# ASSIGNMENT 2

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* Grid Detail

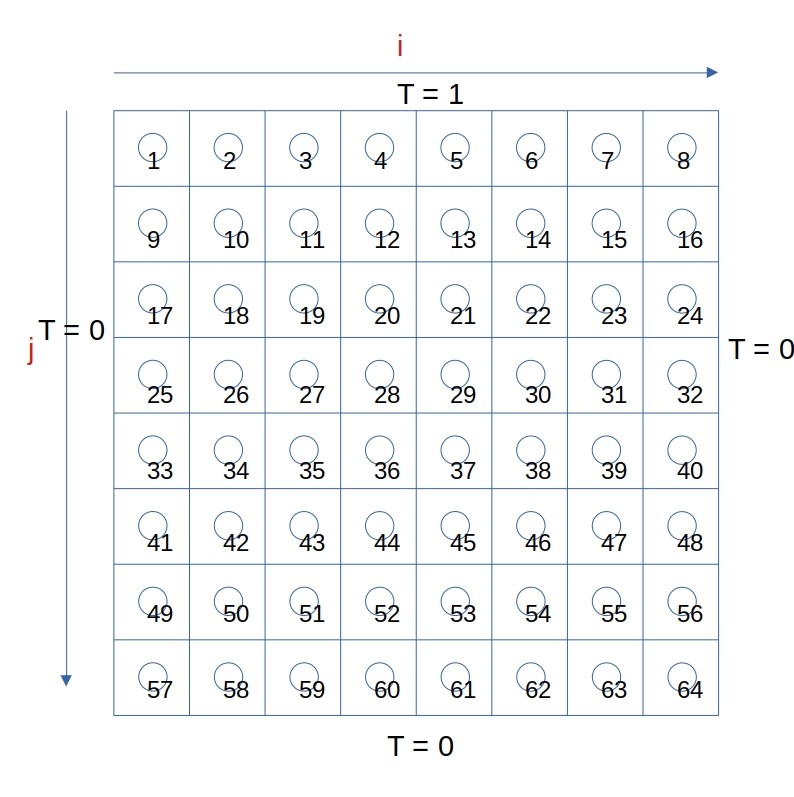
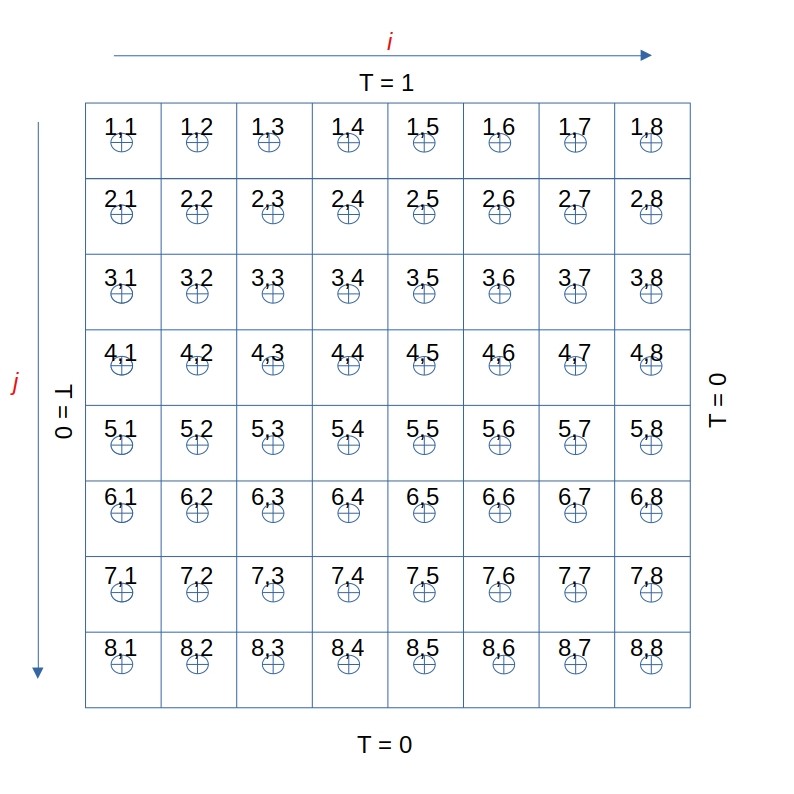


Fig.1 Normal ordering Fig.2 Lexicographic ordering

* Discretized Equation

(1)

(2)

(3)

(4)

Where N = ni x nj , n = ni = ni

ni and nj are the number of rows and columns of the grid respectively.

