Operation Research:-

II-BBA

16CCBB8

Section-A

1. Define "Operation Research":-

Operation Research is a Scientific Method of providing executive departments with a quantitative basis for decisions regarding the operations under this Control.

- Morse and Kimball.

2. What is Graphical Method:-

Graphical Method It is essential involves indicative the Constraints on the Graph and determining the feasible region.

3 Transportation problem:-

The Transportation problem is one of the Sublasses of LPP's. Here quantities of a Single homogeneous Commodity that are initiatly stored at various Origions to different distinations in Such a way that the transportation Cost is minimum

4. define "feasible Solution":-

Any Set of non-negative allocations $(x_{ij} \geq 0)$ which Satisfies the row and Column Sum is called a feasible Solution.

5. Mean by Assignment problem:-

* Subbose there are n jobs to be performed and n persons for available in doing in this job.

* assume that each person can do each job at a time through with very decreas of efficiency

* The problem is find to an assignment, the total cost of performing all the job is minimum.

6 What is linear programing:-

It is the coralisis of problem in which a linear function of a number of variables is to be Optimized When the variable are subject to a number or restrains in the form of in equalityes.

7. phases of Operation Research:-

* Judgement pace
* Resowrch pace
* action pace

8. What is Decision Making:-

Decision literally means chosing from available alternatives the essential characteristics all decision are.

1. Drigger
2. Alternative at the disposal
3. Influencing factoures.

9 What is Modals of function:-

The Modal can be three catagories.

(i) Descriptive Model
(ii) predictive Model
(iii) Normative or Optimization model.

10 limitation of Operation Research:-

(i) Models are the only idealized representations of reality and cannot be regarded as absolute in any case

(ii) the validity of the Model of a particular situation of can be only by Condating exprementes.

11 Define "Inventory Control"

The American Institute of Certified public Account (AICPA) defines "Inventory in the sense of tangible goods which are held for sale, in process of production and available for ready Consumption.

12. Meaning of Inventory Control:-

It may mean stock of finished goods only. In a manufacturing Concern it may include raw materials, Work in process and stores, etc. to understand the exact Meaning of the Work inventory

13. Meaning of Replacement:-

The Study of Replacement is Concerned with situvations that arise when some items such as Machines, Men, electric-light bulbs, etc... need replacement due to their deteriorating efficiency, failure or breakdown.

14 Define LPP

LPP involving two decision variable can we solved Graphical the optimum solution to LPP can be evaluating the value of the objective function.

15 What is Raw material:-

It include direct Natrial used in a manufecture of a product. a prepase of holding raw matrial is to ensure production in a event of deliery.

16. Meaning of cost of Inventory:-

In determining and optional inventory polici, the most often is the cost function.

(i) purchase cost
(ii) Ordering cost / set-up cost
(iii) Carrying cost
(iv) Stock out cost.

17. Probabalistic Model:-

We Consider the Situations where demand is not known exactly but the ~~prob~~ probabilistic distribution of demand is some known.

1) Single Period probabilistic Model
2) Multiperiod probabilistic Model.

18 What is Scrap Matrial:-

It represent the Weast Matrial produced in the process of production Scrap is sled to secondary market so as to get some value out of it.

19 Reasons for Carrying Inventory

* Transaction Motive
* Precautionary Motive
* Speculative Motive.

20. Basic EOQ Modal:-

EOQ : Economic Order Quantity

In this model, the demand is assume to be fixed and compectly pre determinied that is stastic demand. EOQ is an important fator Controling inventory.

Section B

5 Mark

1. phase of Operation Research:-

The procedure to be forword in the Study of operation Research generaly involved the following phases

(i) formulation the problem
(ii) Constructing a mathematical Modal
(iii) derivaling the solution from the Modal
(iv) testing the Modal and it's Solution (updateing the Modal)
(v) Controlling the Solution
(vi) implementation.

2. A Company Manufactures two products, A and B These Products are processed in the same machine. It takes 10 Minutes to process one unit of products A and 2 minutes for each unit of product B and the mechine Operates for a maximum of 35 hours in a Week product A requires 1kg and B requires 0.5 kg of raw material Per unit, the supply of which is 600 kg per Week. Market Constraint on product B is known to be minimum of 800 units every week product A Costs ₹ 5 per unit and sold at ₹ 10 product B costs ₹ 6 per unit and can be sold in the market at a unit price of ₹ 8 Determine the number of units of A and B per Week to maximize the profits.

Solution:-

A & B

A required 10 minites

B required 2 minites

maximum 35 hours

raw matrial :-

A required 1. kg

B required 0.5 kg

Decision variable : A & B Consists for $x_1, 1x_2$

Objective Variable

Cost price A 5, Sold = 10

A price = $10-5 = 5x_1$

B price = $8-6 = 2x_2$

$\max z = 5x_1 + 2x_2$.

Constraints = There are two Constraints Product A, product B.

product $10x_1 + 2x_2 \leq 2100$ | 35 hours $35 \times 60 = 2100$

Raw material

$1x_1 + 0.5x_2 \leq 600$

$x_2 \geq 800$

Subject to:

$\max z = 5x_1 + 2x_2$

$10x_1 + 2x_2 \leq 2100$

$1x_1 + 0.5x_2 \leq 600$

3. Scope of Operation Research:-

There is a great scope for economicst, adminisated and technician Working as a team to sail the problem or defience by using Operation Research apporch.

(i) agriculture
(ii) finance
(iii) Industry
(iv) Marketing
(v) Personal Management
(vi) prodution Management
(vii) Research and devopement
(viii) military Operation.

4. Solve the LPP by Graphical Method.

Minimize $Z = 20x_1 + 10x_2$.

