

### MUTHAYAMMAL ENGINEERING COLLEGE

(An Autonomous Institution)

(Approved by AICTE, New Delhi, Accredited by NAAC & Affiliated to Anna University) Rasipuram - 637 408, Namakkal Dist., Tamil Nadu

#### LECTURE HANDOUTS



L	

Course Name with Code	:19MBB05- Quantitative Methods a	and Techniques
Course Faculty	: V.Shanmugapriya	
Unit	: I	Date of Lecture:

Topic of Lecture: Introduction of Operations Research

#### Introduction : (Maximum 5 sentences)

**Operations Research** (OR) is a discipline that helps to make better decisions in complex scenarios by the application of a set of advanced analytical methods.

Applications of OR techniques spread over various fields in engineering, **management** and public systems

Prerequisite knowledge for Complete understanding and learning of Topic: (Max. Four important topics)

It is most often used to analyze complex real life problems typically with the goal of improving or optimizing performance.

It is a science which deals with problem, formulation, solutions and finally appropriate decision making.

It is an Art and Science.

**operational research** has expanded into a field widely **used** in industries ranging from petrochemicals to airlines, finance, logistics, and government, moving to a focus on the development of mathematical models

#### **Detailed content of the Lecture:**

Diagram/ Description/Algorithm/Procedure for solving problems/ Derivation component with supporting content if any

#### **Introduction of Operations Research**

Meaning of operations research:

Operation Research is a relatively new discipline. The contents and the boundaries of the OR are not yet fixed. Therefore, to give a formal definition of the term Operations Research is a difficult task. The OR starts when mathematical and quantitative techniques are used to substantiate the decision being taken. The main activity of a manager is the decision making. In our daily life we make the decisions even without noticing them. The decisions are taken simply by common sense, judgment and expertise without using any mathematical or any other model in simple situations. But the decision we are concerned here with are complex and heavily responsible. Examples are public transportation network planning in a city having its own layout of factories, residential blocks or finding the appropriate product mix when there exists a large number of products with different profit contributions and production requirement etc.

#### Stages of Development of Operations Research

The stages of development of O.R. are also known as phases and process of O.R, which has six important steps. These six steps are arranged in the following order: Step I: Observe the problem environment Step II: Analyze and define the problem Step III: Develop a model Step IV: Select appropriate data input Step V: Provide a solution and test its reasonableness Step VI: Implement the solution

Step I: Observe the problem environment The first step in the process of O.R. development is the problem environment observation. This step includes different activities; they are conferences, site visit, research, observations etc. These activities provide sufficient information to the O.R. specialists to formulate the problem.

Step II: Analyze and define the problem This step is analyzing and defining the problem. In this step in addition to the problem definition the objectives, uses and limitations of O.R. study of the problem also defined. The outputs of this step are clear grasp of need for a solution and its nature understanding.

Step III: Develop a model This step develops a model; a model is a representation of some abstract or real situation. The models are basically mathematical models, which describes systems, processes in the form of equations, formula/relationships. The different activities in this step are variables definition, formulating equations etc. The model is tested in the field under different environmental constraints and modified in order to work. Some times the model is modified to satisfy the management with the results.

Step IV: Select appropriate data input A model works appropriately when there is appropriate data input. Hence, selecting appropriate input data is important step in the O.R. development stage or process. The activities in this step include internal/external data analysis, fact analysis, and collection of opinions and use of computer data banks. The objective of this step is to provide sufficient data input to operate and test the model developed in Step\_III.

Step V: Provide a solution and test its reasonableness This step is to get a solution with the help of model and input data. This solution is not implemented immediately, instead the solution is used to test the model and to find there is any limitations. Suppose if the solution is not reasonable or the behaviour of the model is not proper, the model is updated and modified at this stage. The output of this stage is the solution(s) that supports the current organizational objectives.

Step VI: Implement the solution At this step the solution obtained from the previous step is implemented. The implementation of the solution involves mo many behavioural issues. Therefore, before implementation the implementation authority has to resolve the issues. A properly implemented solution results in quality of work and gains the support from the management. The process, process activities, and process output are summarized in the following.

#### **O.R.** Tools and Techniques

Linear Programming: Game Theory: Decision Theory: Queuing Theory: Inventory Models: Simulation:

Non-linear Programming:

Dynamic Programming:

Network Scheduling:

Video Content / Details of website for further learning (if any):

Can be added as link

**Important Books/Journals for further learning including the page nos.:** Operation Research - Paneerselvam.R- Page No:1-4

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#### LECTURE HANDOUTS

Course Name with Code	:19MBB05- Ç	Quantitative Methods and Techniques
Course Faculty	: V.Shanmug	<b>zapriya</b>
Unit	: I	Date of Lecture:
Topic of Lecture: Linear Prog	ramming	
Introduction : (Maximum 5	sentences)	
		echnique which can be applied to a variety of
		bution, Investment, Production, Refinery Operations,
and Transportation analysis.	fortishing, Distrib	ation, investment, i roduction, reemery operations,
	ful not only in in	dustry and business but also in non-profit sectors such
as Education, Government, Ho	•	•
	•	n problems characterized by the presence of decision
variables.		n problems characterized by the presence of decision
	constraints can l	he expressed as linear functions of the desision
variables.		be expressed as linear functions of the decision
	t quantities that	are in some cance, controllable inputs to the system
	it quantities that	are, in some sense, controllable inputs to the system
being modeled		
	-	erstanding and learning of Topic:
( Max. Four important topics	)	
<b>Objective Function:</b> is a linear	function of the	decision variables representing the objective of the
manager/decision maker.		
Constraints: are the linear equ	ations or inequa	alities arising out of practical limitations.
Decision Variables: are some	physical quantit	ties whose values indicate the solution.
Feasible Solution: is a solution	1 which satisfies	all the constraints (including the non-negative) presents
in the problem. Feasible Region	n: is the collection	on of feasible solutions.
Detailed content of the Lectu	ire:	
Diagram/ Description/Algor	rithm/Procedur	e for solving problems/ Derivation component
with supporting content if a	-	· · · ·
	-	
Linear Programming Problem I	Formulation	