Now eq.4 becomes

(5)

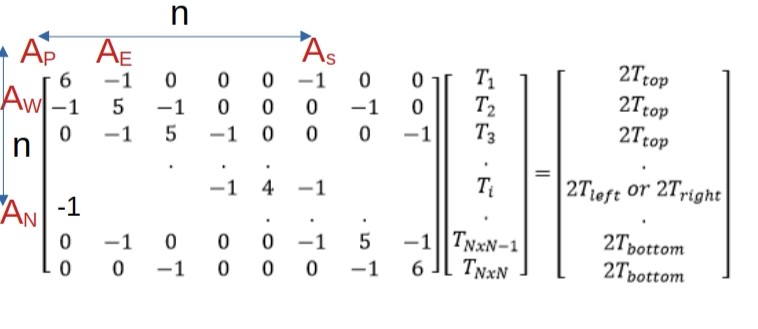
For top layer, there is no north node. But instead there will be boundary.

So, .

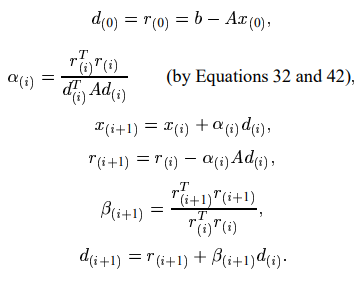
i.e,

At boundary, the coefficient of terms will increase and constant values goes to RHS.

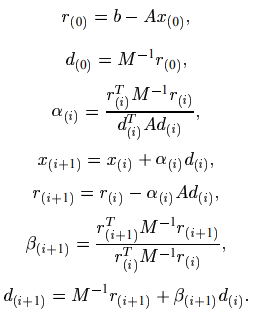
A T = Boundary values



**Conjugate Gradient Method**



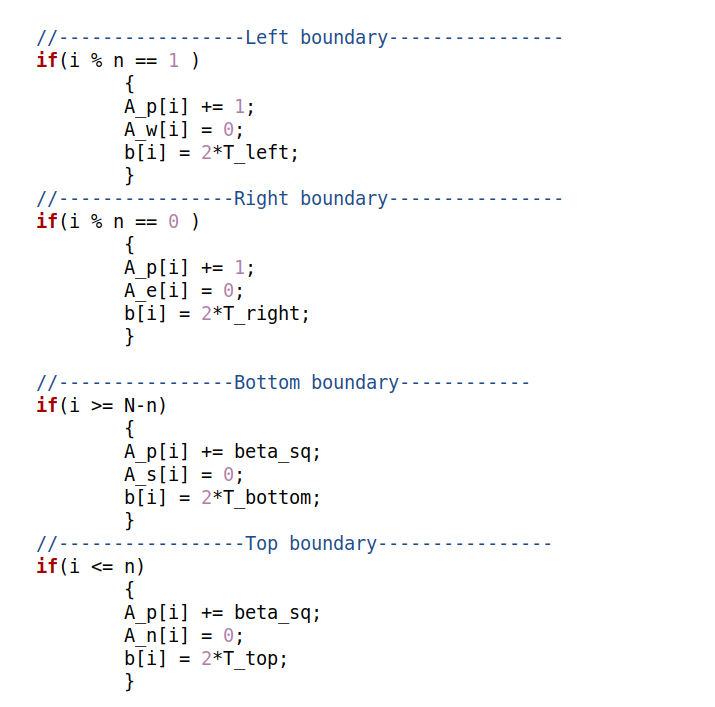
**Preconditioned Conjugate Gradient Method**