Subject to

$$x_1 + 2x_2 \leq 40$$
$$3x_1 + x_2 \geq 30$$
$$4x_1 + 3x_2 \geq 60$$
$$x_1, x_2 \geq 0.$$

(i) $x_1 + 2x_2 \leq 40$

$x_1 = 0$

$x_1 + 2x_2 = 40$

$0 + 2x_2 = 40$

$x_2 = \frac{40}{2} = 20$

$x_2 = 20$ point $(0, 20)$

(ii) $x_2 = 0$

$x_1 + 2x_2 = 40$

$x_1 + 0 = 40$

$x_1 = \frac{40}{1} = 40$

$x_1 = 40$ point $(40, 0)$

(ii) $3x_1 + x_2 \geq 30$

$x_1 = 0$

$3x_1 + x_2 = 30$

$0 + x_2 = 30$

$x_2 = \frac{30}{1} = 30$ point $(0, 30)$

$x_2 = 30$

$x_2 = 0$

$3x_1 + x_2 = 30$

$3x_1 + 0 = 30$

$x_1 = \frac{30}{3} = 10$ point $(10, 0)$

$x_1 = 10$

(iii) $4x_1 + 3x_2 = 60$

$x_1 = 0$

$4x_1 + 3x_2 = 60$

$0 + 3x_2 = 60$

$x_2 = \frac{60}{3} = 20$ point (0, 20)

$x_2 = 20$

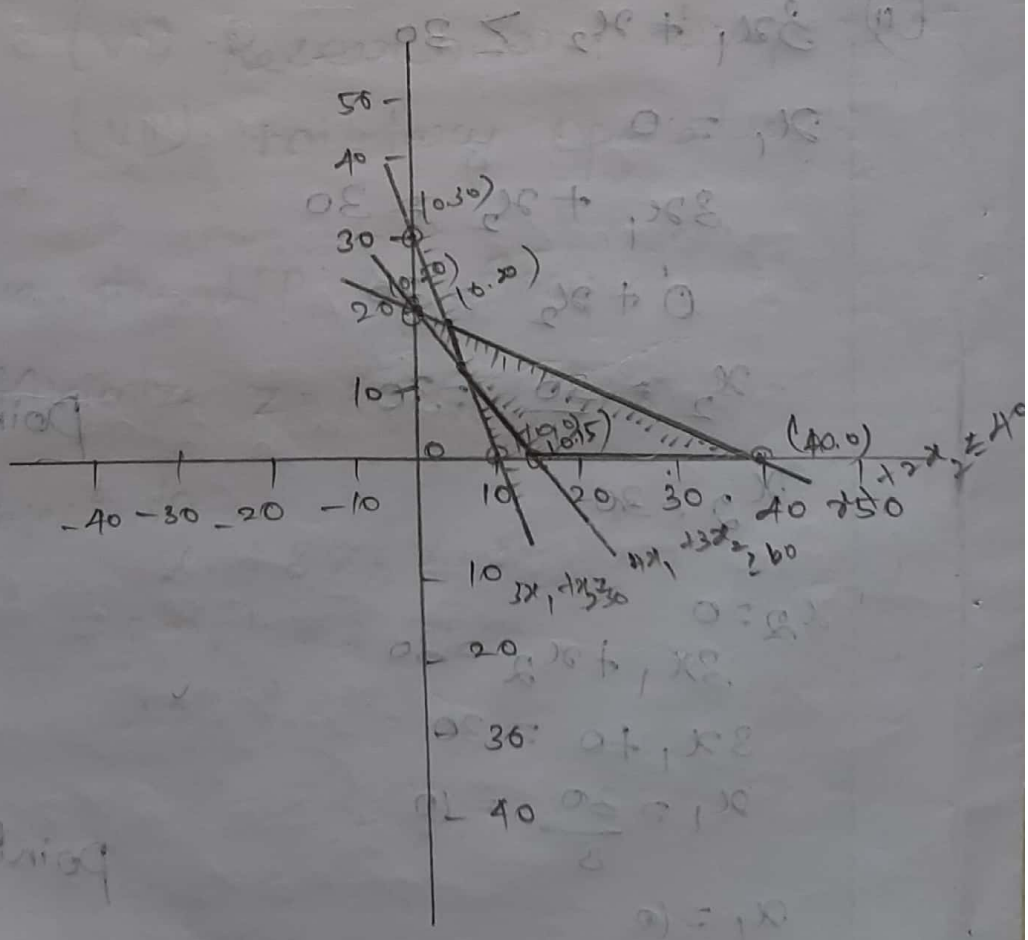
$x_2 = 0$

$4x_1 + 3x_2 = 60$

$4x_1 + 0 = 60$

$x_1 = \frac{60}{4} = 15$ point (15, 0)

$x_1 = 15$



$x_1 + 2x_2 = 40$; $3x_1 + x_2 = 30$

A = (15, 0)

B = (40, 0) $x_1 + 2x_2 = 40 \Rightarrow ① \times 3$

C = ? $3x_1 + x_2 = 30 \Rightarrow ②$

D = ?

$3x_1 + 6x_2 = 120$

$3x_1 + x_2 = 30$

$5x_2 = 90$

$x_2 = 90$

$x_2 = \frac{90}{5} = 18$ $x_2 = 18$

$x_2 = 18 \Rightarrow$ Substitute to I

$x_1 + 2x_2 = 40$

$x_1 + (2 \times 18) = 40$

$x_1 + 36 = 40$

$x_1 = 40 - 36$

$\boxed{x_1 = 4}$

$4x_1 + 3x_2 = 60$; $3x_1 + x_2 = 30$

$4x_1 + 3x_2 = 60 \Rightarrow ①$

$3x_1 + x_2 = 30 \Rightarrow ② \times 3$

$9x_1 + 3x_2 = 600 = 90$

$4x_1 + 3x_2 = 90 = 60$

$5x_1 = +30$

$x_1 = \frac{30}{5} = 6$

$x_1 = 6$

$3x_1 + x_2 = 30$

$(3 \times 6) + x_2 = 30$

$18 + x_2 = 30$

$x_2 = 30 - 18$

$x_2 = 12.$

point (6, 12)

$\min Z = 20x_1 + 10x_2$

Points	value
A (15, 0) →	300
B (40, 0) →	800
C (4, 18) →	200
D (6, 12) →	240

(i) $20x_1 + 10x_2 = Z$

$(20 \times 15) + (0 \times 0) = Z$

$300 + 0 = 300$

(ii) $20x_1 + 10x_2 = Z$

$(20 \times 40) + 10 \times 0 = Z$

$800 + 0 = 800$

(iii) $20x_1 + 10x_2 = Z$

$(20 \times 4) + (10 \times 18) = Z$

$80 + 180 = 260$

(iv) $20x_1 + 10x_2 = Z$

$(20 \times 6) + (10 \times 12) = Z$

$120 + 120 = 240.$

5 Different between transportation problem and Assignment problem.

	transporatation problem	Assignment problem
1.	Number of sources and destinations need not to be equal the cost is not neccessary for a square matrix.	assignment problem is don on a one-to-one pasis the number sources and destination are equal, the cost matrix must be. Square matrix.
2.	The problem is un balanced if the total supply and total demand are not equal	The problem is un balanced it the cost matrix is not a square matrix.
3.	The capacity and the requirement value is equal to ai and bj, for the sources of j^{th} destination $i = 1, 2 \ldots m$, $j = 1, 2 \ldots n$	The capacity and the requirement value is exactly one, that is for each sources of each destination.

