4E4134

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B. Tech. IV-Sem. (Main / Back) Exam; April-May 2017

Electronics & Communication Engg.

4EC5A Optimization Techniques

Time : 3 Hours

Maximum Marks : 80

Min. Passing Marks : 24

Instructions to Candidates :-

*Attempt any **five questions**, selecting **one question** from **each unit**. All Questions carry **equal** marks. Schematic diagrams must be shown wherever necessary. Any data you feel missing suitably be assumed and stated clearly.*
Units of quantities used / calculated must be stated clearly.
Use of following supporting material is permitted during examination.
(Mentioned in form No. 205)

1. NIL 2. NIL

UNIT - I

1 (a) Explain the term 'optimization'. Discuss briefly the applications of optimization techniques in engineering field. **8**

(b) A carpenter has 90, 80 and 50 running feet respectively of teak, plywood and rosewood. Product A requires 2, 1 and 1 running feet of take, plywood and rosewood respectively. Product B requires 1, 2 and 1 running feet of teek, plywood and rosewood respectively. If A would sell for Rs. 48 and B would sell for Rs. 40 per unit, how much of each should he make and sell in order to obtain the maximum gross income out of his stock of wood ? Give a mathematical formulation to this linear programming problem. **8**

OR

1 (a) Discuss the meaning, significance and scope of optimization techniques. **8**

(b) Vitamin C and vitamin E are found in two different fruits F_1 and F_2. One unit of fruit F_1 contains 3 units of vitamin C and 2 units of vitamin E. Similarly, one unit of fruit F_2 contains 2 units of vitamin C and 2 units vitamin E in it. A patient needs minimum of 30 units of vitamin C and 20 units of vitamin E. Also one unit of fruit F_1 costs Rs. 20 and one unit of fruit F_2 costs Rs. 25. The problem, that the hospital faces is to find such units of fruit F_1 and F_2 which should be supplied to the patients at minimum cost. Formulate the above as a linear programming problem. **8**

UNIT - II

2 (a) Describe the revised simplex procedure for solving a linear programming problem. **8**

(b) Solve the following LPP by converting it into its dual :

Minimize $Z = x_1 + x_2$

Subject to $3x_1 + 2x_2 \geq 4$

$-x_1 + 3x_2 \geq 5$

$4x_1 + 2x_2 \geq 5$

$2x_1 + x_2 \geq 1$

and $x_1, x_2 \geq 0$ **8**

OR

2 (a) Solve the following LPP using simplex method :

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

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

$-2x_1 + 4x_2 \le 12$

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

and $x_1, x_2, x_3 \ge 0$

8

(b) Consider the linear programming problem :

Maximize $Z = 3x_1 + 5x_2 + 4x_3$

Subject to $2x_1 + 3x_2 \le 8$

$2x_2 + 5x_3 \le 10$

$3x_1 + 2x_2 + 4x_3 \le 15$ and

$x_1, x_2, x_3 \ge 0$

The optimum solution to this problem is contained in the following simplex table :

Basic variables	$C_j \rightarrow$		3	5	4	0	0	0
	C_B	X_B	X_1	X_2	X_3	X_4	X_5	X_6
x_2	5	$50/41$	0	1	0	$15/41$	$8/41$	$-10/41$
x_3	4	$62/41$	0	0	1	$-6/41$	$5/41$	$4/41$
x_1	3	$89/41$	1	0	0	$-2/41$	$-12/41$	$15/41$
$\left(Z = 765/41\right)$ $Z_j - C_j \rightarrow$			0	0	0	$45/41$	$24/41$	$11/41$

Find the range over which components b_2 and b_3 of the requirement vectors can be changed maintaining the feasibility of the solution.

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UNIT - III

3 (a) Find the optimum solution of the following transportation problem :

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

8

(b) Solve the following assignment problem :

Jobs

Machines		J_1	J_2	J_3	J_4	J_5
	M_1	10	4	5	3	11
	M_2	13	11	9	12	10
	M_3	12	3	10	1	9
	M_4	9	1	11	4	8
	M_5	8	6	7	3	10

8

OR

3 (a) Find the optimum solution of the following transportation problem :

Stores

Factories		1	2	3	4	Supply
	A	4	6	8	13	50
	B	13	11	10	8	70
	C	14	4	10	13	30
	D	9	11	13	8	50
	Demand	25	35	105	20	

8

(b) A department head has five subordinates and five jobs to be done. The subordinates differ in efficiency and jobs differ in their intrinsic difficulty. The estimate of the times each man would take to perform each job is given in effectiveness matrix. How should the tasks be allocated on one to one basis, so as to minimize the total man hours.

Subordinates

Jobs		*I*	*II*	*III*	*IV*	*V*
	A	1	3	2	3	6
	B	2	4	3	1	5
	C	5	6	3	4	6
	D	3	1	4	2	2
	E	1	5	6	5	4

8

UNIT - IV

4 (a) Solve by steepest descent method :

Minimize $f(x) = 2x_1^2 + x_2^2 + 2x_1x_2 + x_1 - x_2$ starting from the point $x_1 = (0, 0)$.

8

(b) Solve :

Minimize $f(x) = x_1^2 + x_2^2$

Subject to $g_1(x) = -x_1 - x_2 + 5 \leq 0$

$g_2(x) = -x_1 + x_2 \leq 0$

By the exterior penalty method and find the solutions corresponding to $r = 1$, 10 and ∞.

8

OR

4 (a) Solve :

Minimize $f(x) = x_1 - x_2$

Subject to $g(x) = 3x_1^2 + x_2^2 - 2x_1x_2 - 1 \leq 0$

Using the sequential linear programming method and taking the convergence limit $\in = 0.02$.

8

(b) Compute the Newton step corresponding to $x_1 = (0, 1)$ in a search of unconstrained nonlinear programming

Minimize $f(x_1, x_2) = (x_1 + 1)^4 + (x_2 + 1)^4 + x_1 x_2$.

8

UNIT - V

5 (a) State Bellman's principle of optimality, using it solve the following dynamic programming problem :

Minimize $Z = x_1^2 + x_2^2 + x_3^2$

Subject to $x_1 + x_2 + x_3 \geq 15$ and

$x_1, x_2, x_3 \geq 0$.

8

(b) Solve the following LPP by using dynamic programming method :

Maximize $Z = 3000x_1 + 2000x_2$

Subject to $5x_1 + 2x_2 \leq 180$

$3x_1 + 3x_2 \leq 135$

and $x_1, x_2 \geq 0$.

8

OR

5 (a) State the 'Principle of optimality' in dynamic programming, using it solve the following dynamic programming problem :

Maximize $Z = x_1\, x_2\, x_3$

Subject to $x_1 + x_2 + x_3 = 10$ and

$x_1, x_2, x_3 \geq 0$

8

(b) Solve the following linear programming problem by using dynamic programming approach :

Maximize $Z = 6x_1 + 4x_2$

Subject to $2x_1 + x_2 \le 390$

$3x_1 + 3x_2 \le 810$

$x_2 \le 200$

and $x_1, x_2 \ge 0$.

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