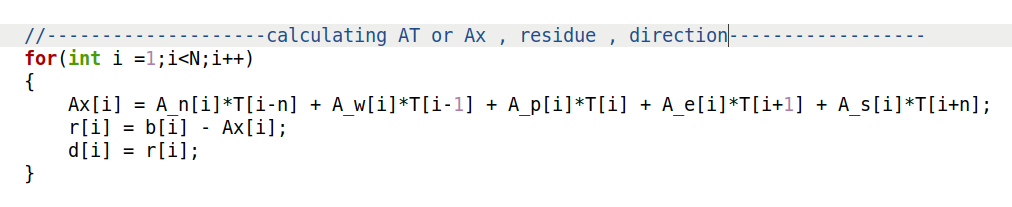
**Coding Part**

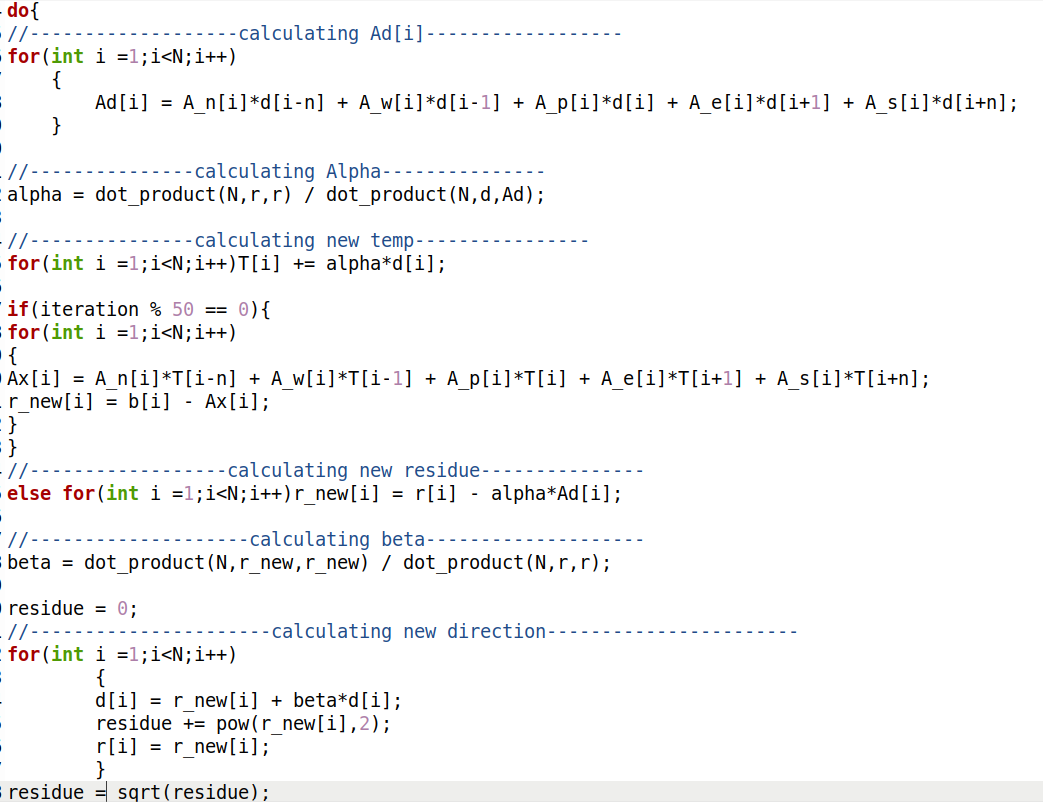
An input.txt file is made reading inputs required which include the Number of grids, temperature BCs , Upper limit , Lower limit