* x_{ij}, the quantity to be transported from i^{th} origin to the j^{th} destination can take any posible positive value.

x_{ij} the j^{th} is to be assined to the i^{th} pers and can take eighter the value one and 1 or 0

b. Explain the North West Corner Rule

	A	B	C	supply
01	5	6	7	9
02	7	8	6	10
03	2	4	3	6
Demand	5	9	11	25

	A	B	C	
01	5	4		9 4
02	7	5 8	5 6	10 5 0
03	2	4	6 3	6 0
	5	9 5		

$x_{11} = 5$

$x_{12} = 4$

$x_{22} = 5$

$x_{23} = 5$

$x_{33} = 6$

total cost $(5\times5) + (4\times6) + (5\times8) + (5\times6) + (3\times6)$

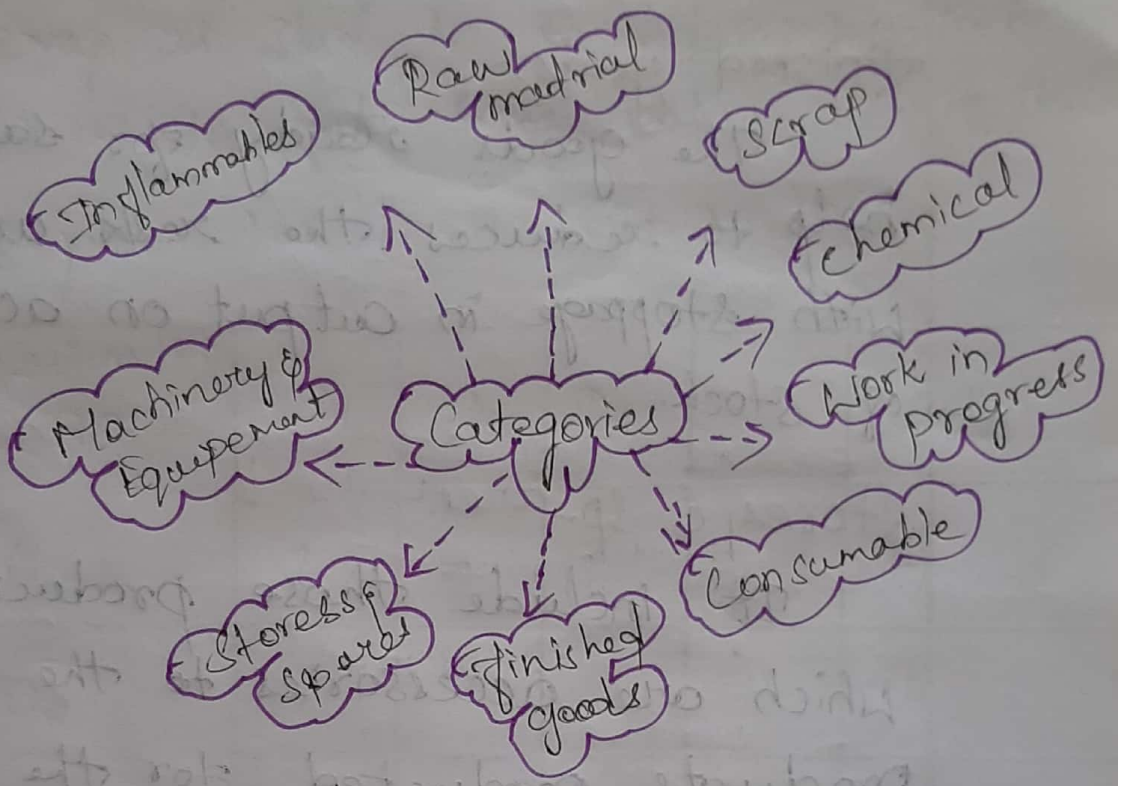
$\Rightarrow 25 + 24 + 40 + 30 + 18$

$\Rightarrow 49 + 70 + 18$

$\Rightarrow 119 + 18$

$\Rightarrow$ 137

7 Categories of Inventory



Raw Madrial:-

It include direct Madrial used in a manufacture of a product a propase of holding raw madrial is to ensure production in a event of deliery

Work in prograss:-

It include finished goods and Madrial help between manufactureing stage. It allso can be raw matrial which are used in production process.

Consumable :-

The product are consumes buy recurrently. It is ideams which get usedup.

finished goods :-

The goods ready for sale. It help to reduces the resk associated with stoppage in output on account of stock.

Stores & Spares :-

It include those products which are accessories to the main products. producted for the propose of sale

Machinery & Equipement :-

All the Machinery, power and hand driven Equipement such as Eectric Motors, types writers, late machines and other machines in used in production in other department.

Chemical :-

The should be stored preserved and issued very careful securitly sense there use good event life to resask.

Scrap Matrial :-

It represent the weast Matrial produced in the process of production Scrap is sled to secondary Market so as to get some value out of it.

8 Explain the least cost Method.

Destination / Origin	D_1	D_2	D_3	D_4	Supply
O_1	6	4	1	5	14
O_2	8	9	2	7	16
O_3	4	3	6	2	5
dd	6	10	15	4	35

$a_{ij} = 35 = b_{ij}$

	D_1	D_2	D_3	D_4	
O_1	6	4	14 1	5	14 0
O_2	6 8	9 9	1 2	7	16 15 9
O_3	4	4 3	6	4 2	5 1
	6 0	16	15 1	4	

$x_{13} = 14$
$x_{21} = 6$
$x_{22} = 9$
$x_{23} = 1$
$x_{32} = 1$
$x_{34} = 4$

Total Cost = (14×1) + (6×8) + (9×9) +
(1×2) + (1×3) + (4×2)

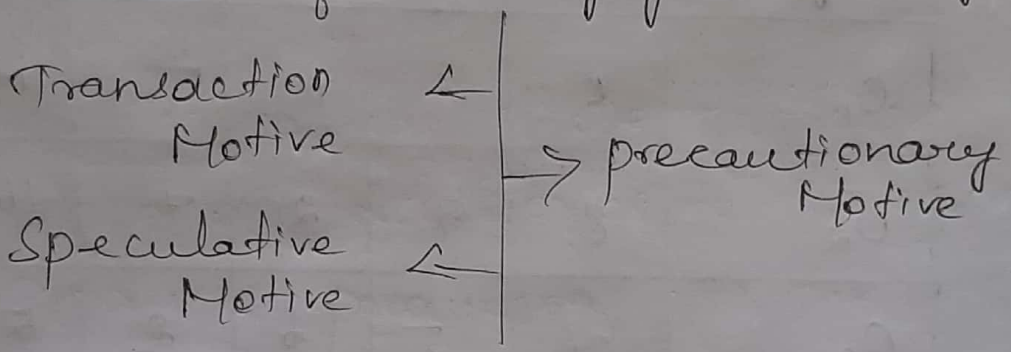
= 14 + 48 + 81 + 2 + 3 + 8

= 62 + 83 + 11

= 145 + 11

Least Cost = 156//.

