Model Solution

M.C.A. 2020 (Management Faculty)

Optimization Techniques (2020 Pattern)- Set B

(MT-21) (Semester - II)

Max. Marks : 50

Time: 2.5 Hours

Instructions to the candidates:

1) *All questions are compulsory.*
2) *Use of statistical table and non programmable calculator is allowed.*
3) *Figures to the right indicate full marks.*

Q1) Attempt the following MCQs (0.5 mark each) [10]

1 A minimization problem can be converted into a maximization problem by changing the sign of coefficients in the ________

a) constraints

b) **Objective Function**

c) Both A and B

d) None of the above

2 The order in which machines are required for completing jobs is called as

a) Machine order

b) Job order

c) Processing order

d) Working order

3 Floats for critical activities will be always ____________

a) one

b) zero

c) highest

d) same as duration of the activity

4 Problems based on the phenomenon of decision making under risk are referred to as ______________.

a) Numerical Problem

b) Complex problem

c) Probabilistic problems

d) None of above

5 The saddle point in a payoff matrix is always the ___________.

a) largest number in the matrix

b) Smallest number in its column and the smallest number in its row

c) Smallest number in the Matrix

d) largest number in its column and the smallest number in its row

6 As simulation is not an analytical model, therefore the result of simulation must be viewed as

a) Unrealistic

b) Exact

c) **Approximation**

d) Simplified

7 If in a LPP , the solution of a variable can be made infinity large without violating the constraints, the solution is _________

a) Infeasible

b) Unbounded

c) Alternative

d) None of the above

8 In sequencing if smallest time for a job belongs to machine A then that job has to placed towards ------------------- in the sequence

a) right

b) left

c) centre

d) None of the above

9 Backward pass calculations are done to find ------------------- occurrence times of events.

a) tentative

b) definite

c) latest

d) earliest

10 In the Hurwicz approach, Coefficient of Pessimism is denoted by

a) α

b) 1- α

c) 1/α

d) α 2

11 In a mixed strategy, each player should optimize the

a) maximum payoffs

b) lower value of the game

c) minimum loss.

d) expected gain

12 A problem is classified as Markov chain provided

a) There are finite number of possible states

b) States are collectively exhaustive & mutually exclusive

c) Long-run probabilities of being in a particular state will be constant over time

d) All of the above

13 In simplex method, if there is tie between a decision variable and a slack (or surplus) variable for entering, ___________ should be selected

a) Slack variable

b) Surplus variable

c) Decision variable

d) None of the above

14 To identify the optimal sequence, a 3 machine problem has to be converted into --------- machine problem

a) 1

b) 2

c) M

d) none of the above

15 CPM stands for________

a) Control Path Method

b) Critical Path Method

c) Control Path Management

d) Critical Plan Management

16 The minimin criterion is used when consequences are given in the form of ___________.

a) Probabilities

b) Table

c) Opportunity loss

d) Payoff

17 Each player should follow the same strategy regardless of the other player's strategy in which of the following games?

a) Constant strategy

b) Mixed strategy
c) **Pure strategy**
d) Dominance strategy

18 In Markov analysis, state probabilities must
a) **Sum to one**
b) Be less than one
c) Be greater than one
d) d. None of the above

19 ------------------------are the entities whose values are to be determined from the solution of the LPP.
a) Objective function
b) **Decision Variables**
c) Constraints
d) Opportunity costs

20 The longest path in the network diagram is called ____________path.
a) best
b) worst
c) sub-critical
d) **critical**

Q 2) **a)** Solve the following LPP [6]

Maximize $Z = -2x_1 - x_3$

subject to

$x_1 + x_2 - x_3 \geq 5$

$x_1 - 2x_2 + 4x_3 \geq 8$

$x_1, x_2, x_3 \geq 0$

Solution:

PHASE-I

	C_j	0	0	0	0	0	-1	-1		
Basic variables	C_B	X_1	X_2	X_3	S_1	S_2	A_1	A_2	**Solution values**	**Ratio**
A_1	-1	1	1	-1	-1	0	1	0	5	---
A_2	-1	1	-2	4	0	-1	0	1	8	2 →
	Z_j	-2	1	-3	1	1	-1	-1		
	$C_j - Z_j$	2	-1	3 ↑	-1	-1	0	0		