The linear programming problem formulation is illustrated through a product mix problem. The product mix problem occurs in an industry where it is possible to manufacture a variety of products. A

product has a certain margin of profit per unit, and uses a common pool of limited resources. In this case the linear programming technique identifies the products combination which will maximize the profit subject to the availability of limited resource constraints.

Suppose an industry is manufacturing two types of products P1 and P2. The profits per Kg of the two products are Rs.30 and Rs.40 respectively. These two products require processing in three types of machines.

The following table shows the available machine hours per day and the time required on each 19 machine to produce one Kg of P1 and P2. Formulate the problem in the form of linear programming model. Profit/Kg P1 Rs.30 P2 Rs.40 Total available Machine hours/day Machine 1 3 2 600 Machine 2 3 5 800 Machine 3 5 6 1100 Solution:

The procedure for linear programming problem formulation is as follows:

Introduce the decision variable as follows:

Let x1 = amount of P1 x2 = amount of P2 In order to maximize profits,

we establish the objective function as 30x1 + 40x2 Since one Kg of P1 requires 3 hours of processing time in machine 1 while the corresponding requirement of P2 is 2 hours.

So, the first constraint can be expressed as  $3x1 + 2x2 \le 600$  Similarly, corresponding to machine 2 and 3 the constraints are  $3x1 + 5x2 \le 800$   $5x1 + 6x2 \le 1100$  In addition to the above there is no negative production, which may be represented algebraically as  $x1 \ge 0$ ;  $x2 \ge 0$ 

Thus, the product mix problem in the linear programming model is as follows:

Maximize 30x1 + 40x2

Subject to:  $3x1 + 2x2 \le 600 \ 3x1 + 5x2 \le 800 \ 5x1 + 6x2 \le 1100$ 

 $x1 \ge 0, x2 \ge 0$ 

Formulation with Different Types of Constraints

Example 2.2: A company owns two flour mills viz. A and B, which have different production capacities for high, medium and low quality flour. The company has entered a contract to supply flour to a firm every month with at least 8, 12 and 24 quintals of high, medium and low quality respectively. It costs the company Rs.2000 and Rs.1500 per day to run mill A and B respectively. On a day, Mill A produces 6, 2 and 4 quintals of high, medium and low quality flour, Mill B produces 2, 4 and 12 quintals of high, medium and low quality flour respectively. How many days per month should each mill be operated in order to meet the contract order most economically.

Solution: Let us define x1 and x2 are the mills A and B. Here the objective is to minimize the cost of the machine runs and to satisfy the contract order.

The linear programming problem is given by

 $Minimize \ 2000x1 + 1500x2$ 

Subject to:  $6x1 + 2x2 \ge 8 \ 2x1 + 4x2 \ge 12 \ 4x1 + 12x2 \ge 24$  $x1 \ge 0, x2 \ge 0$ 

Video Content / Details of website for further learning (if any):

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Important Books/Journals for further learning including the page nos.: Operation Research - Paneerselvam.R- Page No:9-12

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#### **LECTURE HANDOUTS**





I/II



**Course Name with Code** 

:19MBB05- Quantitative Methods and Techniques

**Course Faculty** Unit

: V.Shanmugapriya : I

Date of Lecture:

Topic of Lecture: Graphical Methods

#### Introduction : (Maximum 5 sentences)

Geometric **method**, allows solving simple linear programming problems intuitively and visually. This **method** is limited to two or three problems decision variables since it is not possible to **graphically**.

#### Prerequisite knowledge for Complete understanding and learning of Topic:

( Max. Four important topics)

The **graphical method** is applicable to solve the LPP involving two decision variables  $x_1$ , and  $x_2$ , we usually take these decision variables as x, y instead of  $x_1$ ,  $x_2$ .

To solve an LP, the graphical method includes two major steps.

The determination of the solution space that defines the feasible solution.

**Graphical methods** are quick and easy to use and make visual sense. Calculations can be done with little or no special software needed. Visual test of model (i.e., how well the points line up) is an additional **benefit**.