9 Reasons for carrying Inventory



Transaction Motive

Every firm has to maintain some level of inventory to meet the day to day requirements of sales, production process, customer demand, etc. This motive makes the firm to keep the inventory of finished goods as well as raw materials.

2) precaudionary Motive:-

firm should keep some inventory for unforsee circumstances. also. Ex the fresh supply of raw material may not reach the factory due to Stricit by the transporters or due to natural calamities in a particular area.

3) Speculative Motive:-

The firm may be temptied to keep some inventory in Order to capitalize an opportunity to make profit eg Sufficent level of inventory may help the firm to earn extra profit in case of expectes shortage in the Market.

10. Explain the Vogel's Approximation Method:-

To/from	W_1	W_2	W_3	W_4	Scepply
F_1	6	4	1	5	14
F2	8	9	2	7	16
F_3	4	3	6	2	5
dq	6	10	15	7	

					I	II	III	IV	V
6	4	1	5	4	3	3	3	3	1
8	9	2	7	5	5	1	1	1	1
4	3	6	2	1	1	1	1	-	-

I	2	1	1	3
II	2	1	-	3
III	2	1	-	-
IV	2	1	-	-
V	2	-	-	-

$= (4\times6) + (10\times4) + (1\times8) + (5\times9) + (1\times4) + (4\times2)$

$= 24 + 40 + 8 + 30 + 4 + 8$

Total cost = 114

11) Replacement policy for Equipement That Deteriorates Gradually:-

When Operational efficiency of an item deteriorates with time (gradual failure), it is economical to replace the same with a new one.

Besides there could be a number of alternative choices and one may like to compare available alternatives on the basis of the running costs. Coverage maintainces and Operating costs involved

12. Calculate EOQ:

Annual Demand = ₹ 20,000

Ordering cost = ₹ 150 per unit

Inventory carrying cost = 24%

$$Q^* = \sqrt{\frac{2AP}{h}} \quad \frac{24}{100} = 0.24$$

$$= \sqrt{\frac{2 \times 20,000 \times 150}{0.24}}$$

$$= \sqrt{\frac{40,000 \times 150}{0.24}}$$

$$= \sqrt{\frac{6000000}{0.24}} = \sqrt{25,00000}$$

$$= ₹\ 5000/-$$

total cost

$$\sqrt{2 \cdot A D h}$$

$$= \sqrt{2 \times 150 \times 20,000 \times 0.84}$$

$$= \sqrt{1,440,000}$$

$$= 1200/-$$

13. Characteristics of Operation Research:-

* System Orientation
* use of inter disciplinary of terms
* application of scientific Method
* uncovering new problems
* Quantitative Solution.
* human factors.

14. Models by the Extent of Generality

This model is divided to two Catagories.

(i) Specific

(ii) General.

Specific:-

It represent a system at some specific time. It is known as Specific Model.

General:-

Similation and Heuristic model fall under the categories of general model.

15 A form is using a machine whose purchas price 13000 installation bars 3600 and the machine has scrap value 1600 the maintance cost in various years

Year	1	2	3	4	5	6	7	8	9
Cost	850	450	1000	1500	2100	2900	4000	4500	6000

The form wants to determind after how many years should the machine replaced on economic Condidorent assuming the machine replacement

Ans:-

Cost of Machine = 13,000

(+) Installation = 3600

Cost of M = 16,600

Scrap value = 1,600 (-)

1 year	2 Maintence cost	3 Cummul	4 C-S	5 = 3+4	6 = 5/n
1	250	250	15000	15250	15,250
2	750	1000	15000	16000	8000
3	1000	2000	15000	17000	5666.6
4	1500	3500	15000	18500	4,625.
5	2100	5600	15000	20600	4120
6	2900	8500	15000	23500	3916.6
7	4000	12500	15000	27500	3928.5
8	4800	17300	15000	32300	4037.5
9	6000	23300	15000	38,300	4255.5

Solution:- It may be minium total average Cost 3916 during 6th year there fowl the Machine should be replace after every 6th years. Otherwise the average cost per year would state increasing.

Section - C   10 Mark

1. Classification of Modal :-

Classification of Modal

- **Models by function**
  - (i) Descriptive Modal
  - (ii) predictive Modal
  - (iii) Normative or Optimization Modal
- **Modals by Structure**
  - (i) Iconic
  - (ii) Analogue
  - (iii) Mathematical
- **Modals by nature of an Environment**
  - (i) Deterministic Modal
  - (ii) probablistic Modal
- **Modals by the Extent of Generality**
  - (i) Specific
  - (ii) General.

Modals by function:-

The Modal can be three catagories

(i) Descriptive modal

(ii) predictive modal

(iii) Normative or Optimization Modal

Descriptive Modal:-

They descript and predict facts and relation ship among the various activies of the problem.

They don't have and objective function as a part of the modal to evaluate the decision alternatives

Predictive modal:-

These modal are used in predictive analysis involved in variety of statistical technices used to analyze the current and historical factors to make predictions about future event

Normative (or) Optimization Modal :-

They are prescriptive in nature and devalpe objective decision role for Optimum Solution.

Modals by Structure:-

This Modal in divided to three types.

(i) Iconic
(ii) Analogue
(iii) Mathematical.

Iconic Modal:-

These are the picporial reprasentatio of real System and have the Oppearance of the real thing

ex:- City map, plue print of house etc...

Analogue Modal:-

They are more apstract than the iconic modal as there is no Similarity between these modal and real life Items

Mathematical Modal:-

They are the most apstract in nature and implay a Set of Mathematical Simbols to represent The compondes of the real System.

Models by Nature of an Environment

This modal divided to two catagories

(i) Deterministic Modal

(ii) probablistic Modal.

Deterministic Modal

In this modal all prametres and financial relationship are assumed to be known with certain decision to be made.

probablistic Modal:-

These model have atleast one paramet or decision oriable as a random variable

Models by the Extent of Generality

This model is divided to two catagories

(i) Specific

(ii) General

Specific

It represent a Syetem at some specific time. It is known as Specific model.

