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#include<stdio.h>
#include<conio.h>

void main()
{
    int i,j,k,m,n;
    static float coeff[20][20],solu_vect[10],rhs_vect[20], aug[20][20];
    float sum=0.0,pivot;
    clrscr();
    printf("\n*****This program implements Gauss Elemination
Method*****");
    1:
    printf("\n\t\tEnter number of equations :: ");
    scanf("%d",&m);
    printf("\n\t\tEnter number of variables :: ");
    scanf("%d",&n);
    if(m != n)
    {
        printf("\nGauss elimination method works when number of equation and
variables are same.\n");
        goto 1;
    }

    /*input coefficients*/
    printf("\nEnter the elements of coefficient matrix:\n");
    for(i=0; i<n; i++)
    {
        printf("\n\tEnter coefficients for equation %d --> ",i+1);
        for(j=0; j<n; j++)
        {
            printf("\n\t\tEnter coefficient for %dth variable --> ",j+1);
            scanf("%f",&coeff[i][j]);
        }
    }

    /*input right hand side vector*/
    printf("\nEnter the elements of right hand side vector:\n");
    for(i=0; i<n; i++)
    {
        printf("\n\tEnter rhs value for equation %d --> ",i+1);
        scanf("%f",&rhs_vect[i]);
    }

    /*create augmented matrix*/
    for(i=0; i<n; i++)
    {
        for(j=0; j<n; j++) aug[i][j] = coeff[i][j];
        aug[i][n] = rhs_vect[i];
    }
}

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/*Forward elemination process for the generation of upper triangular matrix*/
for(i=0; i<n-1; i++)
{
    for(j=i+1; j<n; j++)
    {
        pivot = aug[j][i]/aug[i][i];
        for(k=i; k<=n; k++)    aug[j][k] = aug[j][k] - pivot*aug[i][k];
    }
}

/*Back substitution process to generate solution vector*/
solu_vect[n-1] = aug[n-1][n]/aug[n-1][n-1];
    /*loop for rest of the solutions*/
for(i=n-2; i>=0; i--)
{
    sum=0;
    for(j=i+1; j<n; j++)    sum = sum + aug[i][j]*solu_vect[j];
    solu_vect[i] = (aug[i][n] - sum)/aug[i][i];
}

/*printing solutions*/
printf("\nThe solutions are as follows: \n\n");
for(i=0; i<n; i++)    printf("\n\tx%d=%f\t",i+1,solu_vect[i]);
getch();
return;
}

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