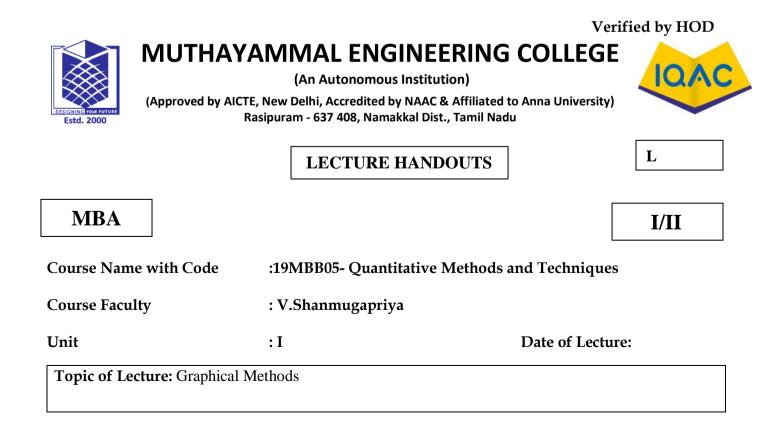
#### **Detailed content of the Lecture:**

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Important Books/Journals for further learning including the page nos.:

Operation Research - Paneerselvam.R- Page No:17-19

**Course Faculty** 



#### **Introduction : (Maximum 5 sentences)**

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#### Prerequisite knowledge for Complete understanding and learning of Topic:

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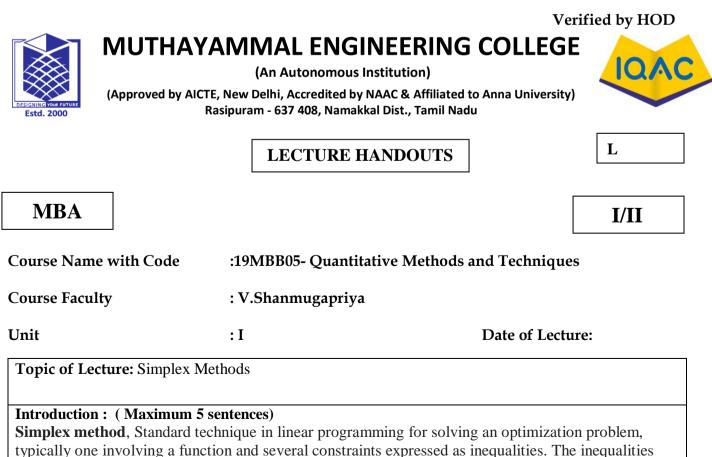
#### Detailed content of the Lecture:

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**Course Faculty** 



typically one involving a function and several constraints expressed as inequalities. The inequalitie define a polygonal region (see polygon), and the solution is typically at one of the vertices.

# **Prerequisite knowledge for Complete understanding and learning of Topic:** (Max. Four important topics)

- Make a change of variables and normalize the sign of the independent terms. ...
- Normalize restrictions.
- Match the objective function to zero.
- Write the initial tableau of Simplex method.
- Stopping condition.
- Choice of the input and output base variables.
- Update tableau

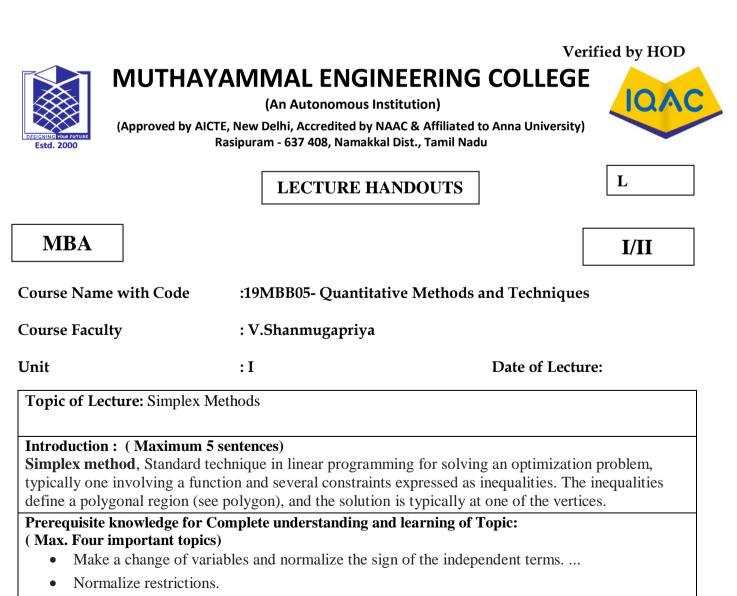
#### **Detailed content of the Lecture:**

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Important Books/Journals for further learning including the page nos.:

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**Course Faculty** 



- Match the objective function to zero.
- Write the initial tableau of Simplex method.

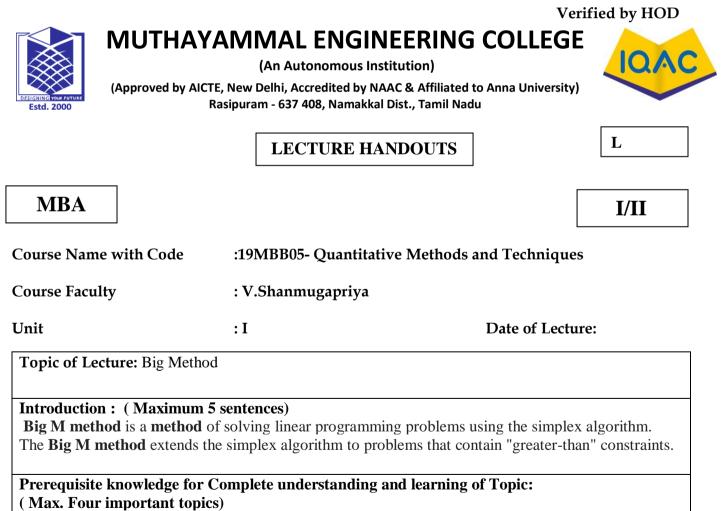
- Stopping condition.
- Choice of the input and output base variables.
- Update tableau