General:-

Similation and heuristic model fall under the catagories of General model.

Q. A Manufacture product produce two type of model m_1 & m_2. each model of the type m_1 require 4 hours of grinding and 2 hours of polishing. each model of the type m_2 require 2 hours of grinding and 5 hours of polishing

The manufacture has 2 Grainter 3 polisher each grainder workes 40 hours in a week and each polisher work for 60 houres a week

profit on m_1 model is 3 Rs and m_2 model 4 Rs

two types of model make the miximum profit in a week.

Solution:-

M_1 & M_2.

M_1 required 4 hours - Grinding
2 hours - polishing

M_2 required 2 hours - Grinding
5 hours - polishing

Grinder = 2 polisher = 3

↓ (2×40) ↓ (3×60)

40 hours 60 hours

profit . $M_1 = 3₹$ $M_2 = 4₹$

Decision variables = $M_1 \times M_2$ Consist for x_1, x_2.

Objective Variables Max $z = 3x_1 + 4x_2$

Constraints : There are two Constraints

(i) Grainder (ii) polisher

(i) first consist for Grinder (40×2)

$$4x_1 + 2x_2 \leq 80$$

(ii) Second consist for polisher (60×3)

$$2x_1 + 5x_2 \leq 160$$

Solution :-

$$\max z = 3x_1 + 4x_2$$

subject to:

$$4x_1 + 2x_2 \leq 80$$

$$2x_1 + 5x_2 \leq 160$$

$$x_1, x_2 \geq 0$$

i) Explain the transportation problem of initial steage :-

Trasportation problem :-

The transportation problem is one of the sublasses of LPP's. Here quantities of a single homogeneous Commodity that are initiatly stored at various Origins to different distinations in such a way that the transportation Cost is minimum.

(i) feasible solutions
(ii) Basic feasible solution
(iii) Non-degnerate Basic feasible solution.
(iv) Degenerate basic feasible solution.

(i) feasible solution :-

Any set of non-negative allocations ($x_{ij} > 0$) which satisfies the row and column sum is called a feasible solution.

2. Basic feasible solution:-

A feasible solution is called a basic feasible solution, if the number of non-negative allocation is equal to (m+n-1) where m is the number of rows and n the number of columns in a transportation table

3. Non degenerate Basic feasible solution

Any feasible solution to a transportation problem Containing m origin and n destinations is said to be non-degenerate it Contains m+n-1 occupied cells and each allocation is an independent position.

4. degenerate basic feasible solution:-

If a basic feasible solution Contains less than m+n-1, non negative allocation it is set to be degenerate.

Optimal Solution:-

Optimal solution is a feasible solution, which minimizes the total cost

The solution of a transportation problem can be captained in two

(i) initial stage

(ii) optimum solution.

(i) initial steage

* north, west corner Rule (NWCR)
* least cost Method (or) Matrix minimum Method
* Vogel's Approximation Method (VAM)

4) $\max Z = 3x_1 + 4x_2$

Subject to

$5x_1 + 4x_2 \leq 200$

$3x_1 + 5x_2 \leq 150$

$5x_1 + 4x_2 \geq 100$

$8x_1 + 4x_2 \geq 80$

$x_1, x_2 \geq 0$

(i) $5x_1 + 4x_2 = 200$

$x_1 = 0$

$0 + 4x_2 = 200$

$x_2 = \frac{200}{4}^{50}_{1}$

$x_2 = 50$

0, 50

$x_2 = 0$

$5x_1 + 0 = 200$

$x_1 = \frac{200}{5}^{40}_{1}$

40, 0

(ii) $3x_1 + 5x_2 = 150$

$x_1 = 0$

$0 + 5x_2 = 150$

$x_2 = \frac{150}{5}^{30}_{1}$

0, 30

$x_2 = 0$

$3x_1 + 0 = 150$

$x_1 = \frac{150}{3}^{50}_{1}$

50, 0

(iii) $5x_1 + 4x_2 = 100$

$x_1 = 0$

$0 + 4x_2 = 100$

$x_2 = \frac{4^{1}}{100}_{25}$

0, 25

$x_2 = 0$

$5x_1 + 0 = 100$

$x_1 = \frac{5^{1}}{100}_{20}$

20, 0.

(iv) $8x_1 + 4x_2 = 80$

$x_1 = 0$

$0 + 4x_2 = 80$

$x_2 = 4\,1$

80 $\quad 20$

(0, 20)

