M.Sc. DEGREE EXAMINATION,APRIL 2020
II Year IV Semester
Operations Research

Time : 3 Hours **Max.marks :75**

Section A $(10 \times 2 = 20)$ Marks

Answer any **TEN** questions

1. Write the dual of the following LP problem

   Maximize $Z = 3x_1 - 2x_2 + 4x_3$

   Subject to the constraints

   $3x_1 + 5x_2 + 4x_3 \geq 7$
   $6x_1 + x_2 + 3x_3 \geq 4$
   $7x_1 - 2x_2 - x_3 \leq 10$
   $x_1 - 2x_2 + 5x_3 \geq 3$
   $4x_1 + 7x_2 - 2x_3 \geq 2$
   and $x_1, x_2, x_3 \geq 0$

2. Write the Comparison between simplex method and revised simplex method.
3. State Bellman's principle of optimality.
4. Write the general algorithm of the Dynamic Programming problem.
5. Define setup cost and holding cost.
6. What do you mean by inventory system's performance?
7. Define Service Process.
8. What do you mean by pure Birth process?
9. State the necessary condition for local extrema of a function.
10. State general non-linear programming problem.
11. Define Pure Death Process.
12. State the necessary condition to achieve relative maximum for an LPP.

Section B $(5 \times 5 = 25)$ Marks

Answer any **FIVE** questions

13. Use the dual simplex method to solve the Linear Programming problem

    Maximize $Z = -2x_1 - x_3$
    Subject to the constraints
    $x_1 + x_2 - x_3 \geq 5$
    $x_1 - 2x_2 + 4x_3 \geq 8$
    and $x_1, x_2, x_3 \geq 0$

14. Use dynamic programming to solve the following problem

    Maximize $Z = y_1^2 + y_2^2 + y_3^2$
    Subject to the constraints
    $y_1 + y_2 + y_3 = 10$
    and $y_1, y_2, y_3 \geq 0$

15. A commodity is to be supplied at a constant rate of 200 units per day. Supplies of any amount can be obtained at any required time, but each ordering costs Rs. 50; cost of holding the commodity in inventory is Rs.2.00 per unit per day while the delay in the supply of the item induces a penalty of Rs 10 per unit per day. Find the optimal policy (Q,t), where t is the reorder cycle period and Q is the inventory after reorder. What would be the best policy, if the penalty cost becomes infinite?

16. The demand for an item in a company is 18,000 units per year, and the company can produce the item at a rate of 3,000 per month. The cost of one set-up is Rs 500 and the holding cost of one unit per moth is 15 paise. The shortage cost of one unit is Rs 240 per year. Determine the optimum manufacturing quantity and the number of shortages.

    Also determine the manufacturing time and the time between set-ups.

17. Solve graphically the following Non-linear programming problem

    Maximize $Z = 8x_1 - x_1^2 + 8x_2 - x_2^2$
    Subject to the constraints
    $x_1 + x_2 \leq 12$
    $x_1 - x_2 \geq 4$
    and $x_1, x_2 \geq 0$

18. A company operating 50 weeks in a year is concerned about its stocks of copper cable. This costs Rs.240 a meter and there is a demand for 8,000 meters a week. Each replenishment costs Rs.1050 for administration and Rs.1,650 for delivery, while holding costs are estimated at 25 per cent of value held a year. Assuming no shortages are allowed, what is the optimal inventory policy for the company? How would this analysis differ if the company wanted to maximize profit rather than minimize cost?What is the gross profit if the company sell cable for Rs 360 a meter?

19. Write about relationships among performance measures of a Queuing system.

Section C $(3 \times 10 = 30)$ Marks

Answer any **THREE** questions

20. Use the revised simplex method to solve the following LP problem

    Maximize $Z = 3x_1 + 5x_2$
    Subject to the constraints
    $x_1 \leq 4$
    $x_2 \leq 6$
    $3x_1 + 2x_2 \leq 18$
    and $x_1, x_2 \geq 0$

21. Determine the value of u_1, u_2 and u_3 so as to
    Maximize $Z = u_1.u_2.u_3$
    Subject to
    $u_1 + u_2 + u_3 = 10$
    $u_1, u_2, u_3 \geq 0$

22. Explain the EOQ model with Constant Rate of Demand and Variable Order Cycle Time.

23. 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 call is assumed to be distributed exponentially, with mean 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 booth 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 him more than 10 minutes altogether to wait for the phone and complete his call?

24. Obtain necessary conditions for the optimum solution of the following problem

    Minimize $f(x_1, x_2) = 3e^{2x_1+1} + 2e^{x_2+5}$
    Subject to
    $g(x_1, x_2) = x_1 + x_2 - 7 = 0$
    $x_1, x_2 \geq 0$