N.B. : 1) **Attempt any THREE questions.**
2) **Figures to the right indicate marks.**
3) **Graph papers, statistical tables with be provided on request.**

Q.1 a) Food I contains 6 units of vitamin A per gram, 7 units of vitamin B per gram and costs 12 paise per gram. Food II contains 8 units of vitamin A per gram, 12 units of vitamin B per gram and costs 20 paise per gram. The daily minimum requirement of vitamin A and vitamin B are 400 units and 480 units respectively Formulate L.P.P. to minimize the cost.   3

b) Use graphical method to solve the following LP problem -

Maximize $Z = 5x + 7y$

Subject to,

$x + y \leq 4$

$3x + 8y \leq 24$

$10x + 7y \leq 35$

$x, y \geq 0$ 4

c) Write the dual of the following LP problem

min $Zx = 7x_1 + 3x_2 + 8x_3$

subject to,

$8x_1 + 2x_2 + x_3 \geq 3$

$3x_1 + 6x_2 + 4x_3 \geq 4$

$4x_1 + x_2 + 5x_3 \geq 1$

$x_1 + 5x_2 + 2x_3 \geq 7$

$x_1, x_2, x_3 \geq 0$ 3

Q.2 a) Obtain an optimal solution for the following transportation problem -

	D_1	D_2	D_3	D_4	Supply
S_1	19	30	50	10	7
S_2	70	30	40	60	9
S_3	40	8	70	20	18
Demand	5	8	7	14	

5

b) Use simplex method to solve the following LP problem -

Maximize $Z = 5x_1 + 3x_2$

Subject to,

$3x_1 + 5x_2 \leq 15$

$5x_1 + 2x_2 + \leq 10$

$x, y \geq 0$

Q.3 a) Determine an initial basic feasible solution to the following transportation   5
problem by using   i)   North -west corner rule

     ii)   Lowest cost method

     iii)   Vogel's approximation method.

		Destinations				Supply
		D_1	D_2	D_3	D_4	
Source	S_1	21	16	15	3	11
	S_2	17	18	14	23	13
	S_3	32	27	18	41	19
Demand		6	10	12	15	

b) A solicitor's firm employs typists on hourly piece-rate basis for their daily work.
There are five typists and their charges and speed are different. According to an
earlier understanding only one job is given to one typists and the typists is paid
for a full hour even if he works for a fraction of an hour. Find the assignment of
job to typists in such a way that the cost is minimum. The cost matrix is -

	Jobs				
Typists	P	Q	R	S	T
A	85	75	65	125	75
B	90	78	66	132	78
C	75	66	57	114	69
D	80	72	60	120	72
E	76	64	56	112	68

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Q.4 a) Determine the optimal sequence of jobs that will minimise total elapsed time,
based on the following data. Also obtain idle time for machine M_1, M_2 and M_3.
Process time is in hr. and passing is not allowed.

	Jobs						
Machine	A	B	C	D	E	F	G
M_1	3	8	7	4	9	8	7
M_2	4	3	2	5	1	4	3
M_3	6	7	5	11	5	6	12

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b) Draw a network and identify the critical path. Also Calculate the earliest start
and Latest finish time for all the activities. Calculate total float, free float,
independent float.

activity	duration	activity	duration
1-2	4	4-9	5
1-3	1	6-8	1
2-4	1	7-8	2
3-4	1	8-10	5
3-5	6	9-10	7
5-6	4		
5-7	8		

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Q.5 a)   A project has the following activities and other characteristics -

Activity	Preceding activity	Time optimistic	pessimistic	most likely
A	---	4	16	7
B	---	1	15	5
C	A	6	30	12
D	A	2	8	5
E	C	5	17	11
F	D	3	15	6
G	B	3	27	9
H	E,F	1	7	4
I	G	4	28	19

i)   Draw the PERT network diagram.

ii)   Identify the critical path.

iii)   Determine the expected completion time and variance for each activity.

iv)   Find the probabilty that the project is completed in 36 weeks.   6

b)   Draw a network for the following project. Find the critical path. Also calculate earliest Start & latest finish for each activity.

activity	duration	activity	duration
1-2	2	5-8	2
1-3	2	6-7	0
1-4	2	6-8	4
2-5	4	7-9	5
3-6	5	8-9	3
3-7	8	9-10	4
4-7	4		

4

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