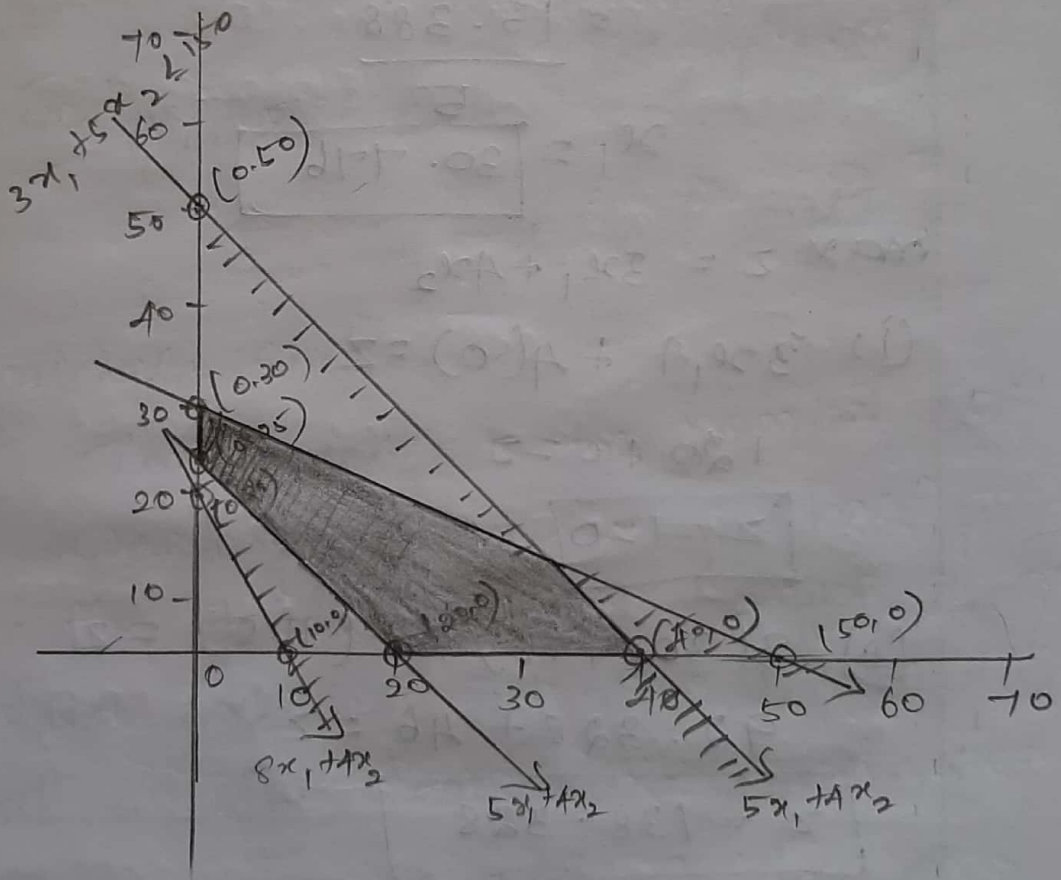
$x_2 = 0$

$8x_1 + 0 = 80$

$x_1 = 8\,1$

80 $\quad 10$

(10, 0)



$5x_1 + 4x_2 = 200$ — (1) $\times 3$

$3x_1 + 5x_2 = 150$ — (2) $\times 5$

$15x_1 + 12x_2 = 600$

$15x_1 + 25x_2 = 750$

$13x_2 = 150$

$x_2 = \frac{150}{13} \cdot 11.53$

$\boxed{x_2 = 11.53}$

$5x_1 + 4x_2 = 200$

$5x_1 + (4 \times 11.53) = 200$

$5x_1 + 46.12 = 200$

$5x_1 = 200 - 46.12$

$5x_1 = 15.388$

$= \frac{15.388}{5}$

$x_1 = \boxed{30.776}$

$\max z = 3x_1 + 4x_2$

(i) $3x_1 4 + 4(0) = z$

$120 + 0 = z$

$\boxed{z = 120}$

(ii) $3(30.776) + 4(11.5) = z$

$92.328 + 46 = z$

$\boxed{z = 138.328}$

(iii) $3(0) + 4(30) = z$

$0 + 120 = z$

$\boxed{z = 120}$

(iv) $3(0) + 4(25) = z$

$0 + 100 = z$

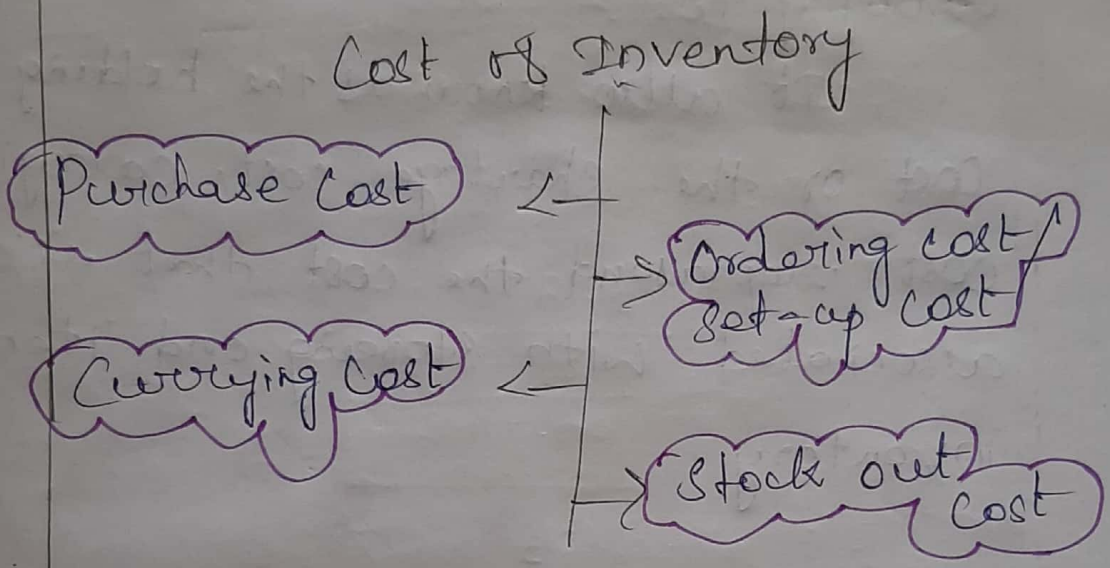
$\boxed{z = 100}$

Point are (30.776, 11.5)

mix = 138.328

5 What are inventory cost
Cost and term associated with Inventory

In determining and optional inventory polici, the most often is the cost function.



Purchase cost:-

This regese to the nominal cost of inventory. It is the purchase price for the items that are bought from outside sources, and the production cost. If the teams are producted with in the Organisation. This may be Consent per unit. or, it make very as the Quvantity purchased increase or discrease

Ordering cost / setup cost :-

It is incurred when were the inventory is reinfished. It include cost associated with the processing and transpaction inpection and Quality etc...

carrying cost :-

It allso know as the holding cost or the shortage cost, carrying cost reprasend the cost that is associated with storing and item in inventory

Stock out cost :-

Stock out cost needs the cost associated with not serving the customer stock out important shortages. if the shortout interval.

---

b) Explain the NWCR, least cost method, and VAM Method.

6	8	7	1	18
9	6	13	12	25
17	8	5	4	30
30	10	15	18	73

NWCR.

18 / 6	8	7	1	~~18~~
12 / 9	10 / 6	3 / 13	12	~~25~~ ~~13~~ ~~3~~
17	8	12 / 5	18 / 4	~~30~~ ~~18~~
~~30~~ 12	~~10~~	~~15~~ 12	18	

$x_{11} = 18$

$x_{21} = 12$

$x_{22} = 10$

$x_{23} = 3$

$x_{33} = 12$

total cost

$(18 \times 6) + (12 \times 9) + (10 \times 6) + (13 \times 3) + (12 \times 5) + (18 \times 4)$

$= 108 + 108 + 60 + 39 + 60 + 72$

total cost 447//.

least cost

6	8	7	1	18
9	6	13	12	25
17	8	5	4	30
30	10	15	18	73

6	8	7	1	18 0
9	6	13	12	15 0
14	8	5	4	15
15	10	15	18	
15	0	0	0	

Total cost

$(18 \times 1) + (15 \times 9) + (10 \times 6) + (15 \times 17) + (15 \times 5)$

$= 18 + 135 + 60 + 255 + 75$

$= 543.$

VAM Method

6	8	7	1	18	5
9	6	13	12	15	3
14	8	5	4	15	1
15	10	15	18		
15					

	I	II	III	IV
5		-	-	-
3	← 3	← 3		-
1	1	1	1	1

I 3 2 2 3

II 3 2 2 -

III 3 - 2 -

IV 11 - 2 -

total cost

$(18 \times 1) + (15 \times 9) + (10 \times 6) + (15 \times 17) + (15 \times 5)$

$= 18 + 135 + 60 + 255 + 75$

$= \boxed{543}$

7) Cost an team of Inventory Method.

