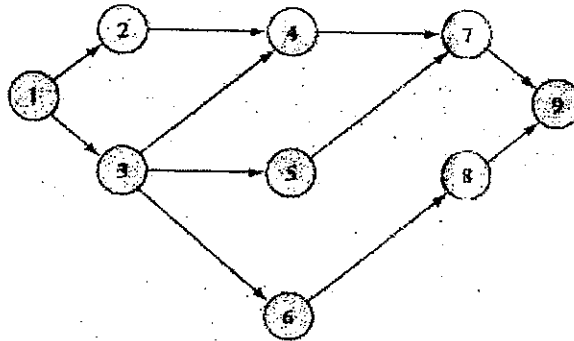
7. Using Kruskal's algorithm, find the minimum spanning tree for the weighted graph of the network shown below: 20



8. Consider the project network given below: For each activity, you are given the estimates of a, b, and m in the table. 20

Determine the following:

- (a) critical path for this network
- (b) total float for each activity
- (c) free float for each activity
- (d) probability that the project is completed within 40 days.



Activity	a	b	m
(1,2)	4	8	6
(1,3)	2	8	4
(2,4)	1	7	3
(3,4)	6	12	9
(3,5)	5	15	10
(3,6)	7	18	12
(4,7)	5	12	9
(5,7)	1	3	2
(6,8)	2	6	3
(7,9)	10	20	15
(8,9)	6	11	9

(FINANCE)

- N.B. : (1) Answer any FIVE questions.
(2) Figure on the RHS indicates full marks.
(3) Support your answers with diagrams illustrations and assumptions if necessary.
(4) Use of non-programmable scientific calculator and statistical tables is permitted.
(5) Graph paper will be given if required.

1. What are the types of reordering systems that can be used in inventory control? 20
Explain the importance and drawback of EOQ model with examples.

2. Use the following information to answer the questions below regarding a Fixed Order Quantity (FOQ) inventory system. Round to the nearest single decimal place. (4 points)

Average weekly demand	12.5
Order cost	\$20
Lead time	3 weeks
Weeks per year	52
Holding cost/unit/year	\$1.20
Current on hand inventory	35 units
Scheduled receipts	20 units
Backorders	2 units

- (a) What is the economic order quantity (EOQ) (Q^*) ?
(b) What is the total annual cost for the EOQ ?
(c) What is the reorder point (r) without safety stock ?
(d) Based on these calculations, should an order be placed ? And if so, for how many units ?

3. Explain with an example Gomory's Cutting Plane Algorithm to solve an IPP. 20

4. From the following information, ascertain by how much the value of sales must be increased by the company to break-even : 20

	₹
Sales	3,00,000
Fixed Cost	1,50,000
Variable Cost	2,00,000

5. Maximize $z = x_1 + 4x_2$ 20

Subject to

$$2x_1 + 4x_2 \leq 7$$

$$5x_1 + 3x_2 \leq 15$$

$$x_1, x_2 \text{ are integers } \geq 0$$

6. Mr. X has retired at the age of 60 from the Government service. He has been paying into his retirement account per month from the last 30 years and now after his retirements, he can start withdrawing funds from the retirement account. As per the agreement, the retirement company is giving him to pay 30,000 on the 1st of each year for the next 25 years, or another option is a one-time payment of 500,000. Now Mr. X wants to know the value of the 30,000 yearly payments made to him compared to a one-time payment. He has the option to choose and he wants to choose which gives him more money. What is the better option for Mr. X at 6% discount rate? **20**
7. Write short notes on : (i) Safety Stock (ii) Reorder Level **20**
8. A glass factory specializing in crystal is experiencing a substantial backlog, and the firm's management is considering three courses of action: **20**
- Arrange for subcontracting
 - Construct new facilities
 - Do nothing (no change)

The correct choice depends largely upon demand, which may be low, medium, or high. By consensus, management estimates the respective demand probabilities as 0.1, 0.5, and 0.4. Given the payoffs solve this problem using a decision tree.

