2012

MCA

3rd SEMESTER EXAMINATION

COMPUTER BASED OPTIMIZATION TECHNIQUE

PAPER—MCA-304

Full Marks : 100

Time : 3 Hours

The figures in the margin indicate full marks.

Candidates are required to give their answers in their own words as far as practicable.

Illustrate the answers wherever necessary.

Group—A

(Marks : 50)

Answer *Q. No. 1* and any *two* from the rest.

1. Solve by following LP problem using simplex method :

Maximize $Z = 3x_1 - x_2$

subject to the constraints

(i) $2x_1 + x_2 \leq 2$

(ii) $x_1 + 3x_2 \geq 3$

(iii) $x_2 \leq 4$

and $x_1, x_2 \geq 0$ 7

2. (a) Solve the following LPP by dual simplex method :

Minimize $Z = x_1 + x_2$

subject to $3x_1 + 2x_2 \geq 3$

$2x_1 + x_2 \geq 3$

$x_1 + 4x_2 \geq 3$

$x_1, x_2 \geq 0$ 7

(b) Solve the following LPP by simplex method :

Maximize $Z = 2x_1 + 5x_2$
subject to $3x_1 + 2x_2 \leq 6$
$2x_1 + 3x_2 \leq 6$
$x_1, x_2 \geq 0.$

Using the optimal table solve the LPP when the objective function is changed to $Z = 5x_1 + 2x_2$. 7

3. (a) Using Gomory's cutting plane method solve the following Integer Programming Problem :

Maximize $Z = x_1 - x_2$
subject to $-x_1 + x_2 \leq 1$
$4x_1 + 3x_2 \leq 10$
$x_1, x_2 \geq 0$
x_1, x_2 are integers. 7

(b) Solve the following LPP by simplex method :

Maximize $Z = 2x_1 + x_2$
subject to $x_1 + 3x_2 \leq 3$
$x_1 + x_2 \leq 2$
$x_1, x_2 \geq 0$

Using the optimal table solve the LPP when the requirement vector is changed to $\begin{bmatrix}2\\3\end{bmatrix}$ from $\begin{bmatrix}3\\2\end{bmatrix}$. 7

4. (a) Obtain an initial BFS to the transportation problem given below using Vogel's approximation method. Hence find the optimal solution : 7

	D_1	D_2	D_3	D_4	
O_1	19	30	50	10	7
O_2	70	30	40	60	9
O_3	40	8	70	20	18
	5	8	7	14	

(b) Determine the minimum assignment cost for the following assignment problem :

	I	II	III	IV
A	12	9	9	8
B	11	10	8	9
C	11	9	8	10
D	12	12	11	11

Internal Assessment **15**

Group—B

(Marks : 50)

Answer *Q. No. 5* and any *two* from the rest.

5. Tasks A, B, C, ..., H, I constitute a project. The notation X < Y means that the task X must be finished before Y can begin. With the notation

A < D, A < E, B < F, D < F, C < G, C < H, F < I, G < I

Draw a PERT network to represent the sequence of tasks and find the minimum time of completion of the project, when the time (in days) of completion of each task is as follows :

Task :	A	B	C	D	E	F	G	H	I
Time :	8	10	8	10	16	17	18	14	9

5

6. (a) A new tempo costs Rs. 1,00,000 and may be sold at the end of year at the following prices :

Year	:	1	2	3	4	5	6
Selling Price (*Rs.*)	:	60,000	45,000	32,000	22,000	10,000	2,000

The corresponding annual operating costs are :

Year	:	1	2	3	4	5	6
cost/year (*Rs.*)	:	10,000	12,000	15,000	20,000	30,000	45,000

It is not only possible to sell the tempo after use but also to buy a second hand tempo. It may be cheaper to do so than a buy a new tempo :

Age of tempo	:	0	1	2	3	4	5
Purchase price (*Rs.*)	:	1,00,000	60,000	45,000	33,000	20,000	10,000

What is the age to buy and to sell so as to minimise average annual cost? 8

(b) Six jobs have to be processed on Machines M1, M2 and M3 in order M1, M2 and M3. Time taken by each job on these machine is given below. Determine the sequence so as to minimize the processing time :

Job	M1	M2	M3
1	12	7	3
2	8	10	4
3	7	9	2
4	11	6	5
5	10	10	3
6	5	5	4

7. (i) A TV repairman finds that time spent on his jobs has an exponential distribution with mean 30 minutes. If he repairs sets in the order in which they came in and if the arrival of sets is approximately Poisson with an average rate of 10 per 8 hour day, what is repairman's expected idle time each day?

How many hobs are ahead of the average set just brought in? 6

(ii) A small project is composed of Seven activities whose estimates are listed in the table as follows :

Activity		*Estimated duration* (weeks)		
i	*j*	*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

(a) Draw the project network.

(b) Find the expected duration and variance of each activity.

(c) Calculate early and late occurrence times for each event. What is the expected project length ?

(d) Calculate variance and standard deviation of the project length. 8

8. (a) Four jobs 1, 2, 3 and 4 are to be processed on each of the five machines M1, M2, M3, M4 and M5 in the order M1, M2, M3, M4, M5. Determine total minimum elapsed time if no passing off is allowed. Also find out the idle time of each of the machines. Processing time are given in the matrix below :

Job	Machines				
	M_1	M_2	M_3	M_4	M_5
1	8	4	6	3	9
2	7	6	4	5	10
3	6	5	3	2	8
4	9	2	1	4	6

7

(b) The activities in a PERT project are given in the table below :

Activity	Optimistic time	Most likely time	Pessimistic time
A (1–2)	2	6	10
B (1–3)	14	10	30
C (2–4)	12	6	12
D (3–5)	3	18	3
E (3–6)	4	8	6
F (5–7)	4	6	8
G (6–7)	3	6	15
H (7–8)	2	5	14
I (4–8)	2	5	8

(i) Draw a network diagram using the above data.

(ii) Find the expected duration and variance of each activity.

(iii) Calculate the Earliest and Latest event times for all nodes and find the critical path. What is the expected project length ?

(iv) Find the probability of completing the project before 36, after 40 days. 8

Internal Assessment **15**