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| **Reg. No.** |  |  |  |  |  |  |  |  |  |  |  |

D.K.M. COLLEGE FOR WOMEN (AUTONOMOUS), VELLORE-1

SEMESTER EXAMINATIONS

NOVEMBER – 2018 15CMA5D

# INDUSTRIAL APPLICATIONS OF MATHEMATICS

Time : 3 Hrs Max. Marks : 75

SECTION-A (10 x 2 = 20)

Answer ALL the questions.

1. *Define Constraints.*
2. *Write down the mathematical formulation of LPP.*
3. *What is called Artificial Variable?*
4. *State fundamental theorem of Duality.*
5. *What is called balanced transportation problem?*
6. *Define basic feasible solution.*
7. *Write down the Mathematical representation of the Assignment model.*
8. *What is called cost matrix?*
9. *What is called stock?*
10. *What is known as shortage?*

SECTION-B (5 x 5 = 25)

Answer any FIVE of the following questions.

1. *A chemical company produces two products X and Y. Each unit of product X requires 3 hours on operation 1 and 4 hours on operation II, while each unit of product Y requires 4 hours on operation I and 5 hours on operation II. Total available time for operations I and II is 20 hours and 26 hours respectively. The production of each unit of product Y also results in two units of a by product Z at no extra cost. Product X sells at profit of Rs.10/unit , while Y sells at profit of Rs.20/unit by product Z brings a unit profit of Rs.6 if sold in case it cannot be sold, the destruction cost is Rs.4/unit. Forecasts indicate that not more than 5 units of Z can be sold. Formulate LP model to determine the quantities of X and Y to be produced keeping Z in mind , so that the profit earned is maximum.*
2. *Solve the following LPP by using the graphical method*

*Minimum *

*Subject to the constraints:*

**

1. *Solve the following LPP by using the Big – M method*

*Maximize Z = *

*Subject to the constraints:*

**

1. *Construct the dual of the problem*

*Minimize Z = *

*Subject to the constraints:*

**

1. *Find the Initial basic feasible solution of the following transportation problem by using Vogel’s approximation method.*

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  |  | *Distribution centres* | | | | *Availability* |
|  |  | *D1* | *D2* | *D3* | *D4* |
|  | *S1* | *11* | *13* | *17* | *14* | *250* |
| *Origin* | *S2* | *16* | *18* | *14* | *10* | *300* |
|  | *S3* | *21* | *24* | *13* | *10* | *400* |
| *Requirement* |  | *200* | *225* | *275* | *250* |  |

1. *Find the optimal solution of the following problem*

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | *To* | | | | *Supply* |
|  |  | *1* | *2* | *3* |
|  | *1* | *5* | *1* | *7* | *10* |
| *From* | *2* | *6* | *4* | *6* | *80* |
|  | *3* | *3* | *2* | *5* | *15* |
| *Demand* |  | *75* | *20* | *50* |  |

1. *Four different jobs can be done on four different machines. The set up and take down time costs are assumed to be prohibitively high for change overs. The matrix below given the cost in rupees of processing job on machine j.*

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| ***Machines*** | | | | | |
| ***Job*** |  | *M1* | *M2* | *M3* | *M4* |
| *J1* | *5* | *7* | *11* | *6* |
| *J2* | *8* | *5* | *9* | *6* |
| *J3* | *4* | *7* | *10* | *7* |
| *J4* | *10* | *4* | *8* | *3* |

*He should the jobs be assigned to the various machines so that the total cost is minimum.*

1. *A stockist has to supply 12,000 units of a product per year to his customer the demand is fixed and known and the shortage cost is assumed is to be infinite. The inventory holding cost is Rs.0.20 per unit per month and the ordering cost per order is Rs.350. Determine* 
   1. *the optimum lot size  .*
   2. *optimum Scheduling period  .*
   3. *minimum total variable yearly cost.*

SECTION-C (3 x 10 = 30)

Answer ALL the questions.

1. *(a) Use simplex method to solve the following problem:*

*Maximize Z = *

*Subject to the constraints:*

**

*(Or)*

*(b) Obtain the dual of the primal problem*

*Maximize Z = *

*Subject to the constraints:*

**

1. *(a) Find the basic feasible solution of the following transportation problem by north-west   
    corner rule. Also find the optimal transportation plan:*

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  | *1* | *2* | *3* | *4* | *5* | *Available* |
|  | *4* | *3* | *1* | *2* | *6* | *80* |
| *B* | *5* | *2* | *3* | *4* | *5* | *60* |
| *C* | *3* | *5* | *6* | *3* | *2* | *40* |
| *D* | *2* | *4* | *4* | *5* | *3* | *20* |
| *Required* | *60* | *60* | *30* | *40* | *10* | *200* |

*(Or)*

*(b) A company has a team of four salesman and there are four districts where the company   
 wants to starts its business. After taking into account the capabilities of salesman and   
 the nature of districts, the company estimates that the profit per day in rupees for each   
 salesman in each district is as below:*

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | *District* | | | | |
| *Salesman* |  | *1* | *2* | *3* | *4* |
| *A* | *16* | *10* | *14* | *11* |
| *B* | *14* | *11* | *15* | *15* |
| *C* | *15* | *15* | *13* | *12* |
| *D* | *13* | *12* | *14* | *15* |

*Find the assignment of salesman to various districts which will yield maximum profit.*

1. *(a) (i) Calculate the E.O.Q in units and total variable cost for the following items, assuming an ordering*

*cost of Rs.5 and a holding cost of 10%.*

|  |  |  |
| --- | --- | --- |
| *Item* | *Annual demand* | *Unit price (Rs.)* |
| *A* | *800 units* | *0.02* |
| *B* | *400 units* | *1.00* |
| *C* | *392 units* | *8.00* |
| *D* | *13,800 units* | *0.29* |

*(ii) For the above problem , compute E.O.Q in Rs. as well as in years of supply. Also calculate the*

*E.O.Q frequency for each of the four items.*

*(Or)*

*(b) (i) The demand for a commodity is 100 units per day. Every time an order is placed , a fixed*

*cost of Rs.400 is incurred . Holding cost is Rs.0.08 per unit per day. If the lead time is 13*

*days, determine the economic lot size and the reorder point.*

*(ii) A stockist purchases an item at the rate of Rs.40 per piece from a manufacturer, 2000*

*units of the item are required per year. What should be the order quantity per order if the*

*cost per order is Rs.15 and the inventory charges per year are 20 paise?*

\* \* \* \* \* \* \*