#### **Detailed content of the Lecture:**

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**Course Faculty** 

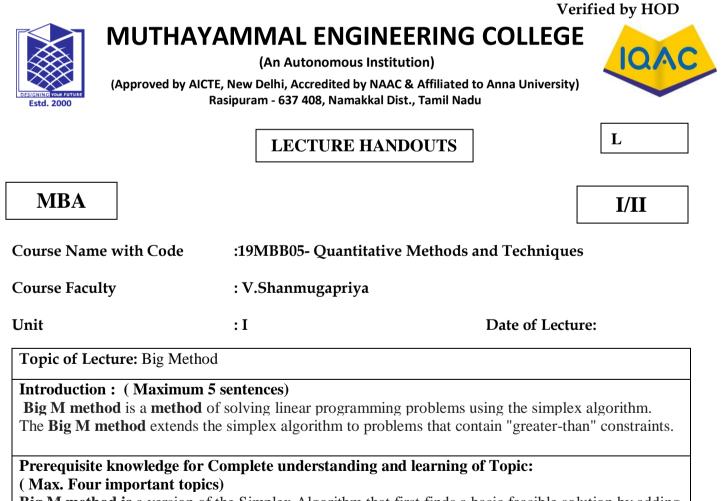


**Big M method is** a version of the Simplex Algorithm that first finds a basic feasible solution by adding "artificial" variables to the problem creating the artificial region and then moves to real region thus improving the objective solution

**Detailed content of the Lecture:** 

Can be added as link

**Important Books/Journals for further learning including the page nos.:** Operation Research - Paneerselvam.R- Page No:25-29



**Big M method is** a version of the Simplex Algorithm that first finds a basic feasible solution by adding "artificial" variables to the problem creating the artificial region and then moves to real region thus improving the objective solution

**Detailed content of the Lecture:** 

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MBA			I/II
Course Name with	Code :19MBB05- Quant	titative Methods and Tee	chniques
Course Faculty	: V.Shanmugapri	ya	
Unit	: I	Date	of Lecture:
Topic of Lecture:	Dual Simplex Method		
<b>Dual Simplex Me</b> working towards : <b>Method</b> because if the <b>dual</b> linear pro-	ledge for Complete understan	strategy is called the <b>D</b> u ing the usual <b>Simplex</b> I	ual Simplex Method on
1) Understanding classes of linear pr	g the <b>dual</b> problem leads to sp rogramming problems. 2) The g an initial feasible solution to	dual can be useful for s	sensitivity analysis. 3)

**Course Faculty** 

**Detailed content of the Lecture:** 

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	LECTURE HANDOUTS	L
MBA		I/II
Course Name with Code	:19MBB05- Quantitative Method	ls and Techniques
Course Faculty	: V.Shanmugapriya	
Unit	: I	Date of Lecture:
Topic of Lecture: Two Phas	se Method	
involving artificial variables	<b>5 sentences)</b> whole procedure of solving a linea s is divided into <b>two phases</b> In <b>j</b> the usual simplex algorithm is used	phase II, the original objective
Prerequisite knowledge for	r Complete understanding and lea	arning of Topic:

#### ( Max. Four important topics)

First Phase:

(a) All the terms on R.H.S. should be non negative. If some are -ve then they must be made +ve as explained earlier.

(b) Express constraints in standard form.

(c) Add artificial variables in equality constraints or (>) type constraints.

(d) Form a new objective function W which consisted of the sum of all the artificial variables

 $W = A1 + A2 + \dots + Am$ 

Function (W) is known as infeasibility form.

(e) Function W is to be minimized subject to constraints of original problem and the optimum basic feasible solution is obtained.

Any of the following three cases may arise:

(i) Min. W > 0 and at least one artificial variable appears in column "Basic variables" at Positive level. In such case, no feasible solution exists for the original L.P.P. and the procedure is stopped.

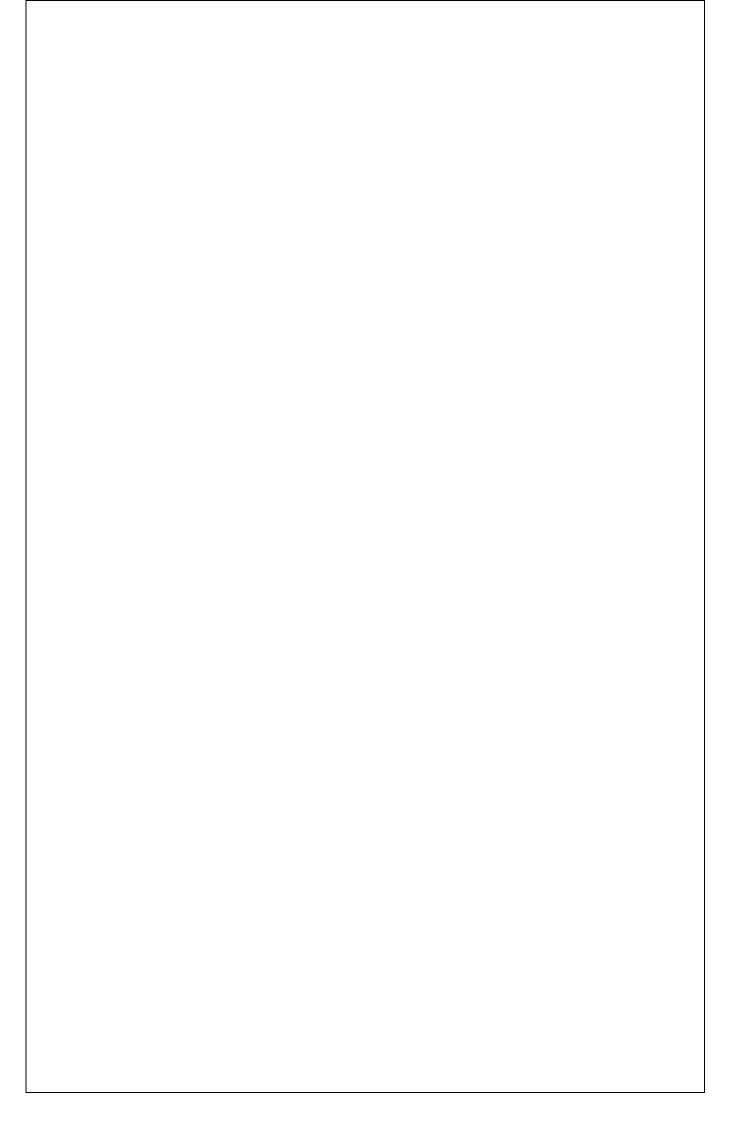
(ii) Min. W = 0 and at least one artificial variable appears in column "Basic Variables" at zero level. In such a case, the optimum basic feasible solution to the infeasibility form may or may not be a basic feasible solution to the given (original) L.P.P. To obtain a basic feasible solution, we continue phase I and try to drive all artificial variables out of the basis and then proceed to phase II.