Calculate EOQ :-

Annual Demand = ₹ 42,000/-

Ordering cost = ₹ 300 per unit

Inventory carrying = 38%.

Solution :-

$$D^* = \sqrt{\frac{2AD}{h}}$$

$$= \sqrt{\frac{2 \times 300 \times 42,000}{0.38}}$$

$$= \sqrt{\frac{25.200.000}{0.38}}$$

$$= \sqrt{66.315}$$

$$= \boxed{8.1434}$$

total cost

$$\sqrt{2ADh}$$

$$= \sqrt{2 \times 300 \times 42000 \times 0.38}$$

$$= \sqrt{9.576.000}$$

$$= \boxed{3,094.51}$$

8 What are the Operation Research of decision Making?

Decision Making:-

Decision literally means chosering from available alternatives the essentia Characteristices all decision are

(i) Driigger
(ii) Alternative at the disposal
(iii) Influencing factoures.

Operation Research is the Science of Manageing Which is Concanded way making decision most of the times

It is the decision Science that helps the management to make better decisions is a tivatal word in Manageing.

In or Scientific it used in Order to make butter management decision. the essential gutures of decision namely objectives, alternative and influencing factors or expreed.

in terms of scientific qualification or mathemetrial solution.

9. $\max z = 3x_1 + 2x_2$

Subject to

$5x_1 + x_2 \geq 10$

$x_1 + x_2 \geq 6$

$x_1 + 4x_2 \geq 12$

$x_1, x_2 \geq 0$

Solution:-

(i) $5x_1 + x_2 = 10$

$x_1 = 0$

$0 + x_2 = 10$

$x_2 = 10$

$P(0, 10)$

$x_2 = 0$

$5x_1 + 0 = 10$

$x_1 = \frac{10}{5} = 2.$

$P(2, 0)$

(ii) $x_1 + x_2 = 6$

$x_1 = 0$

$0 + x_2 = 6$

$x_2 = 6$

$P(0, 6)$

$x_2 = 0$

$x_1 + 0 = 6$

$x_1 = 6$

$P(6, 0)$

(iii) $x_1 + 4x_2 = 12$

$x_1 = 0$

$0 + 4x_2 = 12$

$x_2 = 12/4$

$x_2 = 3.$

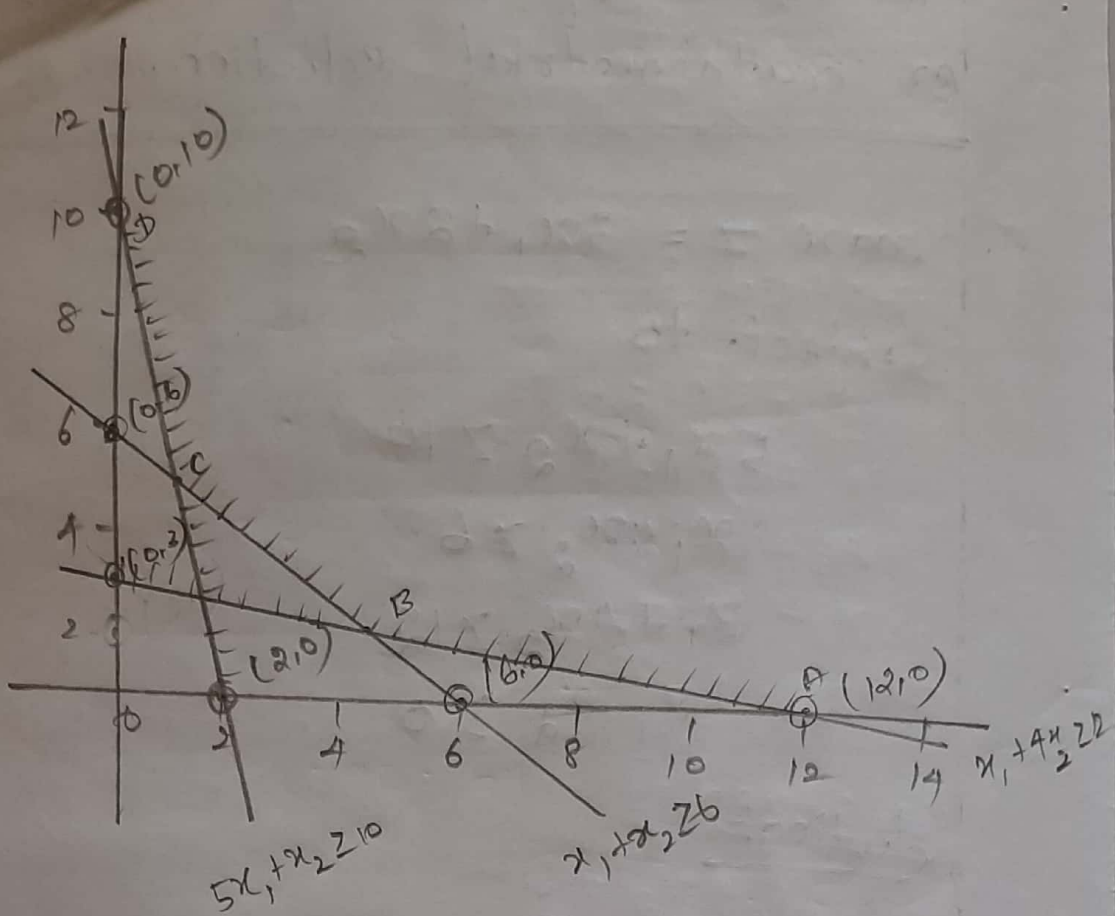
$P(0, 3)$

$x_2 = 0$

$x_1 + 0 = 12$

$x_1 = 12$

$P(12, 0)$



A = 0, 10 = 20

B (1, 5) = 13

C = (4, 2) = 16

D 12, 0 = 36

B $x_1 + x_2 = 6$ — ① × 5

$5x_1 + x_2 = 10$ — ②

$4x_2 = 20$

$x_2 = \frac{20}{4}$ $x_2 = 5$

C $x_1 + 4x_2 = 12$ — ③

$x_1 + x_2 = 6$ — ④

$x_1 + 4x_2 = 12$

$4x_1 + 4x_2 = 24$

$3x_1 = 12$

$3x_1 = 12$

$x_1 = \frac{12}{3} = 4$

$\boxed{x_1 = 4}$

Subsitued I

$x_1 + 5x_1 = 6$

$x_1 + 5x_1 = 6$

$x_1 + 5 = 6$

$x_1 = 6 - 5$

$x_1 = 1$

Subsitued II

$x_1 + x_2 = 6$

$4 + x_2 = 6$

$x_2 = 6 - 4$

$\boxed{x_2 = 2.}$

A) $Z = 3x_1 + 2x_2$

$= 3x0 + 2x10 = Z$

$0 + 20 = Z$

$\boxed{Z = 20}$

B) $Z = 3x_1 + 2x_2$

$3x1 + 2x5 = Z$

$3 + 10 = Z$

$\boxed{Z = 13}$

C) $Z = 3x_1 + 2x_2$

$3x4 + 2x2$

$12 + 4 = Z$

$\boxed{Z = 16}$

D) $Z = 3x_1 + 2x_2$

$3x12 + 2x0 = Z$

$36 + 0 = Z$

$\boxed{Z = 36}$

10) Calculate NCWR, Least Minima, VAM Method:

8	7	5	9	25
4	8	6	5	20
16	7	18	4	50
15	10	50	20	95

$a_{ij} = 95 = b_{ij}$

NCWR

15	10			~~25~~ 10
8	7	5	9	
		20		
4	8	6	5	~~20~~
		30	20	
16	7	18	4	~~50~~ ~~40~~
~~15~~	~~10~~	~~50~~ 30	20	