	C_j	0	0	0	0	0	-1		
Basic variables	C_B	X_1	X_2	X_3	S_1	S_2	A_1	**Solution values**	**Ratio**
A_1	-1	5/4	1/2	0	-1	-1/4	1	7	28/5 →
X_3	0	1/4	-1/2	1	0	-1/4	0	2	8
	Z_j	-5/4	-1/2	0	1	1/4	-1		
	$C_j - Z_j$	5/4 ↑	1/2	0	-1	-1/4	0		

	C_j	0	0	0	0	0	
Basic variables	C_B	X_1	X_2	X_3	S_1	S_2	Solution values
X_1	0	1	2/5	0	-4/5	-1/5	28/5
X_3	0	0	-3/5	1	1/5	-1/5	3/5
	Z_j	0	0	0	0	0	
	$C_j - Z_j$	0	0	0	0	0	

Artificial variables are eliminated hence we proceed to Phase-II

PHASE- II

	C_j	-2	0	-1	0	0		
Basic variables	C_B	X_1	X_2	X_3	S_1	S_2	Solution values	Ratio
X_1	-2	1	2/5	0	-4/5	-1/5	28/5	14 →
X_3	-1	0	-3/5	1	1/5	-1/5	3/5	---
	Z_j	-2	-1/5	-1	7/5	3/5		
	$C_j - Z_j$	0	1/5 ↑	0	-7/5	-3/5		

	C_j	-2	0	-1	0	0	
Basic variables	C_B	X_1	X_2	X_3	S_1	S_2	Solution values
X_2	0	5/2	1	0	-2	-1/2	14
X_3	-1	3/2	0	1	-1	-1/2	9
	Z_j	-3/2	0	-1	1	1/2	
	$C_j - Z_j$	-1/2	0	0	-1	-1/2	

Optimum Solution is arrived at with value of variables as :

$X_1 = 0$, $X_2 = 14$, $X_3 = 9$

Maximum Z = -9 ; x1=0, x2=14, x3= 9

b) Solve the game for the given pay-off matrix: [4]

-5	3	1	20
5	5	4	6
-4	-2	0	-5

Solution:

	B_1	B_2	B_3	B_4	Row Minimum	
A_1	-5	3	1	20	-5	
A_2	5	5	4	6	4	**Maximin = 4**
A_3	-4	-2	0	-5	-5	
Column Max	5	5	4	20		

Minimax = 4

Saddle Point = 4

Optimal Strategy for A = A_2

Optimal Strategy for B = B_1

Value of the game V = 4

OR

Q 2) a) Solve the following LPP:

$$\text{Maximize } Z = 3x_1 + 2x_2$$

Subject to the constraints:

$$x_1 + x_2 \leq 4$$

$$x_1 - x_2 \leq 2$$

$$x_1, x_2 \geq 0$$

Solution:

	C_j	3	2	0	0		
Basic variables	C_B	X_1	X_2	S_1	S_2	**Solution values**	**Ratio**
S_1	0	1	1	1	0	4	4
S_2	0	1	-1	0	1	2	2 →
	Z_j	0	0	0	0		
	$C_j - Z_j$	3 ↑	2	0	0		

	C_j	3	2	0	0		
Basic variables	C_B	X_1	X_2	S_1	S_2	**Solution values**	**Ratio**
S_1	0	0	2	1	-1	2	2 →
X_1	0	1	-1	0	1	2	Reject
	Z_j	3	-3	0	3		
	$C_j - Z_j$	0	5 ↑	0	-3		

	C_j	3	2	0	0	
Basic variables	C_B	X_1	X_2	S_1	S_2	**Solution values**
X_2	2	0	1	1/2	-1/2	1
X_1	3	1	0	1/2	1/2	3
	Z_j	3	2	5/2	1/2	
	$C_j - Z_j$	0	0	-5/2	-1/2	

Optimum Solution is arrived at with value of variables as :

$X_1 = 3$

$X_2 = 2$

Maximum Z = 13 ; $x_1=3$, $x_2=2$

b) The following is the pay-off matrix of a game being played by A and B. Determine the optimal strategies for the players and the value of the game.

