M.A./M.Sc. Examination 2017

Semester - IV

Mathematics

Course: MMC-42

(Operations Research)

Time: Three Hours **Full Marks: 40**

Questions are of value as indicated in the margin.
Notations and symbols have their usual meanings.
*Answer **any four** questions.*

1. a) Explain the relative advantages of the revised simplex method over the regular simplex method. 2

   b) Use revised simplex method to solve the following LPP:

   Maximize $f(x_1, x_2) = x_1 + 2x_2$

   subject to $3x_1 + 2x_2 \geq 6,$

   $x_1 + 6x_2 \leq 3,$

   $x_1, x_2 \geq 0$. 6+2

   Comment on the characteristic of the solution.

2. a) Discuss the application areas of sensitivity analysis. 2

   b) Find the optimal simplex table of the following LPP:

   Maximize $f(x_1, x_2, x_3) = 3x_1 - 2x_2 + 4x_3$

   subject to $x_1 + 2x_2 + x_3 \leq 430,$

   $3x_1 + 2x_3 \leq 460,$

   $x_1 + 4x_2 \leq 420,$

   $x_1, x_2, x_3 \geq 0.$ 2+2+4

   What will be the effect when

   (i) a new constraint $3x_1 + 2x_3 \leq 500$ and

   (ii) a new constraint $3x_1 + 2x_3 \leq 400$ is added to the problem?

3. a) Distinguish between ordinary linear programming problem and integer linear programming problem. 2

   b) Find the optimal solution to the LPP:

   Maximize $f(x_1, x_2) = 2x_1 + 2x_2$

   subject to $5x_1 + 3x_2 \leq 8,$

   $x_1 + 2x_2 \leq 4,$

   $x_1, x_2 \geq 0$ and are integers. 8

P.T.O.

4. a) State Kuhn-Tucker necessary and sufficient conditions to find a solution of the non-linear programming problem (NLPP). 2

   b) Use the Kuhn-Tucker necessary and sufficient conditions to solve the following NLPP:

   Minimize $f(x_1, x_2) = -\log_e x_1 - \log_e x_2$

   subject to $x_1 + x_2 \le 2,$

   $x_1, x_2 \ge 0$. 4

   c) Show the following NLPP graphically:

   Minimize $f(x_1, x_2) = x_1^2 - 2x_1 + x_2^2 + 1$

   subject to $x_1 + x_2 \le 0,$

   $x_1^2 - 4 \le 0,$

   $x_1, x_2 \ge 0$. 4

5. a) In a deterministic inventory model where supply is instantaneous and shortages are permitted in the sense of back orders, find mathematical expressions for the optimal lot size and corresponding annual cost. 6

   b) The purchase manager currently follows EOQ policy of ordering for an item in the stores of his company. The annual demand of the item is 1600 units. Its carrying cost is 40% of the unit cost where the unit cost is Rs. 400. The ordering cost is Rs. 500 per order. Recently, the vendor supplying that item gives a discount of 10% in its unit cost if the order size is minimum of 500 units. 2+2

   (i) Find EOQ and the corresponding total cost per year.

   (ii) Check whether the discount offer given by the vendor can be considered by the purchase manager.

6. a) For the queueing model system (M/M/1 : N/FCFS), find the probability of n customers in the system in the form $p_n = \dfrac{(1-\rho)\rho^n}{1-\rho^{N+1}},\ \rho \ne 1,\ n = 0, 1, 2, ..., N.$ 6

   b) In a railway marshaling yard, goods trains arrive at a rate of 30 trains per day. Assume that the inter arrival time follows an exponential distribution and the service time distribution is also exponential with an average of 36 minutes. Calculate: 2+2

   (i) The probability that the yard is empty.

   (ii) Average queue length assuming that the line capacity of the yard is 9 trains.

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