(iii) Min. W=0 and no artificial variable appears in the column "Basic variables" current solution'. In such a case a basic feasible solution to the original L.P.P. has been found. Proceed to phase II.

#### Second Phase:

Use the optimum basic feasible solution of phase I as a starting solution for the original L.P.P. Using simplex method make iterations till an optimal basic feasible solution for it is obtained. It may be noted that the new objective function W is always of minimization type regardless of whether the given (original ) L.P.P. is of maximization or minimization type. Let us take the following example.

Detailed content of the Lecture:



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	LECTURE HANDOUTS	L
MBA		I/II
Course Name with Code	:19MBB05- Quantitative Methods	and Techniques
Course Faculty	: V.Shanmugapriya	
Unit	: I	Date of Lecture:

Topic of Lecture: Principles of Duality

**Introduction : (Maximum 5 sentences) Duality**, in mathematics, **principle** whereby one true statement can be obtained from another by merely interchanging two words. It is a property belonging to the branch of algebra known as lattice theory, which is involved with the concepts of order and structure common to different mathematical systems

Prerequisite knowledge for Complete understanding and learning of Topic: (Max. Four important topics)

According to **principle of duality** "Dual of **one** expression is obtained by replacing AND (.) with OR (+) and OR with AND together with replacement of 1 with 0 and 0 with 1. For **example**: consider the expression A+B=0. The dual of this expression is obtained by replacing + with . and 0 by 1. i.e., A.B=1 is dual of A+B=0.

**Detailed content of the Lecture:** 

Can be added as link

**Important Books/Journals for further learning including the page nos.:** Operation Research - Paneerselvam.R- Page No:40-47

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		LECTURE HANDOUTS		
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Course Name	with Code :19	MBB05- Quantitative Methods	and Techniques	
Course Faculty	· · · · · · · · · · · · · · · · · · ·	.Shanmugapriya		
Unit	: I		Date of Lecture:	
Topic of Lect	ure: Principles of Du	ıality		
statement can belonging to concepts of o <b>Prerequisite I</b> ( Max. Four in According to with OR(+) a	n be obtained from a the branch of algebr rder and structure co knowledge for Comp mportant topics) principle of duality nd OR with AND to consider the expres	ences) Duality, in mathematics, nother by merely interchangin a known as lattice theory, which ommon to different mathematic plete understanding and learning y "Dual of one expression is ob- ogether with replacement of 1 w sion A+B=0. The dual of this ex A.B=1 is dual of A+B=0.	ng two words. It is a property ch is involved with the <u>ical systems</u> <b>ng of Topic:</b> otained by replacing AND (.) with 0 and 0 with 1.	_

Detailed content of the Lecture: Diagram/ Description/Algorithm/Procedure for solving problems/ Derivation component with supporting content if any

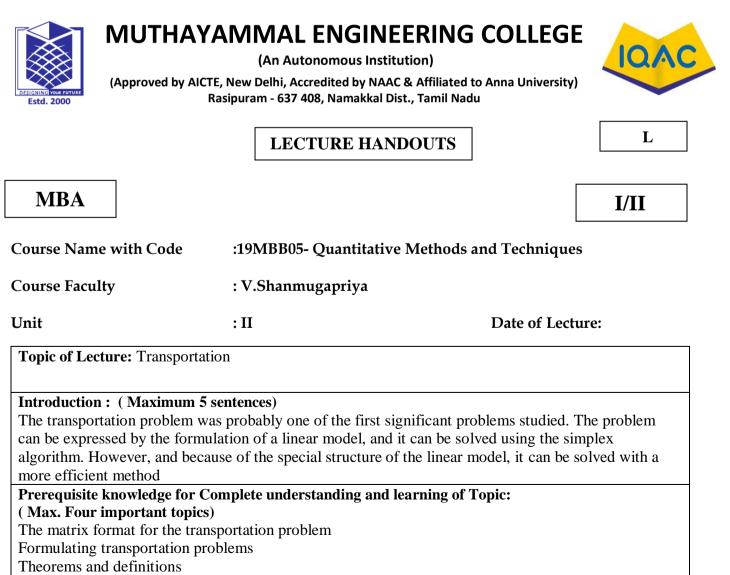
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Finding an initial basic feasible solution