Solution:

		B's Strategy		Row Minimum
		B_1	B_2	
A's Strategy	A_1	9	-6	-6
	A_2	-5	5	-5 ← Maximin
Column Maxima		9	5 ↑ Minimax	

The maximin value is not equal to the minimax value, implying there is no saddle point in this problem. Hence it is a game of mixed strategies.

Let p = Probability that player A uses strategy A_1

∴ 1-p = Probability that player A uses strategy A_2

q = Probability that player B uses strategy B_1

∴ 1-q = Probability that player B uses strategy B_2

for player A we have

$$p = \frac{a_{22} - a_{21}}{(a_{11} + a_{22}) - (a_{12} + a_{21})} = \frac{5 - (-5)}{(5 + 9) - (-5 + (-6))}$$

$$\therefore\ p = \frac{10}{25} = \frac{2}{5} \qquad and \quad 1 - p = 1 - \frac{2}{5} = \frac{3}{5}$$

Similarly, for player B we have,

$$q = \frac{a_{22} - a_{12}}{(a_{11} + a_{22}) - (a_{12} + a_{21})} = \frac{5 - (-6)}{(5 + 9) - (-5 + (-6))}$$

$$\therefore\ q = \frac{11}{25} \qquad and\ 1 - q = 1 - \frac{11}{25} = \frac{14}{25}$$

The maximum gain for player A will be given by the value of the game.

$$v = \frac{a_{11}a_{22} - a_{12}a_{21}}{(a_{11} + a_{22}) - (a_{12} + a_{21})} = \frac{9 \times 5 - (-5)(-6)}{(9 + 5) - (-6 - 5)} = \frac{15}{25} = \frac{3}{5}$$

Hence the optimal strategy for player A is (p, 1- p) i.e $\left(\frac{2}{5}, \frac{3}{5}\right)$

and the optimal strategy for player B is (q, 1- q) i.e $\left(\frac{11}{25}, \frac{14}{25}\right)$

A should use strategy A_1 for $\frac{2}{5}^{th}$ of the times and strategy A_2 for $\frac{3}{5}^{th}$ of the times resulting in a gain of $\frac{3}{5}$ units to A.

Similarly, B should use strategy B_1 for $\frac{11}{25}^{th}$ of the times and strategy B_2 for $\frac{14}{25}^{th}$ of the times resulting in a loss of $\frac{3}{5}$ units to B.

Q 3) a) The following information regarding a project is given [6]

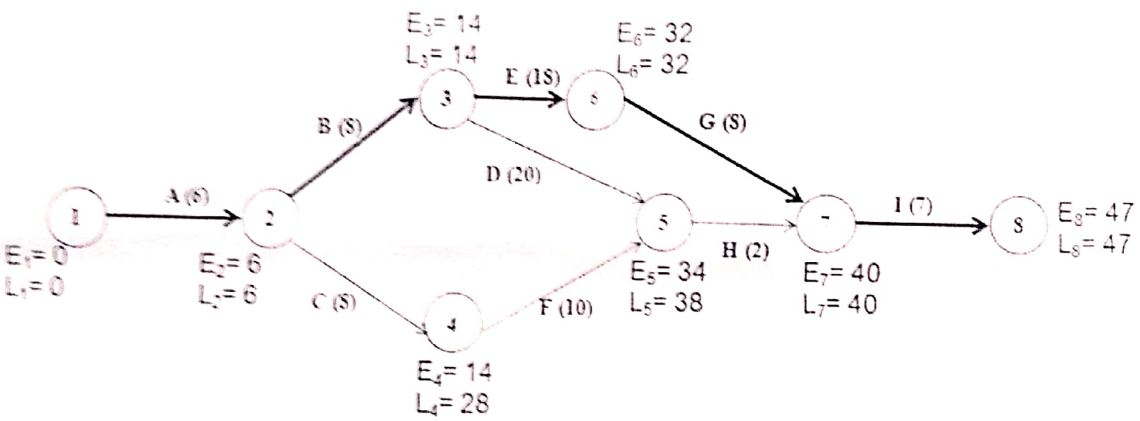
Activity	Immediate Predecessor	Time in days: Most Optimistic	Most Likely	Most Pessimistic	Expected Time	Variance
A	-	4	6	8	6	**0.44**
B	A	5	7	15	8	**2.77**
C	A	4	8	12	8	1.77
D	B	15	20	25	20	2.77
E	B	10	18	26	18	**7.11**
F	C	8	9	16	10	1.77
G	E	4	8	12	8	**1.77**
H	D,F	1	2	3	2	0.11
I	G,H	6	7	8	7	**0.11**

