ME|SemII|CBCGS|MECH|CAD|CAM|Optimization 23|05|18

M-J-18

Q. P. Code: 37853

(03 Hours) Total Marks - 80

NB. I) Attempt any **Four** Questions.
II) Make suitable assumptions if required.

Que.1 (a) Write a short note on (i) Central Composite Design (CCD). (08)
(ii) Design of experiment.

(b) The owner of a chain of four grocery stores has purchased six crates of fresh strawberries. The following table gives the estimated profits at each store when it is allocated various number of boxes : (12)

		Stores			
		1	2	3	4
Number of Boxes	0	0	0	0	0
	1	4	2	6	2
	2	6	4	8	3
	3	7	6	8	4
	4	7	8	8	4
	5	7	9	8	4
	6	7	10	8	4

The owner does not wish to split crates between stores, but is willing to make zero allocations. Find the allocation of six crates so as to maximize the profits.

Que.2 (a) Use branch and bound technique to solve the following integer programming problem. (14)

Maximize; $Z = 2X_1 + 3X_2$
Subject to; $6X_1 + 5X_2 \leq 25$
$X_1 + 3X_2 \leq 10$
$X_1, X_2 \geq 0$ and integers

(b) Define RSM and explain the steps in RSM. (06)

Que.3 (a) Solve the following linear programming problem. (12)

Maximize; $Z = 5X_1 + 12X_2 + 4X_3$
Subject to; $X_1 + 2X_2 + X_3 \leq 5$
$2X_1 - X_2 + 3X_3 = 2$
$X_1, X_2, X_3 \geq 0$

Discuss the effect of changing the requirement vector from {5, 2} to {3, 9} on the optimum solution.

(b) Explain the standard eight steps procedure proposed by Taguchi for applying his method for optimizing any process. (08)

Que.4 (a) Solve by dual simplex method the following problem. (10)

Minimize ; $Z = 3X_1 + 5X_2 + 2X_3$
Subject to ; $-X_1 + 2X_2 + 2X_3 \leq 3$
$X_1 + 2X_2 + X_3 \geq 2$
$2X_1 + X_2 - 2X_3 \leq 4$
$X_1, X_2, X_3 \geq 0$

(b) Use the Kuhn – Tucker condition to solve the following NLPP. (10)

Maximize; $Z = 2X_1^2 - 7X_2^2 + 12X_1X_2$

Subject to; $2X_1 + 5X_2 \leq 98$

$X_1, X_2 \geq 0$

Que.5 (a) Minimize the function $f(x) = x + e^{-x}$ using Newton's method. Perform three iterations starting from $x^{(0)} = 1$ and estimate the rate of convergence and the rate of constant. (12)

(b) An MCDM problem involves four criteria which are expressed in exactly the same units, and three alternatives. The relative weights of the four criteria were determined to be: $W_1 = 0.20$, $W_2 = 0.15$, $W_3 = 0.40$ and $W_4 = 0.25$. The corresponding a_{ij} values are: (08)

$$A = \begin{bmatrix} 25 & 20 & 15 & 30 \\ 10 & 30 & 20 & 30 \\ 30 & 5 & 30 & 5 \end{bmatrix}$$

Solve by using Analytic Hierarchy Process (AHP)

Que.6 (a) Phillips India is engaged in manufacturing different types of equipments for various consumers. The company has two assembly lines to produces its product. The processing time for each of the assembly lines is regarded as a random variable and is described by the following distributions : (10)

Processing time (min.)	40	42	44	46	48
Assembly X	0.10	0.15	0.40	0.10	0.25
Assembly Y	0.20	0.40	0.20	0.15	0.05

Using the following random numbers, generate data on the processing times for 10 units of the product and compute the expected processing time for the product: 4236, 7573, 4943, 1283, 2014, 3604, 9344, 5316, 7606, 0089. For the purpose, read the numbers horizontally, taking the first two digits for the processing time on assembly X and the last two digits for processing time on assembly Y.

(b) Write the dual of the following primal linear programming problem (05)

Minimize; $Z = 2X_1 + 3X_2 + 4X_3$

Subject to; $2X_1 + 3X_2 + 5X_3 \geq 3$

$3X_1 + X_2 + 7X_3 = 4$

$2X_1 + 4X_2 + 6X_3 \leq 6$

$X_1, X_2 \geq 0$, X_3 is unrestricted

(c) Classify the optimization problems and also write engineering application of optimization. (05)

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