2011

MCA

3rd SEMESTER EXAMINATION

COMPUTER BASED OPTIMIZATION TECHNIQUE

PAPER—2304

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 the problem by using revised simplex method.

   Maximize $Z = x_1 + x_2$
   subject to $3x_1 + 2x_2 \leq 6$
   $x_1 + 4x_2 \leq 4$
   $x_1, x_2 \geq 0$ 7

(Turn Over)

2. (a) Solve, if possible, by dual simplex method the following problem :

Maximize $Z = 4x_1 + 2x_2$

subject to $3x_1 + x_2 \geq 27$

$x_1 + x_2 \geq 21$

$x_1 + 2x_2 \geq 30$

$x_1, x_2 \geq 0$

(b) Solve, by Charnes' Big M-Method, the following L.P.P.

Maximize $Z = x_1 + 2x_2 + 3x_3 - x_4$

subject to $x_1 + 2x_2 + 3x_3 = 15$

$2x_1 + x_2 + 5x_3 = 20$

$x_1 + 2x_2 + x_3 + 4x_3 = 10$

$x_1, x_2, x_3, x_4 \geq 0$ 6+8

3. (a) Solve the following integer programming problem :

Maximize $Z = 3x_1 + 4x_2$

subject to $3x_1 + 2x_2 \leq 8$

$x_1 + 4x_2 \leq 10$

x_1, and x_2 integers.

(b) A marketing manager has five salesman and 5 sales district. Considering the capabilities of the salesman and the nature of the districts, the marketing manager estimates that sales per month (in hundred rupees) for each salesman in each district would be

as follows :

		A	B	C	D	E
				District		
	1	32	38	40	28	40
	2	40	24	28	21	36
Salesman	3	41	27	33	30	37
	4	22	38	41	36	36
	5	29	33	40	35	39

Find the assignment of the salesman to districts that will produce maximum sales. 8+6

4. (a) Solve, if possible, by dual simplex method the following problem :

Maximize $Z = 6x_1 + 11x_2$
subject to $x_1 + x_2 \geq 11$
$2x_1 + 5x_2 \geq 40$
$x_1, x_2 \geq 0$

(b) Identical products are produced in three factories and sent to four warehouses for delivery to the customers. The cost of transportation and capacities are given by cost matrix as :

	W_1	W_2	W_3	W_4	Capacities
F_1	5	8	7	4	30
F_2	5	2	9	5	50
F_3	4	3	6	2	80
Demands	20	60	55	40	

(i) Find an optimal schedule of delivery for minimization of cost of transportation.

(ii) Find the idle capacity of the warehouses.

(iii) Do you anticipate any alternate optimum solution for the problem ? How can the same be identified ?

7+7

Internal Assessment — 15

Group—B

(Marks : 50)

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

1. A project consists of a Series of Tasks labelled A, B, ..., H, I with the following relationship (W < X , Y means X and Y cannot start until W is completed; X, Y < X means W cannot start until both X and Y are completed). With

(Continued)

this notation construct the network diagram having the following constraints : 5

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

2. (a) A Taxi owner estimates from his past records that the cost per year for operating a Taxi whose purchase price when new is Rs. 60,000 are as given below :

Age	:	1	2	3	4	5
Operating cost	:	10,000	12,000	15,000	18,000	20,000

After 5 years, the operating cost is Rs. 6,000 K where K = 6, 7, 8, 9, 10 (K denoting age in years). If the resale value decreases 10% of purchase price per year, what is the best replacement policy ? Cost money is zero.

(b) A small project is composed on seven activities whose time estimates are listed in the table as follow :

Activity	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

(i) Draw the project Network.

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

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

(iv) Calculate the variance and standard deviation of project length. What is probability that the project will be completed :

(a) At least 4 weeks earlier than expected ?

(b) No more than 4 weeks later than expected ?

7+8

3. (a) Machine A costs Rs. 9,000. Annual operating costs are Rs. 200 for the first year and then increases Rs. 2,000 every year. Determine the best age at which to replace the machine. If the optimal replacement policy is followed, what will be the average yearly cost of owning and operating the machine ?

Machine B costs Rs. 10,000. Annual operating cost are Rs. 400 for the 1st year and then increases by Rs. 800 every year. You now have a machine of Type A which is one year old. Should you replace it with B, if so when ?

(b) Determine the optimal sequence of jobs that minimizes the total elapsed time based on the following information. (Processing time on machine is given in hours and passing is not allowed).

Job :	A	B	C	D	E	F	G
Machine M1 :	3	8	7	4	9	8	7
Machine M2 :	4	3	2	5	1	4	3
Machine M3 :	6	7	5	11	5	6	12

8+7

4. (a) A small project consists of the following twelve jobs whose precedence relations are identified with their node numbers as follows :

Job	Precedence	Duration (Days)
A	1 – 2	10
B	1 – 3	4
C	1 – 4	6
D	2 – 3	5
E	2 – 5	12
F	2 – 6	9
G	3 – 7	12
H	4 – 5	15
I	5 – 6	6
J	6 – 7	5
K	6 – 8	4
L	7 – 8	7

(i) Draw a network diagram representing the project.

(ii) Find the critical path and project duration.

(iii) Calculate EST, EFT, LST, LFT for all the jobs.

(iv) Tabulate Total float for each jobs.

(b) A book binder has one printing press, one binding machine, and the manuscripts of number of different books. The time required to perform the printing and binding operations for each book are shown below. Determine the order in which books should be processed, in order to minimize the total time required to turn out all the books :

Book	: 1	2	3	4	5	6
Printing time (hrs.) :	30	120	50	20	90	110
Binding time (hrs.) :	80	100	90	60	30	10

8+7

Internal Assessment — 15