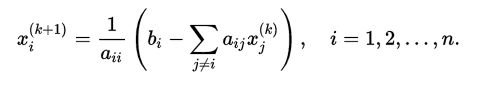
**PROJECT\_CS204\_2017(A3) :**

**INTRODUCTION :**

Many important practical problems give rise to systems of linear equations written as the matrix equation Ax = c , where 'A' is a given (n × n) non-singular matrix and 'c' is an n-dimensional vector ; the problem is to find an n-dimensional vector 'x' satisfying the above equation . To solve them, two types of methods are normally used : direct methods and iterative methods. As a part of the project we were supposed to write codes in 'C' language for direct methods namely LU decomposition(Dolittle's and Cholesky's factorization) and Gaussian elimination method. We were also required to write programs for iterative methods i.e Jacobi and Gauss-Seidel methods.'C' code to calculate norms(1-norm, 2 norm and infinity norms) and functions to read matrix and vectors from a file were also written.

**APPROACH :**

**Jacobi Method is done by using the below formula**



**the above equation is derived from the equation below**



**similarly the other methods are derived in the traditional manner.**

**The Norms of the matrices and vectors are calculated with their standard mathematical meanings.**

**The spectral radius is calculated using the power method.**

**FUNCTIONS USED :**

List of functions used :

## genrn(m,n) : genrn generates a zero matrix of order (mXn)

## genv(m) : genv generates a user defined vector

## genrv(m) : genrv generates a random vector of size m

## gen(m,n) : generates a user defined matrix of order (mXn)

## infnomv(n,vec) : finds the infinite vector norm of vector vec of size n

## nomv2(n,vec) : calculates two-norm of vector vec of size n

## nom1(n,vec) : calculates one-norm of vector vec of size n

## mutlim(n1,n2,n3,n4,a,b,c) : multiplies matrices a and b of order n1Xn2 and n3Xn4 respectively and stores it in c

## matnom1(r,c,mat) : calculates the one-norm for matrix mat of order rXc

## infmatnom(r,c,mat) : calculates the infinite matrix norm of mat of order rXc

## spr(n1,n2,ar,arr) : calculates the spectral radius of arr with initial guess as ar

## det(r,c,a) : calculates the determinant for matrix a of order rXc

## inverse(r,c,a) : calculates the inverse of matrix a with order rXc

## transm(s1,s2,arr,arr1) : calculates the transpose of matrix arr of order s1Xs2 and stores in arr1

## nom2(s1,s2,arr) : calculates the two-norm for matrix arr with the order s1Xs2

## dolildecomp(s1,s2,a,l,u,y,b,x) : factorizes the matrix a into LU form and then its stored in l,u respectively . Using backward and forward substitution the solutions are obtained .

## GaussianElimination(s1,a,b,x) : solves ax=b using Gaussian elimination method

## Cholesky(r,c,a,l,u,y,b,x) : : factorizes the matrix a into LU form and then its stored in l,u respectively . Using backward and forward substitution the solutions are obtained .

## Gausssiedel(s1,a,b,x) : solves the problem using gauss seidel approach

## jacobi(s1,a,b,x) : solves ax=b using Jacobi method .

## main.c contains main menu options .

## filehandling.c contains code used to retrieve data from a file

**CONCLUSION :**

By completing this project we have a deeper understanding towards the methods used for solving the linear equations of the type Ax=c . We were able to explore the use of a programming language to solve the equations for matrices of very large sizes which are otherwise(manually) very tedious to solve .