Lab Session 2

1. It may be noted that in Iterative method when we are solving for

$$f(x) = 0,$$

the same is written as

$$x = g(x).$$

And the algorithm used is

$$x^{n+1} = g(x^n)$$

In the limit as n is large and the method converges, then $x^n \sim x^{n+1}$

$x^{n+1} = g(x^n)$ or $x^{n+1} - x^n = g(x^n) - x^n = 0$ or $x^{n+1} = x^n + f(x)$

Introducing a relaxation parameter, ω, we can write the algorithm as,

$$x^{n+1} = x^n + \omega f(x^n)$$

Now Consider the quadratic equation, $x^2 - 2.2x + 1.2 = 0$. Note that the roots of the equation are 1 and 1.2. You are asked to find the roots of the above equation using fixed point iteration with, $x^{n+1} = x^n + \omega f(x^n)$, where ω is a relaxation parameter. Perform the following steps and comment on the results with valid justifications

   (a) starting with the initial guess x=1.10, ω=1.00, perform 50 iterations
   (b) starting with the initial guess x=0.90, ω=1.00, perform 50 iterations
   (c) starting with the initial guess x=1.10, ω=1.80, perform 50 iterations
   (d) starting with the initial guess x=0.90, ω=1.80, perform 50 iterations
   (e) starting with the initial guess x=1.21, ω=1.0, perform 50 iterations
   (f) starting with the initial guess x=1.21, ω=1.6, perform 50 iterations
   (g) starting with the initial guess x=1.21, ω=-1.6, perform 50 iterations

```
       read (*,*) x, omega
       tol=1e-5
       itermx=50

      do i = 1, itermx
        if(dabs(f(x)).lt. tol) then
        write(*,*)'root is =  ',x,'iterations =',i
        stop
        else
        x=x+omega*f(x)
        endif
        write(*,*)i,x
      enddo
      write(*,*)' iterations exceeded'
      stop
      end
c****************************************************************

      function f(x)
      implicit double precision (a-h,o-z)
      f = x*x-2.2*x+1.2
      return
      end
```

2. Write a code to solve Upper triangular matrix as outlined in the ppt
3. Writ a code to perform Gauss operations as discussed in the ppt
4. Integrate now codes in (3) and (2) to obtain solution for the sent of equations