May-09

Roll No. .....

Subject Code—2062

M.C.S. EXAMINATION

(Fourth Semester)

COMPUTER BASED OPTIMIZATION METHODS

MS-19

Time : 3 *Hours* *Maximum Marks :* 100

Note : The candidates are required to attempt any *Five* questions. All questions carry equal marks.

1. (a) Give any *two* definitions of Operations Research. **5**

(b) Write down the advantages of Operators Research and its limitations. **15**

2. A farmer has a 100 acre farm. He can sell all the tomatoes, chillies and radishes which he produces. The price he can obtain is Re. 1 per kg for tomatoes, Re. 0.75 a head for chillies and Re. .2 per kg for radishes. The average

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yield per acre is 2000 kg of tomatoes, 3000 heads of chillies and 1000 kg of radishes. Fertilizer is available at Rs. 50 per kg and the amount required per acre is 100 kg, each for tomatoes and chillies and 50 kg for radishes. Labour required for sowing, cultivating and harvesting per acre is 5 man-days for tomatoes and radishes and 6 man-days for chillies. A total of 400 man-days of labour are available at Rs. 20 per man-day. Determine crop mix so as to maximize the farmer's total profit. **20**

3. Max. $Z = x + 2x_2 + 3x_3$

S.t. $x_1 - x_2 + x_3 \geq 4$

$x + x_2 + 2x_3 \leq 8$

$x_1 - x_3 \geq 2$

$x_1, x_2, x_3 \geq 0$ **20**

4. Using duality, find the optimal solution of the following problem : **20**

Max. $Z = 3x_1 - 2x_2$

S.t. $x_1 + x_2 \leq 5$

$x_2 \geq -1$

$x_1 \leq 4$

$x_2 \leq 6$

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5. A small project consists of seven activities for which the relevant data are given below :

Activity	Proceding activity	Activity duration (days)
A	–	4
B	–	7
C	–	6
D	A, B	5
E	A, B	7
F	C, D, E	6
G	C, D, E	5

Draw the network and find the project completion time. **20**

6. Let $\{x_n, n \geq 0\}$ be a Markov chain with three states 0, 1, 2 with transition matrix

$$\begin{pmatrix} 3/4 & 1/4 & 0 \\ 1/4 & 1/2 & 1/2 \\ 0 & 3/4 & 1/4 \end{pmatrix}$$

and the initial distribution $P_r\ [x_0 = i] = 1/3$, $i = 0, 1, 2$ show that : **20**

$$P_r\ [x_3 = 1 | x_2 = 2,\ x_1 = 1,\ x_0 = 2]$$

$$P_r\ [x_3 = 1 |\ x_2 = 2]$$

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7. In a car washing system, cars arrive according to Poisson distribution with an average time of 9 minutes between two consecutive arrivals. Average service rate is $\frac{1}{4}$ per minute. It is assumed to be exponentially distributed. Determine :

   (a) Probability that a person will have to wait

   (b) Probability that an arrival will have to wait for more than 10 minutes before the system is free. **20**

8. Solve the following integer programming problem using branch and bound method :

Max. $Z = -3x_1 + x_2 + 3x_3$

S.t $-x_1 + 2x_2 + x_3 \leq 4$

$2x_1 - 1{\cdot}5\, x_3 \leq 1$

$x_1 - 3x_2 + 2x_3 \leq 3$

$x_1, x_2 > 0$ and x_3 is non-negative integer. **20**