

Solving System of Linear Equations

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1 Understanding the code structure

This code is divided into the following source code files:

- main.c
- matrix.c
- util.c
- rref.c
- nullspace.c

The header files are:

- matrix.h
- util.h

Additional files are:

- LICENSE
- makefile

1.1 To build the code and run

```
make
./main.out
```

1.2 Program flow

The main contents of each file are as follows:

- Contains the main driver code
- The main function first asks the user to input the dimensions and the matrices A and b.
- The main function then calls the *solve* function defined in **rref.c** which returns a structure *aug mat* which is defined in **matrix.h** which returns the Reduced Row Echelon Form of matrix A and values of the pivots.
- Then we calculate the nullspace of the matrix by using the results returned in the above step. This is done by the nullspace function defined under **nullspace.c**.
- We can use these results to determine the nature of the solution by using the solution function defined in **rref.c**.

1.3 Sample Input and Output

```
Enter A:
a(11) a(12) ... a(1n)
.....
a(n1) a(n2) ... a(nn)
Enter row and column seperated by space (E.g. 3 3): 3 4
Enter elements of a particular row in the same row itself or the program may exit
with Segmentation Fault
1 2 2 2
2 4 6 8
3 6 8 10

Enter b:
For solving a system of linear equations,
Enter the number of columns of b should be 1
b(11) b(12) ... b(1n)
.....
b(n1) b(n2) ... b(nn)
Enter row and column seperated by space (E.g. 3 3): 3 1
Enter elements of a particular row in the same row itself or the program may exit
with Segmentation Fault
5
4
3
The pivots are:
0 2

1.00 2.00 0.00 -2.00 | 11.00
0.00 0.00 1.00 2.00 | -3.00
0.00 0.00 0.00 0.00 | -6.00

Nullspace of the equation is:
-2.00 2.00
1.00 0.00
-0.00 -2.00
0.00 1.00

Ax = b has No Solution
```