#### Detailed content of the Lecture: Diagram/ Description/Algorithm/Procedure for solving problems/ Derivation component with supporting content if any

The relevant data for any transportation problem can be summarized in a matrix format using a tableau called the transportation costs tableau (see Figure 5.1). The tableau displays the origins with their supply, the destinations with their demand and the transportation per-unit costs. D1 D2  $\cdots$  Dn Supply O1 c11 c12  $\cdots$  c1n a1 O2 c21 c22  $\cdots$  c2n a2  $\cdots$  Om cm1 cm2  $\cdots$  cmn am Demand b1 b2  $\cdots$  bn

Formulating transportation problems

We defined the transportation problem as a problem of goods transportation. However, there is a wide range of different areas of application where it is very useful to formulate other problems by means of the matrix format for the transportation problem, and to apply the specific solution techniques that will be explained along this chapter. In this section, we give two examples to show how to model an inventory planning problem and a production problem as transportation problems.

#### Theorems and definitions

As we previously said, the transportation problem is just a special type of linear programming problem. We can take advantage of its special structure to adapt the simplex algorithm and to have a more efficient solution procedure. In this section we state some theorems and give some definitions that permit us derive the solution method for transportation problems.

Finding an initial basic feasible solution

The procedure of calculating an initial basic feasible solution is performed in a tableau of the same dimensions as the transportation costs tableau; the transportation solution tableau, where each position (i, j) is associated with the decision variable xij, that is, the number of units of product to be transported from origin Oi to destination Dj

- 1. The Northwest Corner method
- 2. Least Cost Method
- 3. Vogel's approximation method

Video Content / Details of website for further learning (if any):

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LECTURE HANDOUTS



I/II

Date of Lecture:

L

Course Name with Code :19MBB05- Quantitative Methods and Techniques

**Course Faculty** 

: V.Shanmugapriya

: II

Unit

**Topic of Lecture:** Transportation Models (Minimization and Maximization Problems)

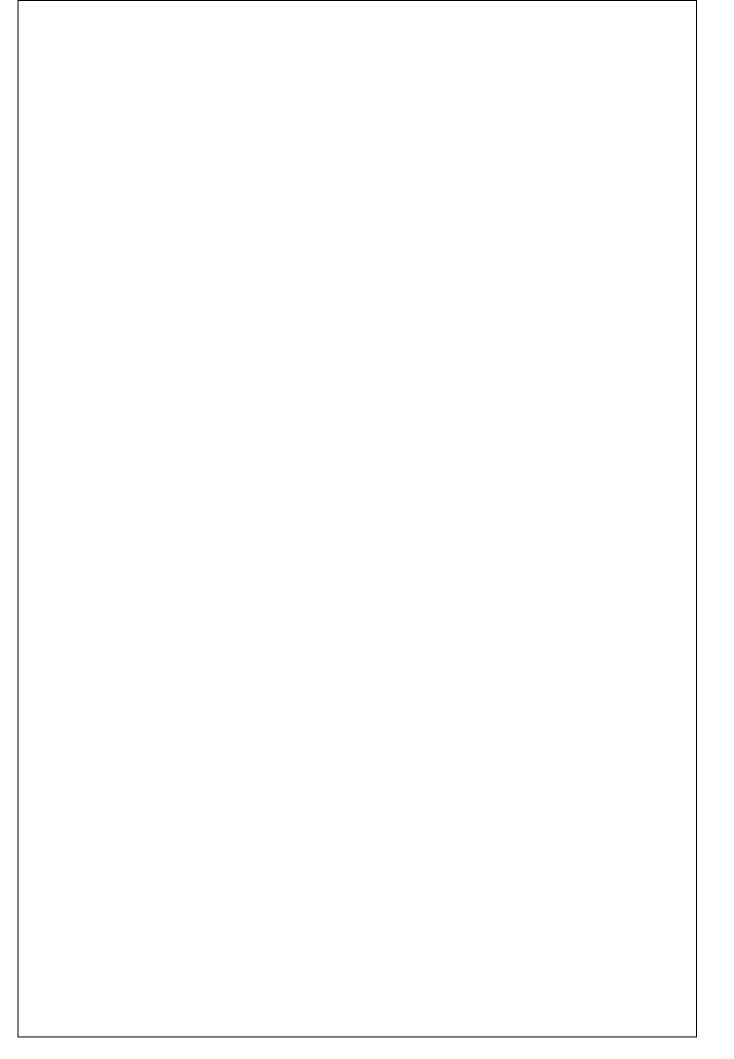
#### Introduction : (Maximum 5 sentences)

**Maximization Transportation Problem**. There are certain types of **transportation problems** where the objective function is to be maximized instead of being minimized. These **problems** can be solved by converting the **maximization problem** into a minimization **problem** 

# Prerequisite knowledge for Complete understanding and learning of Topic: (Max. Four important topics)

**Optimal Solution-** a feasible **solution** is said to be **optimal solution** if it minimize total **transportation** cost Balanced **Transportation Problem** - a **transportation problem** in which the total supply from all sources is equal to the total demand in all the destinations.