i) Construct an arrow diagram for this problem
ii) Determine the critical path and compute the expected completion time.
iii) Determine the probability of completing the project in 55 days.

Solution:

i)

The network diagram is shown below



ii) The critical path is 1-2-3-6-7-8 or A-B-E-G-I
Expected Project completion time is 47 days

iii) Variance = 12.20; $\sigma = 3.492$
$P(X \leq 55) = P(Z \leq 2.29) = 0.9981$

b) Consider the following profit table along with the given probabilities of each state. [6]

Strategies	States: N_1	N_2	N_3
	Probability		
	0.3	**0.6**	**0.1**
S_1	20	18	-9
S_2	25	15	10
S_3	40	-10	12

Calculate

i. EMV
ii. EVPI
iii. VPI

Solution:

i. EMV

$EMV(S_1) = 0.3(20) + 0.6(18) + 0.1(-9) = 15.9$

$EMV(S_2) = 0.3(25) + 0.6(15) + 0.1(10) = 17.5$

$EMV(S_3) = 0.3(40) + 0.6(-10) + 0.1(12) = 7.2$

Maximum EMV is 17.5.

$EMV_{max} = 17.5$ corresponds to Strategy S_2. Hence S_2 is optimal strategy.

ii. $EVPI = 0.3(40) + 0.6(18) + 0.1(12) = 24$

iii. $VPI = EVPI - EMV_{max}$

$= 24 - 17.5$

$= 6.5$

OR

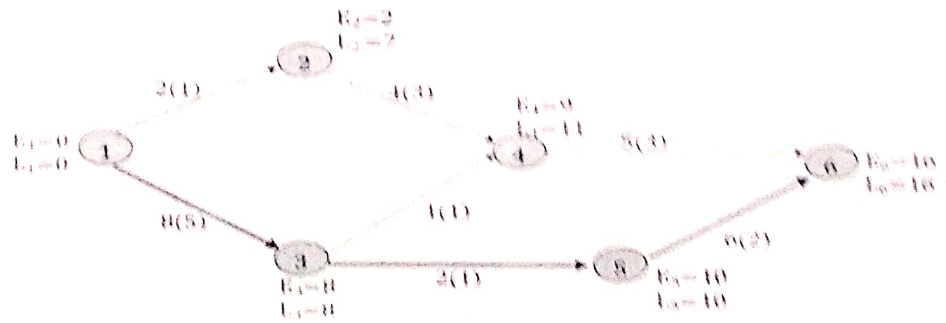
Q 3) a) [6]

For the data given in the table below, draw the network. Crash systematically the activities and determine the optimal project duration and cost.

Activity	Time (weeks) Normal	Time (weeks) Crash	Cost in Rs (000)	Cost in Rs (000) Crash
1 2	2	1	10	15
1 3	8	5	15	21
2 4	4	3	20	24
3 4	1	1	7	7
3 5	2	1	8	15
4 6	5	3	10	16
5 6	6	2	12	36

1. **Draw the project network.**
2. **Determine the critical path and the normal duration and the associated cost.**
3. **Crash the activities so that the project completion time reduces to 9 weeks, with minimum additional cost.**

Solution The network diagram is shown below



The normal duration of the project is 16 weeks.