The management estimates the profits when choosing from the three alternatives (A, B, and C) under the differing probable levels of demand. These profits, in thousands of dollars are presented in the table below:

	0.1	0.5	0.4
	Low	Medium	High
A	10	50	90
B	-120	25	200
C	20	40	60

(PRODUCTION)

- N.B. :** (1) Answer any **FIVE** questions.
(2) **Figure** on the **RHS** indicates **full** marks.
(3) Support your answers with **diagrams** illustrations and assumptions if **necessary**.
(4) Use of non-programmable **scientific calculator** and **statistical tables** is **permitted**.
(5) **Graph paper** will be given if **required**.

1. The demand for a product in each of the last five months is shown below: **20**

Month	1	2	3	4	5
Demand ('00s)	14	15	16	17	18

Use a two month moving average to generate a forecast for demand in month 6.
Apply exponential smoothing with a smoothing constant of 0.9 to generate a forecast for demand for demand in month 6.

2. Use the following information to answer the questions below regarding a Fixed Order Quantity (FOQ) inventory system. Round to the nearest single decimal place. (4 points) **20**

Average weekly demand	12.5
Order cost	\$ 20
Lead time	3 weeks
Weeks per year	52
Holding cost/unit/year	\$ 1.20
Current on hand inventory	35 units
Scheduled receipts	20 units
Backorders	2 units

- (a) What is the economic order quantity (EOQ) (Q^*) ?
(b) What is the total annual cost for the EOQ ?
(c) What is the reorder point (r) without safety stock ?
(d) Based on these calculations, should an order be placed ? And if so, for how many units ?
3. At the end of each month, a research and development team writes status reports for the projects at work. The team leaders A and B, submit them to the R&D director on the first Monday of each month. Unfortunately, they forgot to check their calendar one month until late Friday evening. To their surprise, they discovered that the month ended on Sunday and the reports were due the following Monday morning. As they had not started writing them, they decided to come to work early Saturday morning, so they could finish the reports before Monday morning. They split the work as follows: A writes and edits the reports while B collates data and draws all the necessary graphs. Assume that B starts the work on a report as soon as A is finished with it and that A works continuously. Times for the reports (in hours) are as follows: **20**

Projects	Andrew	Julie
A	4	2
B	3	5
C	5	1
D	7	3
E	8	6

What is the order of the tasks?

4. New Delhi Railway Station has a single ticket counter. During the rush hours, customers 20
hours, customers arrive at the rate of 10 per hour. The average number of customers that
can be served is 12 per hour. Find out the following:
 - (a) Probability that the ticket counter is free.
 - (b) Average number of customers in the queue.
5. Explain the concepts of Exponential and Poisson distributions with respect to a waiting 20
line with an example.
6. Define the concept of Human Machine Interface with at least four examples of industrial 20
applications.
7. A travelling salesman, named Rolling Stone plans to visit five cities 1, 2, 3, 4 & 5. The 20
travel time (in hours) between these cities is shown below :

	To				
From	1	2	3	4	5
1	∞	5	8	4	5
2	5	∞	7	4	5
3	8	7	∞	8	6
4	4	4	8	∞	8
5	5	5	6	8	∞

How should Mr. Rolling Stone schedule his touring plan in order to minimize the total travel time, if he visits each city once a week?

8. What is Goal Programming and explain how does it differ from Linear Programming? 20

(MARKETING)

- N.B. : (1) Answer any FIVE questions.
(2) Figure on the RHS indicates full marks.
(3) Support your answers with diagrams illustrations and assumptions if necessary.
(4) Use of non-programmable scientific calculator and statistical tables is permitted.
(5) Graph paper will be given if required.

