CBCS SCHEME

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15CS653

Sixth Semester B.E. Degree Examination, June/July 2023
Operations Research

Time: 3 hrs. Max. Marks: 80

Note: Answer any FIVE full questions, choosing ONE full question from each module.

Module-1

1 a. Explain the phases of operations research in detail. **(08 Marks)**

b. An agriculturist has a farm with 126 acres. He produces raddish, muttar and potato. Whatever he raises is fully sold in the market. He gets Rs.5 for raddish per kg, Rs.4 for muttar per kg and Rs.5 for potato per kg. The average yield is 1500kg of raddish per acre 1800 kg of muttar per acre and 1200 kg of potato per acre. To produce each 100kg of raddish and muttar and to produce each 80kg of potato, a sum of Rs.12.50 has to be used for manure. Labour required for each acre to raise the crop is 6 man days for raddish and potato each and 5 man days for muttar. A total of 500 man days of labour at a rate of Rs.40 per man-day are available. Formulate this as a linear programming model to maximize the agriculturist total profit. **(08 Marks)**

OR

2 a. Explain in detail, the assumptions in linear programming models. **(08 Marks)**

b. Solve the following LPP graphically

Minimize $Z = 1.5x_1 + 2.5x_2$

Subjected to $x_1 + 3x_2 \geq 3$

$x_1 + x_2 \geq 2$

$x_1, x_2 \geq 0$ **(08 Marks)**

Module-2

3 a. What are slack variables and surplus variables? Explain with examples. **(04 Marks)**

b. Solve the following problem by Big-M method.

Maximize $Z = x_1 + 2x_2 + 3x_3 - x_4$

Subjected to $x_1 + 2x_2 + 3x_3 = 15$

$2x_1 + x_2 + 5x_3 = 20$

$x_1 + 2x_2 + x_3 + x_4 = 10$

and $x_1, x_2, x_3, x_4 \geq 0$ **(12 Marks)**

OR

4 a. Solve the following LPP by simplex method:

Minimize $Z = x_1 - 3x_2 + 2x_3$

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

$-2x_1 + 4x_2 \leq 12$

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

and $x_1, x_2, x_3 \geq 0$ **(08 Marks)**

b. Use two phase simplex method to solve following LPP:

Minimize $Z = 15/2\ x_1 - 3x_2$

Subjected to $3x_1 - x_2 - x_3 \geq 3$

$x_1 - x_2 + x_3 \geq 2$

and $x_1, x_2, x_3 \geq 0$ **(08 Marks)**

Module-3

5 a. Explain the general rules for converting any primal to its dual. **(08 Marks)**

b. Obtain the dual of the following LP problems:

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

Subjected to $4x_1 + 3x_2 + x_3 = 6$

$x_1 + 2x_2 + 5x_3 = 4$

and $x_1, x_2, x_3 \geq 0$

ii) Minimize $Z = 2x_2 + 5x_3$

Subjected to $x_1 + x_2 \geq 2$

$2x_1 + x_2 + 6x_3 \leq 6$

$x_1 - x_2 + 3x_3 = 4$

and $x_1, x_2, x_3 \geq 0$ **(08 Marks)**

OR

6 a. Use duality to solve following LP problem

Minimize $Z_x = 3x_1 + x_2$

Subject to $x_1 + x_2 \geq 1$

$2x_1 + 3x_2 \geq 2$

and $x_1, x_2 \geq 0$ **(08 Marks)**

b. Solve the following problem by dual simplex method:

Minimize $Z = 2x_1 + x_2$

Subjected to $3x_1 + x_2 \geq 3$

$4x_1 + 3x_2 \geq 6$

$x_1 + 2x_2 \geq 3$

and $x_1, x_2 \geq 0$ **(08 Marks)**

Module-4

7 a. Find initial basic feasible solution for the following problem using:

i) NWCR (North West Corner Rule)

ii) LCM (Lowest Cost Entry Method)

Warehouse Factory	W_1	W_2	W_3	W_4	Factory capacity
F_1	19	30	50	10	7
F_2	70	30	40	60	9
F_3	40	08	70	20	18
Warehouse requirement	5	8	7	14	34

(08 Marks)

b. Explain the various steps of Hungarian assignment method. **(08 Marks)**

OR

8 a. Solve the transportation problem using MODI method:

	D_1	D_2	D_3	D_4	Available
F_1	1	2	1	4	30
F_2	3	3	2	1	50
F_3	4	2	5	9	20
Required →	20	40	30	10	

(08 Marks)