MN10 ADM

TIME : 1 ½ Hrs **MARKS : 40**

N.B. :
1. **All questions are compulsory.**
2. **Attempt Any Two sub - questions out of three.**
3. **Bracketed figures to the right indicate marks.**
4. **Graph papers will be provided on request.**

Q.1 a. A firm manufactures two types of products A and B and sells them at a profit of ₹. 15 on type A and ₹. 12 on type B. Each product is processed on two machines G and H. Type A requires one minute of processing time on G and two minutes on H; type B requires one minute on G and one minute on H. The machine G is available for not more than 6 hours 40 minutes while machine H is available for 10 hours during any working day. Formulate the problem as a linear programming problem. **(5)**

b. Solve the following linear programming problem graphically. **(5)**

Max $z = x_1 + x_2$

Subject to $x_1 + 2x_2 \leq 20$

$x_1 + x_2 \leq 15$

$x_2 \leq 6$

and $x_1, x_2 \geq 0$

c. In the process of obtaining the optimal solution to the given linear program problem is shown below. **(5)**

Min $z = x_1 - 3x_2 + 2x_3$

Subject to $3x_1 - x_2 + 3x_3 \leq 7$

$-2x_1 + 4x_2 \leq 12$

$-4x_1 + 3x_2 + 8x_3 \leq 10$

and $x_1, x_2, x_3 \geq 0$

Simplex table.

Basic Variable	$C_j \rightarrow$ C_B	X_B	X_1	X_2	X_3	S_1	S_2	S_3
X_1	-1	4	1	0	6/5	2/5	1/10	0
X_2	3	5	0	1	3/5	1/5	3/10	0
S_3	0	11	0	0	11	1	-1/2	1

Test whether the solution in the above simplex table is optimum. Determine the optimum value of the objective function.

Q.2 a. For the following transportation problem find the initial basic feasible **(5)**

From \ To	W	X	Y	Supply
A	16	24	24	152
B	48	72	48	164
C	24	48	72	154
Demand	144	204	82	

Q.2 **b.** For the following transportation problem for which the cost, origin - availabilities and destination requirements are as given below. **(5)**

	D_1	D_2	D_3	D_4	Availability
O_1	5	3	6	2	19
O_2	4	7	9	1	37
O_3	3	4	7	5	34
Destination	16	18	31	25	

Final initial basic feasible solution by Vogel's approximation method.

c. The table below has been taken from the solution procedure of the transportation problem. **(5)**

Plant	Project Location				Supply
	A	B	C	D	
W	20	40 (70)	40 (82)	0	152
X	80	120 (124)	80	0 (40)	164
Y	40 (144)	80 (10)	120	0	154
Demand	144	204	82	40	470

Determine the solution given in the above transportation problem is optimum. If not find the optimum solution.

Q.3 **a.** In a factory there are 5 Employees and 5 jobs are to be done on a one to one basis. Time required (in Minutes) is given for each Employee Job combination. Find optimal Assignment of Employee & Job to minimize total time. **(5)**

Employee \ Job	A	B	C	D	E
I	160	130	175	190	200
II	135	120	130	160	175
III	140	110	155	170	185
IV	50	50	80	80	110

b. Solve the following assignment problem. The data given in the table refer to production in certain units. **(5)**

Operator	Machine			
	A	B	C	D
1	10	5	7	8
2	11	4	9	10
3	8	4	9	7
4	7	5	6	4
5	8	9	7	5

c. Seven jobs go first over machine 1 and then over machine 2. Processing times in hours are given as. **(5)**

Job	A	B	C	D	E	F	G
Machine 1	6	24	30	12	20	22	18
Machine 2	16	20	20	12	24	2	6

Find the optimum sequence in which jobs should be processed and the total elapsed time.

Q.4 **a.** Write the dual of the following Linear programming problem. **(5)**

Min $z = x_1 + x_2 + x_3$

Subject to the constraints

$x_1 - 3x_2 + 4x_3 = 5$

$x_1 - 2x_2 \leq 3$

$2x_2 - x_3 \geq 4$

$x_1, x_2, x_3 \geq 0$

b. Determine an initial basic feasible solution to the following transportation problem using North - west corner rule. **(5)**

		I	II	III	IV	V	Supply
Origin	A	2	11	10	3	7	4
	B	1	4	7	2	1	8
	C	3	9	4	8	12	9
	Demand	3	3	4	5	6	

c. Eight jobs are to be processed on three machines A, B & C in the order $A \rightarrow B \rightarrow C$. Each machine can process only one job at a time. The processing time (in hours)are as follows. **(5)**

Job	J_1	J_2	J_3	J_4	J_5	J_6	J_7	J_8
Machine A	10	12	13	7	14	5	16	17
Machine B	15	11	8	9	6	7	16	13
Machine C	12	11	13	15	16	8	10	12