step size ,dx or dy = (Upper limit - Lower limit ) / No of grid points



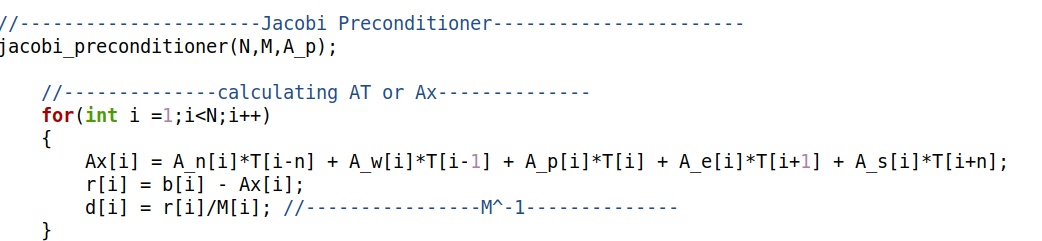
Inside conjugate gradient method

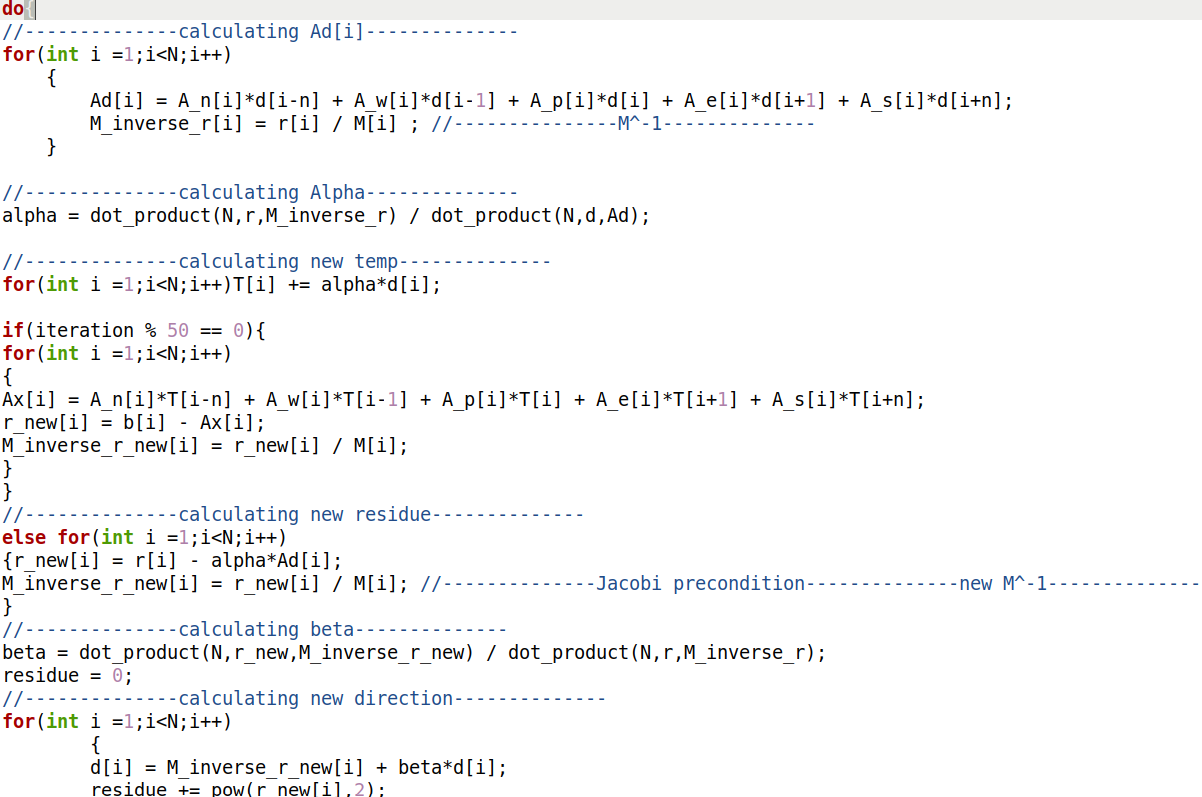
 After this , we will iterate till convergence criteria is satisfied

