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G-035024

Seat No._____

B. Sc. (Sem. V) Examination

April/May - 2019

BSCC506D : Mathematics

(Operation Research-I)

Time : **3** Hours] [Total Marks : **70**

Instructions : (1) All the questions are compulsory.
(2) Figure to the right side indicate marks.
(3) Each sub questions carries equal weightage.
(4) All notations are standard.

1 (a) A manufacturer produces two types of models M and N. Each M model requires 4 hours of grinding and 5 hours of polishing whereas each N model requires 3 hours of grinding and 4 hours of polising. The manufacturer has two grinders and 3 polishers. Each grinder works at most for 40 hours and each polisher works at most for 60 hours a week. The profit on an M model is Rs. 30 and on an N model is Rs. 40. Whatever is produced in a week is sold in the market. **7**

How should the manufacturer allocate his production capacity to the two types of models so that he may make a maximum profit in a week ? Formulate the LP problem.

OR

Prove that the intersection of two convex sets is a convex set.

(b) Let $\{S_1, S_2, ...\}$ be a collection of convex sets then **7**

$\bigcap_{n \in N} S_n$ is convex set. Prove this statement.

OR

Prove that the union of two convex set is not a convex set.

2 (a) Use the Simplex method to solve the following L.P. problem. **7**

Maximize $Z = 5x_1 + 4x_2$

Subject to $4x_1 + 5x_2 \leq 10$

$3x_1 + 2x_2 \leq 9$

$8x_1 + 3x_2 \leq 12$ and $x_1, x_2 \geq 0$

OR

Solve the following LPP by two phase method :

Minimize $Z = x_1 + x_2$

Subject to $2x_1 + x_2 \geq 4$

$x_1 + 7x_2 \geq 7$ and $x_1, x_2 \geq 0$

(b) Solve the following LPP by big-M method : **7**

Maximize $Z = 3x_1 - x_2$

Subject to $2x_1 + x_2 \geq 2$

$x_1 + 3x_2 \leq 3$

$x_2 \leq 4$ and $x_1, x_2 \geq 0$

OR

Solve the following Integer Programming Problem by the Gomory's cutting plane method :

Maximize $Z = 4x_1 + 3x_2$

Subject to $x_1 + 2x_2 \leq 4$

$2x_1 + x_2 \leq 6$ and $x_1, x_2 \geq 0$ are integers.

3 (a) Define Dual-Problem. Prove that the dual of the dual is the primal LP problem. 7

OR

Use the Dual Simplex method to solve the following L.P. problem.

Maximize $Z = -3x_1 - x_2$

Subject to $x_1 + x_2 \geq 1$

$2x_1 + 3x_2 \geq 2$ and $x_1, x_2 \geq 0$

(b) Explain the concept of Duality and principle of duality. 7

OR

Use the principle of Duality to solve the following LP Problem :

Minimize $Z = 2x_1 + 2x_2$

Subject to $2x_1 + 4x_2 \geq 1$

$x_1 + 2x_2 \geq 1$

$2x_1 + x_2 \geq 1$ and $x_1, x_2 \geq 0$

4 (a) Explain the main differences between Transportation problem and Assignment Problem. 7

OR

Use the Least Cost method and the Vogel's Approximation method to find initial basic feasible solutions to the following transportation problem :

Origins	Destinations				Supply
	D_1	D_2	D_3	D_4	
O_1	19	30	50	10	7
O_2	70	30	40	60	9
O_3	40	8	40	20	18
Demand	5	8	7	14	

(b) Solve the following Transportation Problem by MODI Method : 7

Factory	Warehouses				Capacity
	W_1	W_2	W_3	W_4	
F_1	10	2	20	11	15
F_2	12	7	9	20	25
F_3	4	14	16	18	10
Requirements	5	15	15	15	

OR

Sole the following Assignment problem by the minimization criterion :

Jobs	Workers			
	A	B	C	D
J_1	5	7	11	6
J_2	8	5	9	6
J_3	4	7	10	7
J_4	10	4	8	3

5 Answer the following in short : (any **seven**) **14**

(i) Define Convex set.

(ii) Define Surplus variable.

(iii) Define Slack variable.

(iv) Define Artificial variable.

(v) Define Integer Programming Problem.

(vi) Name the method of finding an optimum solution of a transportation problem.

(vii) Name any one method of solving an Assignment Problem.

(viii) Name the methods of solving an LP Problem having an artificial variable.
