N.B.: 1. All questions are compulsory.

2. All questions carry equal marks.

3. Figures to the right indicate maximum marks allotted to the sub-questions.

4. Use of simple calculator is allowed.

Q.1]

A] Attempt any eight multiple choice questions: (Any 08) [08]

i) The linear programming problem $z = x + 4y$, under the constraints $0 \leq x \leq 5, 0 \leq x \leq 6$ has _____

a). no solution b). 3 solutions

c). infinity many solutions d). solution at (5,6).

ii) In case of pay-off table available maximax criterion can be considered as

a) Optimistic view b) pessimistic view c) normal view d) sadistic view

iii) A solution of a Linear Programming Problem, whatever exists, is

a) In every convex region b). In every concave region

c). Within the feasible region d). anywhere in the XY plane.

iv) _____ are the unknown variable x_1, x_2, x_3 ..... to be determined as the optimal feasible solution of the linear programming problem.

a). Decision variables b). Parameters

c). Objective function d). Constraints.

v) Optimality condition are expressed as _____ incase all non-basic cells?

a) Negligent costs b) Advanced costs c) Reduced costs d) None of the above

vi) _____ is one of the fundamental combinatorial optimization problems.

a) Assignment problem b) Transportation problem

c) Optimization problem d) None of the above

vii) For maximization in transportation problem, the objective is to maximize the total ___

a) Solutions b) Profit matrix c) Profit d) None of the above.

viii) To make an unbalanced assignment problem balanced, what are added with all ent zeros?

a) Dummy rows b) Dummy columns c) Both 'a' and 'b' d) Dummy entri

ix) Decision maker has _____ over the occurrence of situation.

a) Always control b) no control c) sometime control d) rarely control

x) In case of pay-off table available for decision making them maximize average c considered as

a) Optimistic view b) pessimistic view c) normal view d) absurd

B] Attempt any seven True or False: (Any 07)

i)Any solution which satisfies at least one of the constraints is included in the feasible regior

ii) A constraint is called redundant when it does not affect the solution.

iii) Decision variable in LPP should be either zero or positive.

iv) In transportation problem, a single source may supply something to all destinations.

v) An Assignment problem may have more than one optimal solution.

vi) The best act to be selected using EMV and EOL are same.

vii) States of nature are under the control of decision maker.

viii) The Hungarian method is designed to solve assignment problems efficiently.

ix) In transportation problem is unbalanced when total supply is equal to total demand.

x) Opportunity loss table will contain all positive value.

Q.2]

A] The projected pay-offs for each variant under each demand situation is given below:

Demand	Product variant		
	Super	Excel	Ultra
20000	60	50	35
15000	35	40	30
10000	15	25	20
5000	-10	05	10

Find the optimal decision using: i) Maimax criterion. ii) Maximin criterion. iii) Laplace criterion iv) Minimax regret criterion. v) Hurwicz criterion using $\alpha = 0.6$. [08]

B] A manufacturer produces two different models X and Y of the same product. Model X makes a contribution of Rs. 50 per unit and model Y, Rs. 30 per unit towards total profit. Raw materials R_1 and R_2 are required for production. At least 18 Kg of R_1 and at least 12 Kg of R_2 must be used daily. Also at most 34 labour hours are to be utilized. A quantity of 2 Kg of R_1 is required for X and 1 Kg of R_1 is required for Y. For each of X and Y, 1Kg of R_2 is required. It takes 3 labour hours to manufacture X and 2 labour hours to manufacture Y. How many units of each modal should be produced to maximize the profit? Formulate the LPP and solve graphically. [07]

OR

C] For the following pay-off matrix:

		Acts(Profits in Rs.)			
State of nature	Probability	A_1	A_1	A_1	A_1
E_1	0.1	500	420	340	260
E_2	0.3	500	520	440	360
E_3	0.5	500	520	540	460
E_4	0.1	500	520	540	560

a) Find optimal decision by EMV criterion.
b) Find optimal decision by EOL criterion.
c) Calculate EPPI.
d) Calculate EVPI. [08]

D] Solve the following linear programming problem graphically and interpret the result.