The critical path is $1 \to 3 \to 5 \to 6$ and the associated cost is:

Total Project Cost = Sum of the Normal Costs

$= 10 + 15 + 20 + 7 + 8 + 10 + 12$ (Note: All costs are in 000's)

= Rs 82,000

Scanned with CamScanner

Cost Slopes:

Activity	1-2	1-3	2-4	3-4	3-5	4-6	5-6
Cost Slope	5000	2000	4000	-	7000	3000	6000

First Crash:
Activity 1 - 3 has minimum costs slope. Crash activity 1 - 3 by 3 weeks.
Project duration = 13 weeks
Crashing cost = 2000x3 = Rs. 6,000

Second Crash:
Crash activity 5 - 6 by 2 weeks.
Project duration=11 weeks
Crashing cost = 6000x2 = Rs. 12,000

Third Crash:
Now there are three critical paths viz
1-3-5-6, 1-3-4-6 and 1-2-4-6 all with duration equal to 11 weeks.

Crash activity 4 -6 by 2 weeks and activity 5 - 6 by two weeks
Project duration=9 weeks
Crashing cost = 6000x2 + 3000x2
= Rs. 18,000

Thus, the project duration has been reduced from 16 weeks to 9 weeks.
Total additional cost =Rs. 6,000 + Rs. 12,000 + Rs. 18,000
= Rs. 36,000

b) A manufacturer of cycle has estimated the following distributing of demand for a particular type of bicycle. [6]

Demand	0	1	2	3	4	5	6
Probability	0.14	0.27	0.27	0.18	0.09	0.04	0.01

Each cycle costs him Rs.7000 and he sells them for Rs.10000 each. Any cycles that are left unsold at the end of the season must be disposed off for Rs.6000 each. How many cycles should be in the stock so as to maximize his expected profit?

Solution:

Demand		**0**	**1**	**2**	**3**	**4**	**5**	**6**	**EMV**
Probability		**0.14**	**0.27**	**0.27**	**0.18**	**0.09**	**0.04**	**0.01**	
Strategies Stock	0	0	0	0	0	0	0	0	0
	1	-1000	3000	3000	3000	3000	3000	3000	2440
	2	-2000	2000	6000	6000	6000	6000	6000	3800
	3	-3000	1000	5000	9000	9000	9000	9000	**4080**
	4	-4000	0	4000	8000	12000	12000	12000	3640
	5	-5000	-1000	3000	7000	11000	15000	15000	2840
	6	-6000	-2000	2000	6000	10000	14000	18000	1880

As per EMV, Strategy S_3 is giving maximum profit of Rs. 4080, so it advised to have 3 cycles every day.

Q 4) a) A company has to process five items on three machines A, B and C. Processing times are given in the following table:

Item	A_i	B_i	C_i
1	4	4	6
2	9	5	9
3	8	3	11
4	6	2	8
5	3	6	7

i. Find the sequence that minimizes the total elapsed time.
ii. Find the idle times for all the machines

Solution: Here, $\min(A_i) = 3$, $\min(C_i) = 6$, $\max(B_i) = 6$

So the condition $\max(B_i) \le \min(C_i)$ is satisfied.

Convert the problem in 2- machine problem

The processing times for the new problem are given below:

Item	$G_i = A_i + B_i$	$H_i = B_i + C_i$
1	8	10
2	14	14
3	11	14
4	8	10
5	9	13

Following Johnson's algorithm, the optimal sequence can be obtained as

1	4	5	3	2

Then the minimum elapsed time is obtained from the following table.

