M.C.M. Part—I (Semester—II) Examination

OPERATION RESEARCH TECHNIQUES

Paper—2MCM5

Time : Three Hours] [Maximum Marks : 80

Note :—(1) Due credit will be given to neatness and adequate dimensions.

(2) Assume suitable data wherever necessary.

(3) Illustrate your answers with the help of neat sketches wherever necessary.

1. (a) Explain all features of operations research approach. 6

(b) Use two-phase simplex method to solve following LP problem.

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

subject to the constraints

(i) $5x_1 + 7x_2 + 4x_3 \leq 7$

(ii) $-4x_1 + 7x_2 + 5x_3 \geq -2$

(iii) $3x_1 + 4x_2 - 6x_3 \geq 29/7$ and $x_1, x_2, x_3 \geq 0$ 10

OR

2. (a) Use the Simplex method to solve the following LP problem :

Max $Z = 20x_1 + 6x_2 + 8x_3$

subject to

$8x_1 + 2x_2 + 3x_3 \leq 250$

$4x_1 + 3x_2 \leq 150$

$2x_1 + x_3 \leq 50$

and $x_1, x_2, x_3 \geq 0$ 10

(b) Write the dual of the following LP problem :

Minimize $Z_x = 3x_1 - 2x_2 + 4x_3$

subject to the constraints

(i) $3x_1 + 5x_2 + 4x_3 \geq 7$

(ii) $6x_1 + x_2 + 3x_3 \geq 4$

(iii) $7x_1 - 2x_2 - x_3 \leq 10$

(iv) $x_1 - 2x_2 + 5x_3 \geq 3$

(v) $4x_1 + 7x_2 - 2x_3 \geq 2$

and $x_1, x_2, x_3 \geq 0$ 6

3. (a) Determine an initial basic feasible solution to the following transportation problem by using :

(i) NWCM

(ii) LCM

Destination

Source	D_1	D_2	D_3	D_4	Supply
A	11	13	17	14	250
B	16	18	14	10	300
C	21	24	13	10	400
Demand	200	225	275	250	

10

(b)

Machines

Jobs	W	X	Y	Z
A	18	24	28	32
B	8	13	17	18
C	10	15	19	22

What are the job-assignment pairs that shall minimize the cost ? 6

OR

4. (a) Give steps of Gomory's all Integer Programming algorithm. 6

(b)

		Employees				
		I	II	III	IV	V
Jobs	A	10	5	13	15	16
	B	3	9	18	13	6
	C	10	7	2	2	2
	D	7	11	9	7	12
	E	7	9	10	4	12

How should the jobs be allocated, one per employee, so as to minimize the total man-hours ? 6

(c) Consider the game with the following payoff table :

		Player B			
Player	A	B_1	B_2	B_3	B_4
	A_1	3	–5	0	6
	A_2	–4	–2	1	2
	A_3	5	4	2	3

Determine :

(i) Strategy selection for each player

(ii) The value of the game. 4

5. (a) Explain the following Inventory cost components :

(i) Purchase cost

(ii) Carrying cost

(iii) Ordering cost

(iv) Customer service cost. 8

(b) The following table shows the machine time (in hours) for 5 jobs to be processed on two different machines :

Job	:	1	2	3	4	5
Machine A	:	3	7	4	5	7
Machine B	:	6	2	7	3	4

Determine a sequence for the five jobs that will minimize the total elapsed time. 8

OR

6. (a) Find the sequence that minimizes the total elapsed time and processing time in hours required to complete the following jobs :

Job	:	1	2	3	4	5	6
Machine A	:	4	8	3	6	7	5
Machine B	:	6	33	7	2	8	4

8

(b) We have five jobs, each of which must go through the machines A, B and C in the order ABC. Processing time (in hours) is as follows :

Job	:	1	2	3	4	5
Machine A	:	5	7	6	9	5
Machine B	:	2	1	4	5	3
Machine C	:	3	7	5	6	7

Determine the sequence for the jobs that will minimize the total elapsed time. 8

7. (a) A small project is composed of 7 activities, whose time estimates are listed in the table below. Activities are identified by their beginning (i) and ending (j) node numbers.

Activity (i–j)	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 network diagram of the activities in the project.

(ii) Find the expected duration and variance for each activity. What is the expected project length ?

(iii) Calculate the variance and standard deviation of the project length. 3+3+4

(b) Explain :—

(i) Total float

(ii) Independent float

(iii) Critical path. 6

OR

8. (a) Explain :

(i) Optimistic time

(ii) Pessimistic time

(iii) Most likely time. 6

(b)

Activity	Predecessors	Duration (days)
A	—	6
B	A	4
C	B	7
D	A	2
E	D	4
F	E	10
G	—	2
H	G	10
I	J, H	6
J	—	13
K	A	9
L	C, K	3
M	I, L	5

(i) Draw an arrow diagram for this project.

(ii) Indicate the critical path.

(iii) For each non-critical activity, find the total and free float. 3+3+4

9. (a) Use dynamic programming to solve the following problem :

Minimize $Z = y_1^2 + y_2^2 + y_3^2$

subject to the constraint

$y_1 + y_2 + y_3 = 10$ and $y_1, y_2, y_3 \geq 0$ 8

(b) Write the steps of the Dual-Simplex algorithm. 8

OR

10. (a) Define :—

(i) Optimum solution

(ii) Optimum basic feasible solution

(iii) Basic feasible solution

(iv) Slack and surplus variables. 8

(b) Discuss the steps of simulation process. 8