SHRIMATHI DEVKUNVAR NANALAL BHATT VAISHNAV COLLEGE FOR WOMEN
(AUTONOMOUS)
(Affiliated to the University of Madras and Re-accredited with 'A+' Grade by NAAC)
Chromepet, Chennai — 600 044.
M.Sc.(Appl.Maths) - END SEMESTER EXAMINATIONS APRIL - 2023
SEMESTER - IV
20PAMET4005 - Operations Research

Total Duration : 2 Hrs. 30 Mins. Total Marks : 60

Section B

Answer any **SIX** questions $(6 \times 5 = 30$ Marks)

1. Examine the economic interpretation of dual variables and dual constraints.
2. Use the revised simplex method to solve the following LP problems:
   Max Z $= x_1 + x_2 + 3x_3$
   subject to the Constraints
   $3x_1 + 2x_2 + x_3 \leq 3$
   $2x_1 + x_2 + 2x_3 \leq 2$
   and $x_1, x_2, x_3 \geq 0$.
3. Describe the recursive equation approach to solve the dynamic programming problem.
4. With an example, define the following dynamic programming terms
   i) decision variables ii) immediate return.
5. i) What will be the effect on the EOQ model with shortages if the shortage cost is very high?
   ii) A commodity is to be supplied at a constant rate of 25 units per day. A penalty cost will be charged at a rate of Rs10 per unit per day, if it is late for missing the scheduled delivery date. The cost of carrying the commodity in inventory is Rs16 per unit per month. The production process is such that each month (30 days) a batch of items is started and is available for delivery any time after the end of the month. Find the optimal level of inventory at the beginning of each month.
6. The demand of an item is uniform at a rate of 25 units per month. The fixed cost is Rs15 each time a production run is made. The production cost is Re1 per item, and the inventory carrying cost is Re0.30 per item per month. If the shortage cost is Rs1.50 per item, per month, determine how often should a production run be mads and of what size should it be?

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7. Consider the function, $f(x) = x_1 + 2x_2 + x_1x_2 - x_1^2 - x_2^2$ .Determine the maximum or minimum point (if any) of the function.

8. Obtain the solution of the following problems by using the method of Lagrangian multipliers
Min z = $3x_1^2 + x_2^2 + x_3^2$
subject to $x_1 + x_2 + x_3 = 2$ and $x_1, x_2, x_3 \geq 0$.

Section C

I - Answer any **TWO** questions $(2 \times 10 = 20$ Marks)

9. Use dual simplex method to solve the following LP problem:
Min z = $3x_1 + x_2$
Subject to $x_1 + x_2 \geq 1$;
$2x_1 + 3x_2 \geq 2$ and
$x_1, x_2 \geq 0$

10. i) A truck can carry a total of 10 tonnes of a product. Three types of products are available for shipment. Their weights and values are tabulated. Assuming that at least one of each type must be shipped, determine the type of loading that will maximize the total value.

Product Type	Value (Rs)	Weight (Rs)
A	20	1
B	50	2
C	60	3

ii) Why is it frequently desirable to solve a problem with a number of decision variables by dividing it into a series of sub problems?

11. A dealer supplies you the following information with regard to a product that he deals in: Annual demand = 10,000 units; Ordering cost = Rs 10 per order; Price = Rs 20 per unit Inventory carrying cost = 20 per cent of the value of inventory per year. The dealer is considering the possibility of allowing some back order (stock out) to occur. He has estimated that the annual cost of back ordering will be 25 per cent of the value of inventory.

(a) What should be the optimum number of units of the product he should buy in one lot?
(b) What quantity of the product should be allowed to be backordered, if any?
(c) What would be the maximum quantity of inventory at any time of the year?
(d) Would you recommend allowing backordering? If so, what would be the annual cost saving by adopting the policy of backordering.

12. Use Wolfe's method to solve the quadratic programming problem:
    Max z $=4x_1 + 6x_2$ - $2x_1^2$ - $2x_1\, x_2$ - $2x_2^2$
    subject to $x_1 + 2x_2 \leq 2$ and x_1,x_2 $\geq$0.

II - Compulsory question $(1 \times 10 = 10$ Marks)

13. Arrivals at telephone booth are considered to be Poisson with an average time of 10 minutes between one arrival and the next. The length of phone calls is assumed to be distributed exponentially, with a mean of 3 minutes.

    (a) What is the Probability that a person arriving at the booth will have to wait?

    (b) The telephone department will install a second both when Convinced that an arrival would expect waiting for atleast 3 minutes for a phone call. By how much should the flow of arrivals increase in order to justify a second booth?

    (c) What is the average length of the queue that forms from time to time?

    (d) What is the probability that it will take a customer more than 10 minutes altogether to wait for the phone and Complete his call?

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