**Detailed content of the Lecture:** 



Video Conten	t/Details of website for further learning (if any):	
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Important Boo	oks/Journals for further learning including the page nos.:	
Operation Res	search - Paneerselvam.R- Page No:63-64	
	Cou	ırse Faculty
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Course Faculty Unit	: V.Shanmugapriya : II Date of Lectury	
		<b>c.</b>
Topic of Lect	ure: Initial Basic Feasible Solution (IBFS)	
This involves	<b>: (Maximum 5 sentences)</b> Initial solution to the given balanced Transportation Problems or F Cost Allocation problem. This is known as Initial Basic Feasible S)	Resource
( Max. Four in A feasible sol is one less tha solution (not total transpor Detailed cont Diagram/ De	<pre>cnowledge for Complete understanding and learning of Topic: nportant topics) ution is said to be basic if the number of positive allocations equals n the number of rows and columns in a transportation problem. A necessarily basic) is said to be optimal if it minimizes the tation cos ent of the Lecture: scription/Algorithm/Procedure for solving problems/ Derivation of ing content if any</pre>	feasible
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### **LECTURE HANDOUTS**



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MBA	[
urse Name with Code	:19MBB05- Quantitative Methods and Techniques
urse Faculty	: V.Shanmugapriya

: II

Unit

Course

Course

Topic of Lecture: N-W Corner Rule, Least Cost and Vogel's Approximation Methods

#### Introduction : (Maximum 5 sentences)

It has three steps: Find the **north west corner** cell of the **transportation** tableau. Allocate as much as possible to the selected cell, and adjust the associated amounts of supply and demand by subtracting the allocated amount. Cross out the row or column with 0 supply or demand

Prerequisite knowledge for Complete understanding and learning of Topic: (Max. Four important topics)

Step 1: Formulate the problem.

Step 2: Obtain the initial feasible solution.

Algorithm for North-West Corner Method (NWC)

Algorithm for Least Cost Method (LCM)

Algorithm for Vogel's Approximation Method (VAM)

#### Detailed content of the Lecture:

Diagram/ Description/Algorithm/Procedure for solving problems/ Derivation component with supporting content if any



**Date of Lecture:** 

Can be added as link

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#### **LECTURE HANDOUTS**





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Course Name with Code	:19MBB05- Quantitati	ve Methods and Technique	es
Course Faculty	: V.Shanmugapriya		
Unit	: II	Date of Lec	ture:
<b>Topic of Lecture:</b> N-W Co	rner Rule, Least Cost and `	Vogel's Approximation Mo	ethods
demand by subtracting the demand Prerequisite knowledge ( Max. Four important to Step 1: Formulate to Step 2: Obtain the Algorithm for Nor	, , , , , , , , , , , , , , , , , , ,	out the row or column wi	th 0 supply or
0	el's Approximation Metho	d (VAM)	
Detailed content of the Lect Diagram/ Description/Algo supporting content if any	ure: rithm/Procedure for solving	problems/ Derivation compo	onent with

Can be added as link

**Important Books/Journals for further learning including the page nos.:** Operation Research - Paneerselvam.R- Page No:66-68

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### LECTURE HANDOUTS



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Course Name with Code	:19MBB05-Quar	ntitative Methods and Techniques
Course Faculty	: V.Shanmugapr	iya
Unit	: II	Date of Lecture:
Topic of Lecture: N-W Corner	Rule, Least Cost	and Vogel's Approximation Methods
much as possible to the select demand by subtracting the al demand	erth west corner of the corner of the cell, and adjust located amount.	cell of the <b>transportation</b> tableau. Allocate as st the associated amounts of supply and Cross out the row or column with 0 supply or
Prerequisite knowledge for 6 ( Max. Four important topics Step 1: Formulate the p Step 2: Obtain the initia Algorithm for North-V Algorithm for Least Co Algorithm for Vogel's	) problem. al feasible solutio Vest Corner Meth ost Method (LCM	lod (NWC)

**Detailed content of the Lecture:** 

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### LECTURE HANDOUTS



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MBA		I/II	
Course Name with Code	:19MBB05- Qu	antitative Methods and Techniques	
Course Faculty	: V.Shanmugaj	oriya	
Unit	: II	Date of Lecture:	
Topic of Lecture: Check for optimality- MODI Method			
Introduction : ( Maximum 5 sentences)			
The modified distribution <b>method</b> , is also known as <b>MODI method</b> or (u -			
v) <b>method</b> provides a minimum cost solution to the transportation problems The objectives			
are to develop and review an integral transportation schedule that meets all demands from the			
inventory at a minimum total transportation cost.			

Prerequisite knowledge for Complete understanding and learning of Topic: ( Max. Four important topics)

It consists in considering each potential new basic variable, and checking its impact on the **objective function**. ... For a maximization (minimization) problem, if the reduced costs of all non basic variables are negative (positive), the solution is **optimal**.

Detailed content of the Lecture: Diagram/ Description/Algorithm/Procedure for solving problems/ Derivation component with supporting content if any

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### LECTURE HANDOUTS



I/II

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Course Name with Code	:19MBB05- Quantita	ntive Methods and Techniques
Course Faculty	: V.Shanmugapriya	
Unit	: II	Date of Lecture:
<b>Topic of Lecture:</b> Check for o	optimality- MODI Method	1
Introduction : (Maximun	ı 5 sentences)	
The modified distribution	<b>method</b> , is also known	as <b>MODI method</b> or (u -
w) mathed provides a mini	mum cost colution to th	a transportation problems The

v) **method** provides a minimum cost solution to the transportation problems. ... The objectives are to develop and review an integral transportation schedule that meets all demands from the inventory at a minimum total transportation cost.