Item	Machine A		Machine B			Machine C		
	Time in	Time out	Time in	Time out	Idle Time	Time in	Time out	Idle Time
1	0	4	4	8	4	8	14	8
4	4	10	10	12	2	14	22	-
5	10	13	13	19	1	22	29	-
3	13	21	21	24	2	29	40	-
2	21	30	30	35	6	40	49	-

Minimum Total Elapsed time= 49 hours
Idle time for machine A = 49-30 = 19 hours.
Idle time for machine B = 4 + 2+1+6+ (49 – 35) = 29 hours.
Idle time for machine C = 8 hours.

b) The number of units of an item that are withdrawn from the inventory on a day to day basis is a Markov Chain process in which the requirements for tomorrow depend on today's requirements. A one-day transition matrix is given below:

		Tomorrow		
		5	10	12
	5	0.6	0.4	0.0
Today	10	0.3	0.3	0.4
	12	0.1	0.3	0.6

i) Develop a two day transition matrix.
ii) Comment how a two-day transition matrix might be helpful to a manager who is responsible for the inventory management

Solution:

(i) Using the given one-day transition matrix, we get the two day transition matrix (P^2) as

$$P^2 = P \times P = \begin{bmatrix} 0.6 & 0.4 & 0.0 \\ 0.3 & 0.3 & 0.4 \\ 0.1 & 0.3 & 0.6 \end{bmatrix} \begin{bmatrix} 0.6 & 0.4 & 0.0 \\ 0.3 & 0.3 & 0.4 \\ 0.1 & 0.3 & 0.6 \end{bmatrix}$$

$\therefore$ By using row column multiplication rule we have

$$P^2 = \begin{bmatrix} 0.6(0.6) + 0.4(0.3) + 0.0(0.1) & 0.6(0.4) + 0.4(0.3) + 0.0(0.3) & 0.6(0.0) + 0.4(0.4) + 0.0(0.6) \\ 0.3(0.6) + 0.3(0.3) + 0.4(0.1) & 0.3(0.4) + 0.3(0.3) + 0.4(0.3) & 0.3(0.0) + 0.3(0.4) + 0.4(0.6) \\ 0.1(0.6) + 0.3(0.3) + 0.6(0.1) & 0.1(0.4) + 0.3(0.3) + 0.6(0.3) & 0.1(0.0) + 0.3(0.4) + 0.6(0.6) \end{bmatrix}$$

$$= \begin{array}{c c} & \begin{array}{ccc} \mathbf{5} & \mathbf{10} & \mathbf{12} \end{array} \\ \begin{array}{c} \mathbf{5} \\ \mathbf{10} \\ \mathbf{12} \end{array} & \begin{bmatrix} 0.48 & 0.36 & 0.16 \\ 0.31 & 0.33 & 0.36 \\ 0.21 & 0.31 & 0.48 \end{bmatrix} \end{array}$$

(ii) Consider that the inventory manager places order every day. If the material so ordered reaches him after two days (i.e. lead time), then the matrix P^2 will be useful to him, for making the ordering decision.
From the two-day transition matrix P^2 we see that, if today's requirement of the item is 5, then two days later (when the ordered material will be received), the probability that 5 units will be required is 0.48, 10 units will be required is 0.36 and 12 units will be required is 0.16 and so on. Thus, these figures will guide him in deciding the quantity to be ordered today.

OR

Q 4) a) Seven jobs are to be processed through 2 machines A and B. Processing times (in hours) are given below:

Jobs	1	2	3	4	5	6	7
Machine A:	10	9	7	15	18	20	14
Machine B:	12	8	7	12	10	6	13

Find the elapsed time and idle times for Machines A and B.

Solution:

Optimal Sequence:

1	7	4	5	2	3	6

Elapsed Time:

Optimal Sequence	Machine:A			Machine:B		
	In	out	Idle	In	Out	Idle
1	0	10	-	10	22	10
7	10	24	-	24	37	2
4	24	39	-	39	51	2
5	39	57	-	57	67	6
2	57	66	-	67	75	0
3	66	73	-	75	82	0
6	73	93	6	93	99	11

Total Elapsed Time = 99 Hours
Idle time of Machine A =(99-93)= 6 hours
Idle time of Machine B =(10+2+2+6+11)= 31 hours

b) The present market shares of three brands of soft drinks are 60%, 30% and 10% respectively. The transition probability matrix is as below: [4]

$$P = \begin{pmatrix} 0.7 & 0.2 & 0.1 \\ 0.2 & 0.6 & 0.2 \\ 0.1 & 0.1 & 0.8 \end{pmatrix}$$

i. Find their expected market shares after two years.
ii. Find their market shares in the long run.