Minimize $Z = 2x + 4y$

Subject to $2x + 2y \leq 28,$
$3x + 2y \geq 30,$
$4x + 2y \leq 36,$
$x, y \geq 0.$

Q.3]

A] Solve the following linear programming problem by Simplex method.

Maximize $Z = 6x_1 - 2x_2$

Subject to $2x_1 - x_2 \leq 2,$
$x_1 \leq 4,$
$x_1, x_2, \geq 0.$

B] The following information is available regarding four different jobs to be performe about the clerks capable of performing the jobs. Cost of each assignment is given in th below.

Clerks	Jobs (cost in hundred rupees)			
	A	B	C	D
I	4	7	5	6
II	-	8	7	6
III	3	-	5	3
IV	8	6	4	2

Clerk II cannot be assigned to job A and Clerk III cannot be assigned to job B. you are req to find out the optimal assignment schedule and the total minimum cost of performing the by using Hungarian method.

OR

C] A company has three plants A, B, C for which capacities are 7, 10 and 18 units. It has four werehouses P, Q, R, S for which demands are 5, 8, 7 and 15 units. Unit transportation cost is given in Rs.

WH / Plant	P	Q	R	S
A	38	60	100	24
B	140	60	80	120
C	80	20	120	40

Find initial feasible solution by Least Cost method. [08]

D] A company has four districts I, II, III and IV to sell its product and four salesmen A, B, C and D for it. The district-wise sales record of each salesman is as given in the table. Determine the area allocation so as to make the sales maximum.

Salesman	Districts			
	I	II	III	IV
A	420	350	280	210
B	300	250	200	150
C	300	250	200	150
D	240	200	160	120

What will be total maximum sale? [07]

Q.4]

A] A company has three factories A, B, C with production capacities of 11, 13, and 19 units(in thousands).It has four warehouses M, N, O and P with demands of 6, 10, 12 and 15 units(in thousands).Unit cost of transportation is given from each factory to each warehouse.

From / To	M	N	O	P
A	42	32	50	26
B	34	36	28	46
C	64	54	36	82

Based on the above information, construct a transportation table. Find initial feasible solution by North-West Corner method. [08]

B] ABC company is evaluating 4 alternatives on investment whose returns are based on the state of economy.

Alternative	Demands		
	Fair	Good	Great
P	1000	3000	6000
Q	500	4500	6800
R	0	5000	8000
S	-4000	6000	8500
Probability	0.2	0.5	0.3

Draw decision tree and determine the expected return for each alternative. Give your decision using EMV. [07]

OR

C] Solve the following linear programming problem by Simplex method. [08]

Minimize $Z = 25x_1 + 30x_2$

Subject to $4x_1 + 3x_2 \geq 60,$

$2x_1 + 3x_2 \geq 36,$

$x_1, x_2 \geq 0.$

D] A distribution company 'Sonata' has four territories open for four transport companies available for assignment. The territories are not equally rich in their economic activity potentials. It is estimated that typical transport company operating in each territory would bring in the following annual economic activity potential measured in rupees.

Territory	I	II	III	IV
Potential (in Rs.)	60,000	50,000	40,000	30,000

The four transport companies are also considered to differ in ability. It is estimated that, working under the same condition, their yearly turnover would be proportionately as follows.

Transport Company	A	B	C	D
Proportion	7	5	5	4

If the criterion is the maximum expected total economic activity potential, What will be maximum Profit? [07]

Q.5]

A] Explain the algorithm of Hungarian method to solve an Assignment problem. [0

B] Explain the concept of perfect information while taking decision under risk. [0

OR

C] Write short notes :(any three) [15]

i) Regret matrix.

ii) Vogel's Approximation method.

iii) Objective function.

iv)Shadow Price of a resource.

V) EOL.

—— The End ——