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It consists in considering each potential new basic variable, and checking its impact on the **objective function**. ... For a maximization (minimization) problem, if the reduced costs of all non basic variables are negative (positive), the solution is **optimal**.

**Detailed content of the Lecture:** 

Can be added as link

**Important Books/Journals for further learning including the page nos.:** Operation Research - Paneerselvam.R- Page No:71-86

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#### LECTURE HANDOUTS



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**Date of Lecture:** 

Course Name with Code	:19MBB05- Quantitative Methods and Techniques
Course Faculty	: V.Shanmugapriya

: II

Unit

**Topic of Lecture:** Case of Degeneracy

#### Introduction : ( Maximum 5 sentences)

In a standard **transportation problem** with m sources of supply and n demand destinations, the test of optimality of any feasible solution requires allocations in m + n - 1 independent cells. If the number of allocations is short of the required number, then the solution is said to be **degenerate**.

Prerequisite knowledge for Complete understanding and learning of Topic: ( Max. Four important topics)

**Degeneracy in Transportation problem**. If number of positive independent allocations is less than m+n-1, then Initial Basic Feasible Solution is **Degenerate**. To Remove **Degeneracy** we allocate very small positive number epsilon (*£*) to the unoccupied cell which have minimum cost and should be on Independent position

Detailed content of the Lecture:

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#### LECTURE HANDOUTS



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Course Name with Code	:19MBB05- Quantitative Methods and Techniques					
Course Faculty	: V.Shanmugapriya					
Unit	: II	Date of Lecture:				
Topic of Lecture: Assignment Models						
Introduction : ( Maximum 5 sentences)						

**Assignment models** is one of topics of operations research. It consists of assigning a specific (person or worker) to a specific (task or job) assuming that there are the number of persons equal to the number of tasks available

Prerequisite knowledge for Complete understanding and learning of Topic: ( Max. Four important topics)

The **assignment problem** is classified into balanced **assignment problem** and unbalanced **assignment problem**. If the number of rows is equal to the number of columns, then the **problem** is termed as a balanced **assignment problem**; otherwise, an unbalanced **assignment problem** 

Detailed content of the Lecture:

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#### LECTURE HANDOUTS



L

Course Name with Code	:19MBB05- Quantitative Methods and Techniques
Course Faculty	: V.Shanmugapriya

Unit

Date of Lecture:

Topic of Lecture: Minimizing and Maximizing problems

: II

#### Introduction : ( Maximum 5 sentences)

The fundamental idea which makes calculus useful in

understanding **problems** of **maximizing** and **minimizing** things is that at a peak of the graph of a function, or at the bottom of a trough, the tangent is horizontal. That is, the derivative f'(xo) is 0 at points xo at which f(xo) is a maximum or a minimum.

Prerequisite knowledge for Complete understanding and learning of Topic: ( Max. Four important topics)

**Minimization and maximization**. Minimize and Maximize yield lists giving the value attained at the minimum or maximum, together with rules specifying where the minimum or maximum occurs

**Detailed content of the Lecture:** 

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**Important Books/Journals for further learning including the page nos.:** Operation Research - Paneerselvam.R- Page No:99-119

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#### LECTURE HANDOUTS



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Course Name with Code	:19MBB05- Quantitative Methods and Techniques
Course Faculty	: V.Shanmugapriya

Unit

Date of Lecture:

Topic of Lecture: Minimizing and Maximizing problems

: II

#### Introduction : ( Maximum 5 sentences)

The fundamental idea which makes calculus useful in

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#### LECTURE HANDOUTS



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Date of Lecture:

Course Name with Code :19MBB05- Quantitative Methods and Techniques

Course Faculty : V.Shanmugapriya

Unit

: III

**Topic of Lecture:** 

**Introduction : (Maximum 5 sentences)** 

**Prerequisite knowledge for Complete understanding and learning of Topic:** (Max. Four important topics)

Detailed content of the Lecture: Diagram/ Description/Algorithm/Procedure for solving problems/ Derivation component with supporting content if any

Video Content / Details of website for further learning (if any):

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#### LECTURE HANDOUTS



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I/II	

Course Name with Code :19MBB05- Quantitative Methods and Techniques

Course Faculty :K.Mayakkannan

Unit

: III

Date of Lecture:

**Topic of Lecture:** 

**Introduction : (Maximum 5 sentences)** 

**Prerequisite knowledge for Complete understanding and learning of Topic:** (Max. Four important topics)

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#### LECTURE HANDOUTS



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Course Faculty :K.Mayakkannan

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### **LECTURE HANDOUTS**



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Course Name v	vith Code	:19MBB05- Q	uantitative Methods ar	ıd Technique	S
Course Faculty		:K.Mayakkan	nan		
Unit		: III		Date of Lec	ture:
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### LECTURE HANDOUTS



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Course Name with Code	:19MBB05- Quantita	tive Methods and Techniques
Course Faculty	:K.Mayakkannan	
Unit	: 111	Date of Lecture:
Topic of Lecture:		
Introduction : (Maximum 5	sentences)	
Prerequisite knowledge for C ( Max. Four important topics	• 0	nd learning of Topic:
Detailed content of the Lectur Diagram/ Description/Algori supporting content if any		ng problems/ Derivation component with
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Course Faculty :K.Mayakkannan

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