Solution: Here we have, for the present year (n = 0)

$R_0 = [0.6 \quad 0.3 \quad 0.1]$ ... present 'state probabilities'

Hence, their market shares (state probabilities) after 1 year i.e. for n = 1 is

$$R_1 = R_0 \times P$$

$$= [0.6 \quad 0.3 \quad 0.1] \begin{bmatrix} 0.7 & 0.2 & 0.1 \\ 0.2 & 0.6 & 0.2 \\ 0.1 & 0.1 & 0.8 \end{bmatrix}$$

$$= [(0.42 + 0.06 + 0.01) \quad (0.12 + 0.18 + 0.01) \quad (0.06 + 0.06 + 0.08)]$$

$$= [0.49 \quad 0.31 \quad 0.20]$$

Thus, the market shares of A, B and C in the next year will be 49%, 31% and 20% respectively. Similarly, market shares after two years i.e. for the period (n = 2) are given by

$$R_2 = R_1 \times P$$

$$= [0.49 \quad 0.31 \quad 0.2] \begin{bmatrix} 0.7 & 0.2 & 0.1 \\ 0.2 & 0.6 & 0.2 \\ 0.1 & 0.1 & 0.8 \end{bmatrix}$$

$$= [0.425 \quad 0.304 \quad 0.271]$$

Thus, the market shares will be 42.5%, 30.4% and 27.1% respectively.

ii) Market shares in long run

$$A = S_A \times 100 = \frac{6}{19} \times 100 = 31.58\%,$$

$$\text{Market share of} \quad B = S_B \times 100 = \frac{5}{19} \times 100 = 26.32\% \text{ and}$$

$$\text{Market share of} \quad C = S_C \times 100 = \frac{8}{19} \times 100 = 42.10\%$$

Q3) a) Rainfall distribution in monsoon season is as follows: [4]

Rain in cm	0	1	2	3	4	5
Probability	0.50	0.25	0.15	0.05	0.03	0.02

Simulate the rainfall for 10 days using following random numbers 67,63,39,55,29,78,70,6,78,76. Find the average rainfall.

Solution:

Generation of Random Number Intervals

Rain (in cm)	Probability	Cumulative Probability	Random Number Interval
0	0.5	0.5	00 --49
1	0.25	0.75	50 --74
2	0.15	0.9	75 --89
3	0.05	0.95	90 --94
4	0.03	0.98	95 --97
5	0.02	1	98 --99

Simulation of Rainfall

Day	Random Number	Simulated Rainfall
1	67	1
2	63	1
3	39	0
4	55	1
5	29	0
6	78	2
7	70	1
8	6	0
9	78	2
10	76	2

Total Rainfall = 10 cm

Average Rainfall = 10/10= 1 cm

b) Explain the following terms with examples:

i) Degeneracy

ii) Multiple Optimal Solution in LPP

OR

Q5) a) A bakery keeps stock of a popular brand of cake. Previous experience shows the daily demand pattern for the item with associated probabilities, as given below:

Daily demand (number)	0	10	20	30	40	50
Probability	0.01	0.20	0.15	0.50	0.12	0.02

Use the following sequence of random numbers to simulate the demand for next 10 days.
Random numbers: 25, 39, 65, 76, 12, 05, 73, 89, 19, 49.
Also estimate the daily average demand for the cakes on the basis of the simulated data.

Solution:

Generation of Random Number Intervals

Daily Demand	Probability	Cumulative Probability	Random Number Interval
0	0.01	0.01	00
10	0.20	0.21	01 --20
20	0.15	0.36	21 --35
30	0.50	0.86	36 --85
40	0.12	0.98	86 --97
50	0.02	1	98 --99

Simulation of Daily demand

Day	Random Number	Simulated Daily Demand
1	25	20
2	39	30
3	65	30
4	76	30
5	12	10
6	05	10
7	73	30
8	89	40
9	19	10
10	49	30

Total Daily Demand = 240 cakes
Average Daily Demand = 240/10= 24 cakes

b) Explain the following terms with examples:
  i) Dummy Activity
  ii) Optimistic Time