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PG CBCS
M.Sc. Semester-IV Examination, 2023
(Mathematics)
PAPER: MTM 495B
(PRACTICAL)
(OR METHODS USING MATLAB AND LINGO)

Full Marks: 25 **Time: 1 Hour**

GROUP-A (LINGO)

Answer any **ONE** of the following questions: 1×6=6

1. Write a code in LINGO to solve the following QPP using Wolfe's modified simplex method.

$$\max z = 4x_1 + 6x_2 - 2x_1^2 - 2x_1x_2 - 2x_2^2$$
$$subject\ to, x_1 + 2x_2 \leq 2$$
$$x_1, x_2 \geq 0$$

2. Write a code in LINGO to solve the Nash equilibrium strategy and Nash equilibrium outcome of the following bi-matrix game.

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

3. Write a code in LINGO to solve the following problem of 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.

4. Write a code 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 profit on machine part are given below. The machining times required on different machines for each
part are not known precisely (as they vary from worker to worker) but are known to follow normal distribution with mean and standard deviations as indicated in the following table.

(P.T.O.)

Type of Machine	Machining time required per unit(minutes)				Maximum time available per week (minutes)
	Part I		Part II		
	Mean	Standard deviation	Mean	Standard deviation	
Lathes	$\bar{a}_{11}=10$	$\sigma_{a11}=6$	$\bar{a}_{12}=4$	$\sigma_{a12}=4$	$b_1=2500$
Milling machines	$\bar{a}_{21}=4$	$\sigma_{a21}=6$	$\bar{a}_{22}=10$	$\sigma_{a22}=7$	$b_2=2000$
Grinding machine	$\bar{a}_{31}=1$	$\sigma_{a31}=2$	$\bar{a}_{32}=1.5$	$\sigma_{a31}=3$	$b_3=450$
Profit per unit(Rs)	$c_1=50$		$c_2=100$		

Determine the number of machine parts I and II to be manufactured per week to maximize the profit without exceeding the available machining times more than once in 100 weeks.

5. Write a code in LINGO to solve the following LPP using simplex method.

$$\max z = 2x_1 + 3x_2 - x_3$$
$$subject\ to, 2x_1 + 5x_2 - x_3 \leq 5$$
$$x_1 + x_2 + 2x_3 = 6$$
$$2x_1 - x_2 + 3x_3 = 7$$
$$x_1, x_2 \geq 0$$

6. Write a code in LINGO to solve the following QPP using Wolfe's modified simplex method.

$$max\ z = 2x_1 + 3x_2 - x_1^2$$
$$subject\ to, x_1 + 2x_2 \leq 4$$
$$x_1, x_2 \geq 0$$

7. Write a code in LINGO to solve the following Geometric Programming Problem.

$$min\ f(x) = 5x_1x_2^{-1} + 2x_1^{-1}x_2 + 5x_1 + x_2^{-1}$$

8. Write a code in LINGO to solve the following Queuing theorem problem.

A telephone exchange has two long distance operators. The telephone company finds that, during the peak load long distance all 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.

(a)What is the probability that a subscriber will have to wait for this long distance call during the peak hours of the day?

(P.T.O.)

(b) If the subscriber waits and are serviced in turn, what is the expected waiting time.

GROUP-B (MATLAB)

Answer any **ONE** of the following questions: 1×9=9

1. Write a code in MATLAB to solve the following problems of Inventory.

A constructer has to supply 10,000 bearing per day to an auto- mobile manufacturer. He find that when he start a production run, he can produce 25,000 bearing per day. The cost of holding a bearing in stock for one year is Rs 2 and set up cost for producing run is Rs 180. How frequently should the production?

2. Write a code in MATLAB to solve the following Stochastic Programming Problem.

A manufacturing firm produces two machines parts using lathes, milling machines and grinding Write a program in MATLAB to solve machines. The machining times required on different machines for each part and the profit on machine part are given below. If the machining times available on different machines are probabilistic (normally distributed) with parameters as given in the following table, find the number of machine parts I and II to be manufactured per week to maximize the profit. The constraint have to be satisfied with a probability of at least 0.99.

Type of Machine	Machining time requiredper piece (minutes)		Maximum time availableper week (minutes)	
	Part I	Part II	Mean	Standard deviation
Lathes	$a_{11}=10$	$a_{12}=5$	$b_1=2500$	$\sigma_{b1}=500$
Milling Machines	$a_{21}=4$	$a_{22}=10$	$b_2=2000$	$\sigma_{b2}=400$
Grinding Machines	$a_{31}=1$	$a_{32}=1.5$	$b_3=450$	$\sigma_{b3}=50$
Profit per unit(Rs)	$c_1=50$		$c_2=100$	

3. Write a code in MATLAB to solve the following problem of Inventory.

The demand for an item in a company is 18000 units per year. The company can produce the item at a rate of 3000 per month. The cost of one set-up is Rs. 500 and the holding cost of one unit per month is Rs. 0.15. The shortage cost of one unit is Rs. 20 per month. Determine the optimum manufacturing quantity. Also determine the manufacturing time and the time between setup.

(P.T.O.)

4. Write a code in MATLAB to solve the following LPP using simplex method.

$$\max z = 3x_1 + 4x_2$$
$$subject\ to, x_1 + x_2 \leq 10$$
$$2x_1 + 3x_2 \leq 18$$
$$x_1 \leq 8$$
$$x_2 \leq 6$$
$$x_1, x_2 \geq 0$$

5. Write a code in MATLAB to solve the following QPP using Wolfe's modified simplex method.

$$max\ z = 2x_1 + x_2 - x_1^2$$
$$subject\ to, 2x_1 + 3x_2 \leq 6$$
$$2x_1 + x_2 \leq 4$$
$$x_1, x_2 \geq 0$$

(P. T. O)

6. Write a code in MATLAB to solve the following Geometric Programming Problem.

$$min\ f(x) = 5x_1x_2^{-1}x_3^2 + x_1^{-2}x_2^{-1} + 10x_2^2 + 2x_1^{-1}x_2\,x_3^{-2}$$

7. Write a code in MATLAB to solve the Nash equilibrium strategy and Nash equilibrium outcome of the following bi-matrix game.

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

8. Write a code in MATLAB to solve the following Queuing theorem problem.

In a car wash service facility information gather indicates that cars arrive for service according to a Poisson distribution with mean 5 per hour. The time for washing and cleaning for each car varies but is found to follow an exponential distribution with mean 10 minutes per car. The facility cannot handle more than one car at a time and has a total of 5 parking spaces. If the parking spot is full, newly arriving cars balk to 6 services elsewhere.

(a) How many customers the manager of the facility is loosing due to the limited parking spaces?

(b) What is the expected waiting time until a car is washed?

Laboratory Note Book and Viva: 05

Field Tour with Report: 05

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