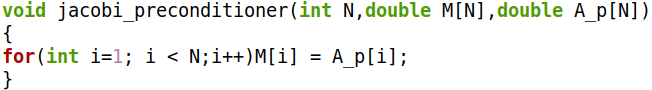


**Preconditioned Conjugate Gradient Method**

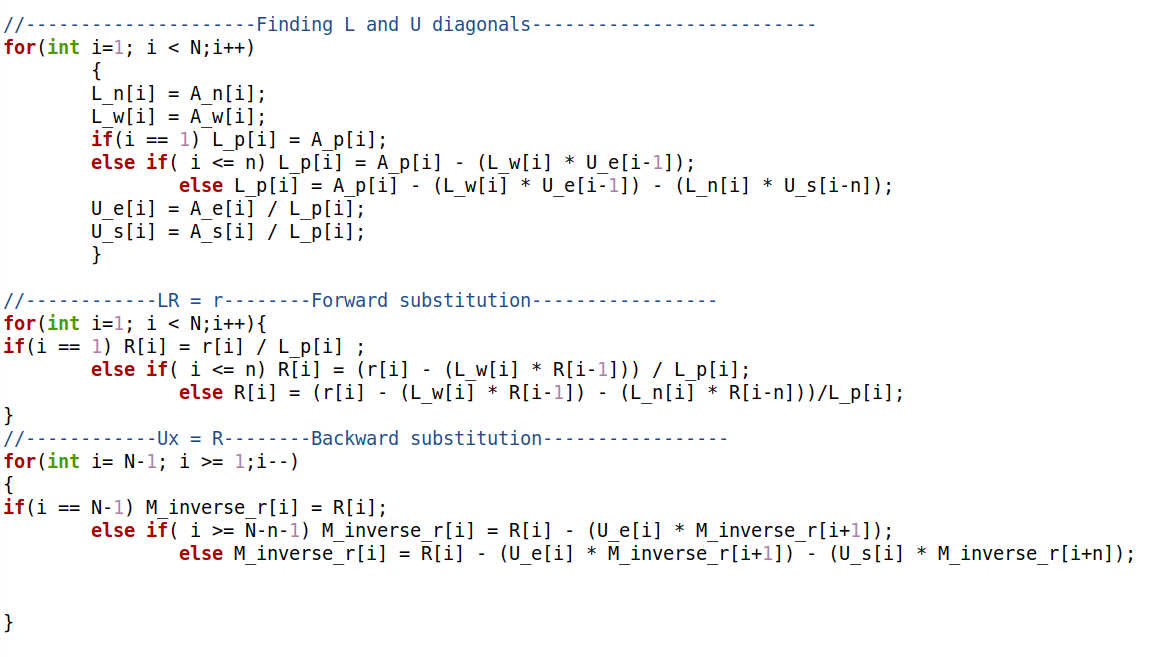
In jacobi precondtioner , the diagonal of matrix A is taken as M







