M.sc 4th Semester Examination,2021

Applied Mathematics With Oceanology And Computer Programming

Paper: MTM-495B

(OR methods using MATLAB and LINGO)

Full Marks:25 Time:2 hour

The figures in the right-hand margin indicate full marks.
Candidates are required to give their answers in their own words as far as practicable.
Illustrate the answers wherever necessary

Group- A

1. Answer any ***one*** question: 1x15=15

(a) (i) Write a program in MATLAB to solve the following Geometric Programming Problem.

Minimize $f(x)=7x_1x_2^{-1} + 7x_2x_3^{-2} + 5x_1^{-3}x_2x_3 + x_1x_2x_3$

(ii) Write a program in MATLABto solve the following problem on Inventory.An engineering factory consumes 5000 units of a component per year. The ordering, receiving and handling cost are Rs.300 per order while trucking cost is Rs.1200 per order,internet cost Rs. 0.06per unit per year,Deterioration and obsolence cost Rs 0.004 per year and storage cost Rs. 1000 per year for 5000 units.Calculate the economic order quantity and minimum average cost.

7+8

(b) (i) Write a program in MATLAB to solve the following LPP using simplex method.

Max $z = 2x_1+3x_2-x_3$

Subject to, $2x_1+5x_2-x_3 \leq 5$

$x_1+x_2+2x_3 = 6$

$2x_1-x_2+3x_3 = 7$

$x_1 , x_2 \geq 0$

(ii) Write a program in MATLAB to solve the following problem on Inventory.

The demand for an item is deterministic and constant over time and is equal to 600 units per year.The unit cost of the item is Rs. 50.00 while the cost of placing an order is Rs. 100.00.The inventory carrying cost is 20% of the item and the shortage cost per month is Rs. 1.Find the optimal ordering quantity.If shortages are not allowed, what would be the loss of the company? 7+8

(c) Write a MATLAB program to solve the following inventory problem:
The demand for an item is 18000 units per year. The inventory carrying cost is Rs. 1.20 per unit per year and the cost of shortage is Rs. 5.00 per unit per year. The ordering cost is Rs.400.00 for each order. Assuming that the replenishment rate is instantaneous, determine the optimum order quantity, shortage quantity and cycle length.

(d) Write a MATLAB program to find the Nash equilibrium and its outcome of the following bi-matrix game $A = \begin{bmatrix} 0 & -1 \\ 1 & -10 \end{bmatrix}$ and $B = \begin{bmatrix} 0 & 1 \\ -1 & -10 \end{bmatrix}$.

(Turn over)

(e) Write a MATLAB program to solve the following IPP:

$$Max\ Z = x_1 + x_2$$
$$subject\ to$$
$$3x_1 + 2x_2 \leq 5$$
$$x_2 \leq 2$$
$$x_1, x_2 \geq 0\ and\ integers.$$

Group-B

2. Answer any ***one*** question: 1x10=10

(a) (i) Write the solution procedure and program in LINGO to solve the following QPP using Wolfe's modified simplex method.
Max z=$2x_1+x_2-x_1^2$
Subject to, $2x_1+3x_2 \leq 6$, $2x_1+x_2 \leq 4$, $x_1, x_2 \geq 0$

(ii) Write the solution procedure and program in LINGO to find the Nash equilibrium strategy and Nash equilibrium outcome of the following bi-matrix game.

$\mathbf{A} = \begin{bmatrix} 1 & 0 \\ 2 & -1 \end{bmatrix}$ $\mathbf{B} = \begin{bmatrix} 2 & 3 \\ 1 & 0 \end{bmatrix}$ 5+5

(b) (i) Write the solution procedure and program in LINGO to solve the following Stochastic Programming Problem.

A manufacturing firm produces two machines parts using lathes, milling machines and grinding machines. The machining times available per week on different machines and the machining times required on different machines for each part are given below. Assuming that the profit per unit of each of the machine parts I and II is a normally distributed random variable, find the number of machine parts to be manufactured per week to maximize the profit. The mean value and standard deviation of profit are Rs. 50 and 20 per unit for part I and Rs. 100 and 50 per unit for part II.

Type of Machine	Machining time required per piece (minutes)		Maximum time available per week (minutes)
	Part I	Part II	
Lathes	$a_{11}=10$	$a_{12}=5$	$b_1=2500$
Milling Machines	$a_{21}=4$	$a_{22}=10$	$b_2=2000$
Grinding Machines	$a_{31}=1$	$a_{32}=1.5$	$b_3=450$

(ii) Write the solution procedure and program in LINGO to solve the following LPP Using Revised Simplex Method.

Max $z=x_1+x_2$
Subject to, $3x_1+2x_2 \leq 6$
$x_1+4x_2 \leq 4$ $x_1, x_2 \geq 0$ 5+5

(c) Write a LINGO program to solve the following queuing problem:
A telephone exchange has two long distance operators. The telephone company finds that, during the peak hours, long distance call arrive in a Poisson fashion at an average rate of 15 per hour. The length of service on this call is approximately exponentially distributed with mean length 5 minutes 10

(d) Write a LINGO program to solve the following LPP:
$Minimize\ z = 5x_1 + 3x_2$
$subject\ to$
$2x_1 + 4x_2 \leq 12$
$2x_1 + 2x_2 = 10$
$5x_1 + 2x_2 \geq 10$
$x_1, x_2 \geq 0$ 10

(e) Write a LINGO program to solve the following IPP: 10

$$Minimize\ z = 5x_1 + 3x_2$$
$$subject\ to$$
$$2x_1 + 4x_2 \leq 12$$
$$2x_1 + 3x_2 = 9$$
$$5x_1 + 2x_2 \geq 10$$
$$x_1, x_2 \geq 0\ and\ x_2\ is\ integer.$$