$x_{11} = 15$

$x_{12} = 10$

$x_{23} = 6$

$x_{33} = 30$

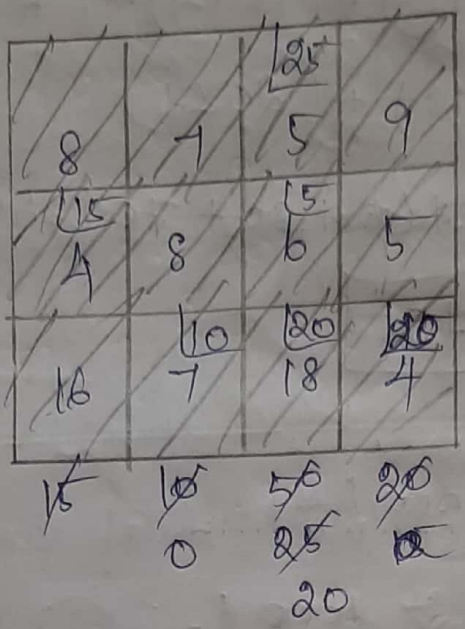
$x_{34} = 20.$

total cost

$(15 \times 8) + (10 \times 7) + (6 \times 20) + (18 \times 30) + (4 \times 20)$

$= 12 + 70 + 120 + 540 + 80$

total cost = 930



total cost

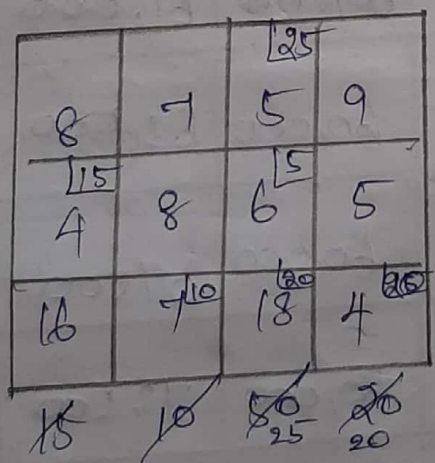
$(25 \times 5) + (15 \times 4) + (5 \times 6) + (10 \times 7)$

$(20 \times 18) + (20 \times 4)$

$= 125 + 60 + 30 + 70 + 360 + 60$

$= \boxed{725}$

VAM



2	2	2	2	—
1	1	1	1	1
3	3	11	2	2

A — 1 1

— — 1 1

— — 1 1

— — 12 —

Total cost

$(25\times5)+(15\times4)+(5\times6)+(10\times7)$

$+(20\times18)+(20\times4)$

$= 125+60+30+70+360+80$

$= ₹725$

11) Machine 61,000/-

Scrap value = 1000/-

year	1	2	3	4	5	6	7	8
M.C	1000	2500	4000	6000	9000	12000	15000	20000

1	2	3	4	5	6
year	Maintance Cost	Cummulative	C-S	3+4	5/1
1	1000	1000	60,000	61,000	61,000
2	2500	3500	60,000	63,500	31,750
3	4000	7500	60,000	67500	22,500
4	6000	13500	60,000	73,500	18375
5	9000	22500	60,000	82,500	16500
6	12000	34500	60,000	94500	15750
7	16000	50500	60,000	110,500	15785.7
8	20000	52500	60,000	1,12,500	14,062.5

Solution:-

It may be minium total average cost 1406 during 8th year. therefore the Machine should be replace after every 8th year otherwise the average cost per year would state increasing.

12) uses & limitations of operation Research

* It provides a logical and systematic approchase to the problem
* It allowes modification of Mathematical solution before they are put to use
* It suggest all the alternative source are action for the some Management
* It helps in finding avenues for new research and impromont in the system.
* It specificate imprute Quality of decision.
* It indicates the scope as well as limitation of a problem.

limitation of Operation Research:-

(i) Models are the only idealized representations of reality and cannot be regarded as absolute in any case

(ii) the valitiy of the model of a particular situation of can be a only by condating exprimeates.

13. A Machine Cost ₹ 10,000 /- Operating Cost & Resale values are given below:-

Year	1	2	3	4	5	6	7	8
Operating Cost	1000	1200	1400	1700	2000	2500	3000	3500
Resale Value	6000	4000	3900	2600	2500	2400	2000	1600

year 1	f(n) 2	Et(n) Cummulat 3	S 4	C-S 5	TC = 3+5 6	6/1 7
1	1000	1000	6000	4000	5000	5000
2	1200	2200	4000	6000	8200	4100
3	1400	3600	3200	6800	10400	3466.6
4	1700	5300	2600	7400	12700	3175
5	2000	73000	2500	7500	14800	2960
6	2500	9800	2400	7600	17400	2900
7	3000	12800	2000	8000	20800	2971.4
8	3500	15300	1600	9400	25700	3212.

Solution:-

It may be minium total aveage Cost 2900 during 6th year therefore the Machine should be replace after every 6th year otherwise the aveage Cost per year would start increasing.