ME/MRCH CAD/CAM & Rob./Sem II /CBCGS/ND-18/26-11-2018

(3 Hours)   (Total Marks : 80)

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

Que. 1 (a) Solve the following mixed integer programming problem by Gomory's (15)
Cutting plane method.
     Maximize ; $Z = 4X_1 + 6X_2 + 2X_3$
     Subject to ; $4X_1 - 4X_2 \leq 5$
                    $-X_1 + 6X_2 \leq 5$
                    $- X_1 + X_2 + X_3 \leq 5$
                    $X_1, X_2, X_3 \geq 0; X_1, X_3$ integer

     (b) Write a short note on generation of Random variable.   (05)

Que. 2 (a) It has been decided to shift grain from a warehouse to a factory in an open (15)
rectangular box of length x_1 meters, width x_2 meters and height x_3 meters.
The bottom, sides and end of the box cost, respectively, $ 80, $ 10 and
$ 20/m². It costs $ 1 for each round trip of the box. Assuming that the box
will have no salvage value, find the minimum cost of transporting 80 m³ of
grain. Solve by geometric programming method.

     (b) Explain sequential nature of RSM   (05)

Que. 3 (a) Write a short note on (i) 2^k Factorial Design (ii) Central Composite Design   (10)

     (b) Find the maximum of the function $f(x) = 2x_1 + x_2 + 10$ (10)
Subject to $g(x) = x_1 + 2x_2^2 = 3$
Using the Lagrange multiplier method. Also find the effect of changing the
right hand side of the constraint on the optimum value of f.

Que. 4 (a) Solve the following linear programming problem, by dual simplex method: (10)
     Minimize ; $Z = 20X_1 + 16X_2$
     Subject to ; $X_1 \geq 2.5$
                  $X_2 \geq 6$
                  $2X_1 + X_2 \geq 17$
                  $X_1 + X_2 \geq 12$
                  $X_1, X_2 \geq 0$

     (b) Obtain the duel of the following primal problem   (05)
         Maximize; $Z = -15Y_1 - 14Y_5 + 2Y_4$
       Subject to; $-Y_1 - 2Y_5 + Y_4 \leq -6$
                  $- 2Y_1 - Y_5 - Y_4 \leq -8$
                     $Y_1, Y_4, \geq 0 ;$
                  $Y_5 = Y_2 - Y_3$ is unrestricted in sign

     (c) What are the basic types of parameter changes that affect the optimal (05)
solution? State the application of optimization techniques.

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Que. 5 (a) Solve the following linear programming problem. (12)

Maximize; $Z = 4X1 + 6X2 + 2X3$

Subject to; $X1 + X2 + X3 \leq 3$

$X1 + 4X2 + 7X3 \leq 9$

$X1, X2, X3 \geq 0$

Discuss the effect of discrete change in the availability of resources from $\{3, 9\}$ to $\{9, 6\}$.

(b) An MCDM problem involves four criteria which are expressed in exactly (08) the same units, and three alternatives. The relative weights of the four criteria were determined to be: $W1 = 0.20$, $W2 = 0.15$, $W3 = 0.40$ and $W4 = 0.25$. The corresponding a_{ij} values are:

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

Solve by using Weighted Product Method (WPM).

Que. 6 (a) Consider the function, $f(x) = x^2 + e^{-x} + \sin[4x]$. Perform two iterations of (12) Newton's method for the function at $x = -1$.

(b) An equation of the form $y = a + (b/x)$ is used provide a best fit in the sense (08) of least squares, for the following points: $(X, Y) = (1, 6)$, $(3, 10)$ and $(6, 2)$. Determine 'a' and 'b'.