MATRICES

AGENDA

1. Matrices, Types

2. Determinants

3. Applications of Matrices

4. Basic Matrix Theory and Algebra

5. Systems of Linear Equations

6. Elementary Row-reduction

7. Types and Methods of Solution

8. Echelon Form

9. Introduction to systems of inequalities and linear programming

This is the arrangement of objects or items in rows (horizontal) and columns (vertical)

TYPE OF MATRICES

1. Square

2. Diagonal

3. Scalar

4. Unit or Identity. It is usually represented with the letter I

5. Null

6. Column

7. Row

8. Upper triangle

9. Lower triangle

TRANSPOSE OF A MATRIX

Given a matrix A, the transpose of that matrix, represented as can be obtained by interchanging rows for columns and vice versa

SYMMETRIC MATRIX

A symmetric matrix is one which is the same as its transpose

MINOR

The minor of a matrix can be found by canceling out the row and column containing that element

The minor of a 3 by 3 matrix can also be found similarly. However, in this case, we have to deal with determinants. That is to say, we find the determinant after we have canceled out the row and column containing that element.

CO-FACTOR OF A MATRIX

The co-factor of a matrix can be found by

1. Finding the minor

2. Applying the sign conventions

For the sign convention, it is a minus raised to the position of the element (that is the row and column of the element)

For example, given a matrix A. When finding the cofactor the element will have a sign . That is . That will be a positive sign.

ADJOINT OF A MATRIX

This is the transpose of the co-factor of a matrix

INVERSE OF A MATRIX

Given a matrix A, the inverse of the matrix can be gotten from the formula:

Only a square matrix can have an inversely

A singular matrix is one that has a determinant of 0

A singular matrix has no inverse and its inverse is therefore undefined

If , then

APPLICATIONS OF MATRICES

1. Solving linear equations (simultaneous equations)

Encoding

Decoding

Mathematics puzzles

Games

Information like credit card number

Optics

Economics

Cryptography: This also utilizes matrices, cryptography is science of information security.

THE ENCRYPTION PROCESS

First, text of the message into a stream of numerical rules and place the data into matrices and multiply the data by encoding matrices. At last, convert the matrices into a stream of numerical values that contain the encrypted message

For example, let A=1, B=2, C=3 and so on. Let a blank be represented by 0. Let us encode the message “I LOVE MY INDIA”.

We need to translate letters into numbers.

I LOVE MY INDIA

9,0,12,15,22,5,0,13,25,0,9,14,4,9,1

Now we decide on a coding matrix

SOLVING LINEAR EQUATIONS WITH MATRICES

1. Crammer’s rule

2. Gaussian Elimination method

3. Gauss Jordan Elimination method

GAUSSIAN ELIMINATION METHOD

In this method, you will have to reduce (or eliminate) values by making them 0

The first row shouldn’t change

The first column of row 2 becomes 0

The first and second columns of row three become 0

Given a simultaneous equation

x + y – z = -2

2x-y+z = 5

-x+2y+2z = 1

First, you express the system of linear equations in a matrix augmented form

To be able to eliminate values, we will need to perform operations with rows and apply either these changes to either the second or third row depending on the element that we want to make 0

The convention to doing this is the convention:

When reducing any row or column, that row or column should come first in the reduction formula before other rows.

For example, if we want to change the first element in row 2 to 0,

You’ll notice that we change the values of the whole row

Similarly, to eliminate the first item in the third row, we can say that:

Now to eliminate the second column of the third row, we can say once again

From this, we can say

GAUSS JORDAN ELIMINATION METHOD

Similar to the Gaussian elimination method, we have a matrix with 0s on the bottom. However, the difference to this is that, you also have zeros on the top as well.

You will be having a matrix of the form:

This can further be reduced to the the “Reduced Row Echelon Form”

Try the following

1.

x – 4y -2z = 21

2x + y + 2z = 3

3x + 2y – z = -2

Answer: (3, -5, 1)

2.

7x – 4y = 12

-4x + 12y -6z = 0

-6y + 14z = 0

3.

x + 2y + 3z = -4

2x + 6y – 3z = 33

4x -2y + z = 3

4.

x – y + 7z = 3

x + 4y + z = 8

x + 3y – 3z = 2