1. Write short notes on: (i) Safety Stock (ii) Re-order line. 20
2. A grocery receives its weekly supply of eggs every Thursday morning. This shipment must last until the following Thursday when a new shipment is received. Any eggs left unsold by Thursday are destroyed. Eggs sell for ₹ 10 per hundred and cost ₹ 8 per hundred. The weekly demand for eggs at this grocery varies from week to week. From past experience, the following probability distribution is assigned to weekly demand: 20

Demand (hundreds of eggs):	10	11	12	13	14
Probability:	0.2	0.3	0.1	0.2	0.2

This pattern of demand remains stable throughout the year - the demand for eggs is not seasonal, and the trend is flat. How many eggs should be ordered for delivery every Thursday?

3. Write short notes on: 20
(a) FSN Analysis of inventory control
(b) Economic order quantity
4. The probability of a certain medical test being positive is 90%, if a patient has disease D. 1% of the population have the disease, and the test records a false positive 5% of the time. If a positive test is received, what is the probability of having D? Use Bayesian approach. 20
5. The table below shows the demand for a new aftershave in a shop for each of the last 7 months. 20

Month	1	2	3	4	5	6	7
Demand	23	29	33	40	41	43	49

- (a) Calculate a two month moving average for months two to seven. What would be your forecast for the demand in month eight?
- (b) Apply exponential smoothing with a smoothing constant of 0.1 to derive a forecast for the demand in month eight.
6. Explain in detail various costs associated with inventory management: 20
7. Explain with examples any four different forecasting techniques. 20
8. An airline offers coach and first-class tickets. For the airline to be profitable, it must sell a minimum of 25 first-class tickets and a minimum of 40 coach tickets. The company makes a profit of ₹ 225 for each coach ticket and ₹ 200 for each first-class ticket. At most, the plane has a capacity of 150 travellers. How many of each ticket should be sold in order to maximize profits? 20

Con. 367-19.

MV-7965

(3 Hours)

[Total Marks : 100

- N.B. : (1) Attempt any 5 questions.
(2) All questions carry equal marks.

1. Explain Characteristics, Capabilities and components of DSS. 20
2. Explain MIS. 20
3. (a) Explain DFD. 10
(b) Explain various components of computers, Input and output devices. 10
4. (a) Explain basic structure of COBOL. 10
(b) Explain different types of Computer Memory and storage capacity. 10
5. Explain RDBMS and Query Language. 20
6. Explain History of Operating System and various functionality. 20
7. Explain various capabilities of an Expert system. 20
8. Write short notes on :— 20
 - (a) Explain role of IS in business environment and Data Processing.
 - (b) Explain various types of software.
 - (c) Explain decision making and looping statement in 'C'.
 - (d) Explain ERD.

Integrated Approach to

Con. 368-19.

O.R.

MV-7996

(3 Hours)

[Total Marks : 100

- N.B. : (1) Question No. 1 is compulsory and attempt any four from the rest.
(2) Real life examples will receive more weightage.
(3) Answer must be brief and to the point.
(4) Figures to the right indicate full marks.

1. Develop a model for business excellence addressing all department of 20 a manufacturing company.

OR

Contribution of OR techniques to achieve breakthrough improvements in FMCG.

2. (a) Explain interface of OR with other departments. 10
(b) Explain various application of OR in Scheduling airlines, trains and buses. 10
3. (a) Explain typical OR study between theory and practice. 10
(b) Explain various OR techniques. 10
4. (a) Explain characteristics of SP & TP. 10
(b) Explain MIS & its limitations. 10
5. (a) Explain transport module with example. 10
(b) Highlight contribution of OR in Corporate Planning & Planning Process. 10
6. (a) Explain stages of development of OR. 10
(b) Explain Lean, Agile & JIT. 10
7. Write short notes on any four of the following :— 20
(a) Different quantitative areas in decision making.
(b) Kaizen.
(c) Internal operation research group.
(d) Role of IT in OR.
(e) Role of DSS in any company.
(f) Kanban.