For ILU , the matrix M changes



**Results**

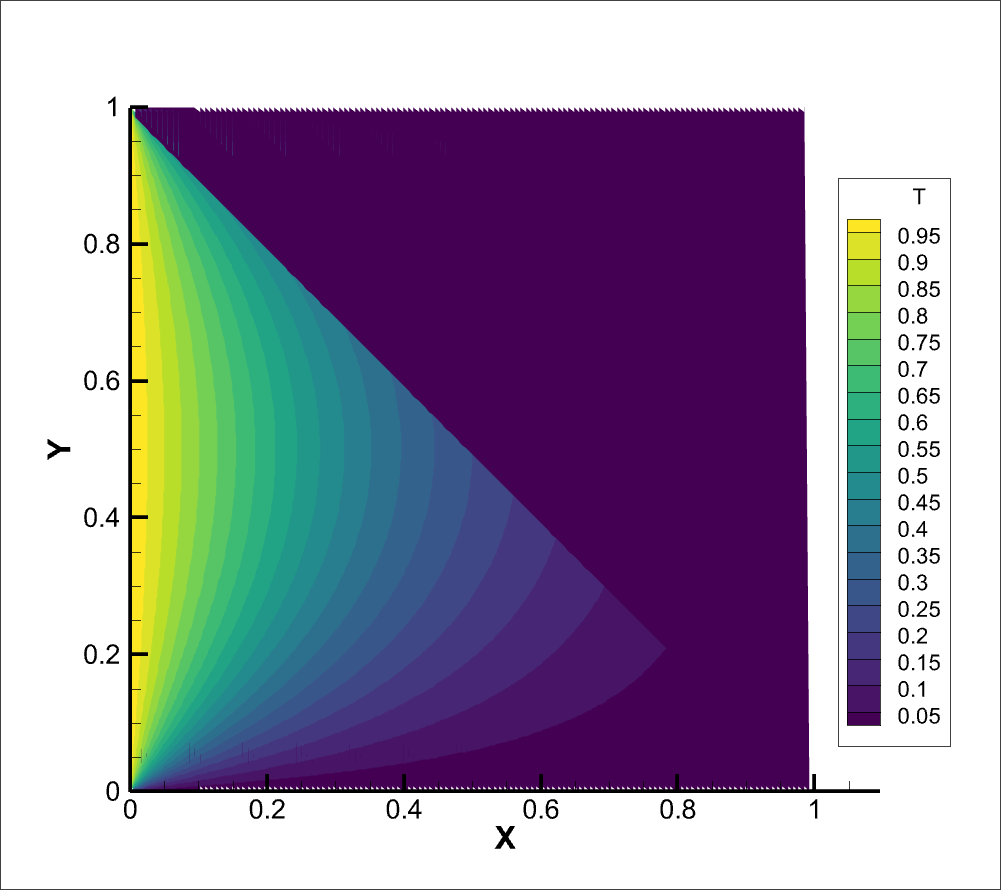


Fig.1 Contour for CG method

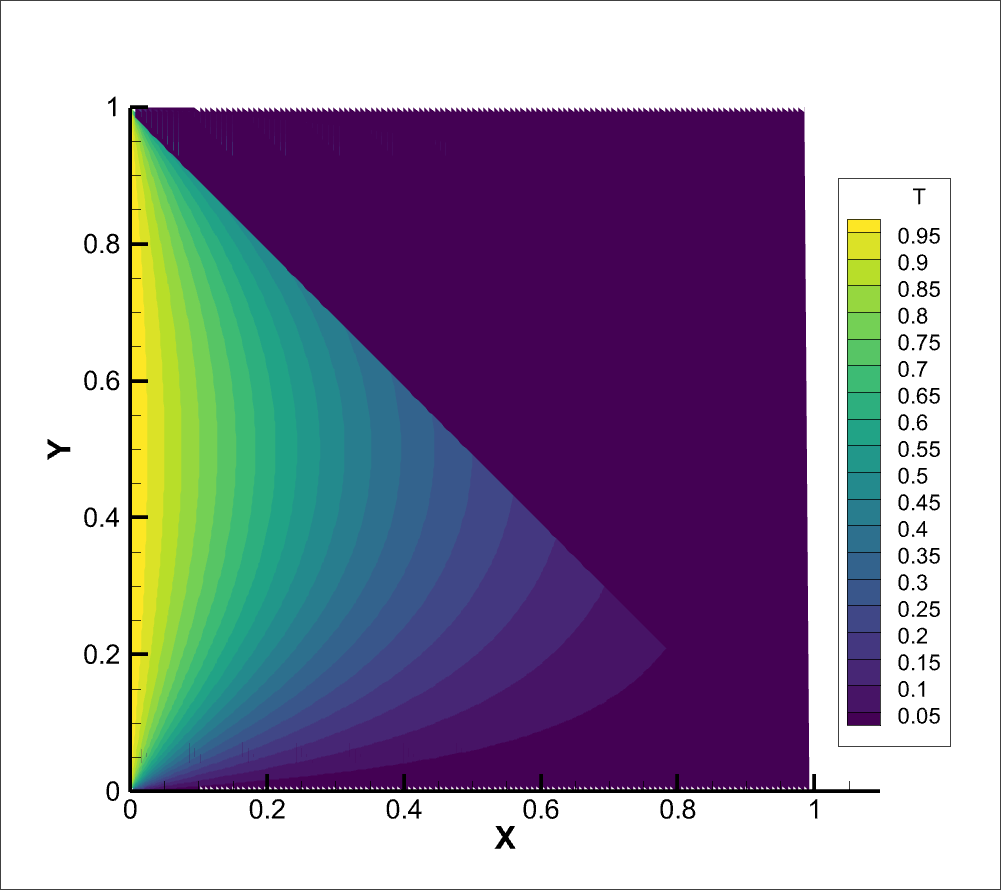


Fig.1 Contour for Jacobi Preconditioned CG method

**FMG**

|  |  |  |  |
| --- | --- | --- | --- |
| **Relaxation Method** | **Wave Number , k** | **Residual** | **Required Iterations** |
| Weighted Jacobi | 1 | 22.919425 | 8 |
| Gauss Siedel | 1 | 19.641558 | 6 |
| Weighted Jacobi | 10 | 2941.761565 | 10 |
| Gauss Siedel | 10 | 2164.555850 | 7 |