ASSIGNMENT – 5

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2. Write an algorithm for Successive-Over-Relaxation (SOR) method.

ass5_2.m

```
n = input('Enter number of equations, n:  ');
A = zeros(n,n+1);
x1 = zeros(1,n);
A=[4 2 3 8; 3 -5 2 -14; -2 3 8 27];
x1 = [0 0 0];
tol = input('Enter tolerance, tol:  ');
m = input('Enter maximum number of iterations, m:  ');
w = input('Enter the parameter w (omega):  ');
k = 1;
while  k <= m
   err = 0;
   for i = 1 : n
      s = 0;
      for j = 1 : n
        s = s-A(i,j)*x1(j);
      end
      s = w*(s+A(i,n+1))/A(i,i);
      if abs(s) > err
         err = abs(s);
      end
      x1(i) = x1(i)+s;
   end
   if err <= tol
      break;
   else

      k = k+1;
   end
end
fprintf('The solution vector after %d iterations is :\n', k);
for i = 1 : n
fprintf('   %11.8f \n', x1(i));
end
```

Command Window

```
Enter number of equations, n:  3
Enter tolerance, tol:  0.001
Enter maximum number of iterations, m:  100
Enter the parameter w (omega):  1.4
The solution vector after 101 iterations is :
   -2.37055245
   -1.60619311
    5.02127522
```

3. Use Gauss Seidel method and SOR method with w = 1.2 to find the solution of the following linear systems with an initial vector [0,0,0,0] and tolerance value 10-3 in the . ∞ norm:

(a) 10x + 8y – 3z + u = 16

2x + 10y + z – 4u = 9

3x – 4y + 10z + u = 10

2x + 2y – 3z + 10u = 11

Editor - C:\Users\DELL\OneDrive\Documents\MATLAB\ass5_3_a.m

ass5_2.m | ass5_3_a.m

```
clc;
clear;
a = [10 8 -3 1;2 10 1 -4;3 -4 10 1;2 2 -3 10];
B=[16;9;10;11];
x=[0;0;0;0];
n=4;
tol=0.00001;
err=1;

while (norm(err,inf)>=tol)
    xold=x;
    for i=1:n
        sum=0;
        for j=1:i-1
                sum=sum+ (a(i,j)*x(j));
        end
        for j=i+1:n
                sum=sum+ (a(i,j)*xold(j));
        end
        x(i)=(B(i)-sum)/a(i,i);
        err=x-xold;
    end
end
x
```

Command Window

```
x =

    1.0000
    1.0000
    1.0000
    1.0000
```

3. Use Gauss Seidel method and SOR method with w = 1.2 to find the solution of the following linear systems with an initial vector [0,0,0,0] and tolerance value 10-3 in the . ∞ norm:

(b) $4x1 + x2 - x3 + x4 = -2$

$x1 + 4x2 - x3 - x4 = -1$

$-x1 - x2 + 5x3 + x4 = 0\ x$

$1 - x2 + x3 + 3x4 = 1$

Editor - C:\Users\DELL\OneDrive\Documents\MATLAB\ass5_3_b.m

ass5_2.m | ass5_3_a.m | ass5_3_b.m

```
clc;
clear;
a = [4 1 -1 1;1 4 -1 -1;-1 -1 5 1;1 -1 1 3];
B=[-2;-1;0;1];
x=[0;0;0;0];
n=4;
tol=0.00001;
err=1;
while (norm(err,inf)>=tol)
    xold=x;
    for i=1:n
        sum=0;
        for j=1:i-1
                sum=sum+ (a(i,j)*x(j));
        end
        for j=i+1:n
                sum=sum+ (a(i,j)*xold(j));
        end
        x(i)=(B(i)-sum)/a(i,i);
        err=x-xold;
    end
end
x
```

Command Window

```
x =

   -0.7534
    0.0411
   -0.2808
    0.6918
```

4. Use Gauss Seidel method to solve the following linear system with an initial vector [0,0,0] and tolerance value 10-3 in the . ∞ norm:

$4.63x1 - 1.21x2 + 3.22\ x3 = 2.22$

$-3.07x1 + 5.48x2 + 2.11x3 = -3.17$

$1.26x1 + 3.11x2 + 4.57x3 = 5.11$

Editor - C:\Users\DELL\OneDrive\Documents\MATLAB\ass5_4.m

ass5_2.m | ass5_3_a.m | ass5_3_b.m | ass5_4.m

```
clc;
clear;
A = [4.63 -1.21 3.22 2.22;-3.07 5.48 2.11 -3.17;1.26 3.11 4.57 5.11];
b=[2.22;-3.17;5.11];
x=[0;0;0];
n=3;
tol=0.001;
err=1;
while (norm(err,inf)>=tol)
    xold=x;
    for i=1:n
        sum=0;
        for j=1:i-1
                sum=sum+ (A(i,j)*x(j));
        end
        for j=i+1:n
                sum=sum+ (A(i,j)*xold(j));
        end
        x(i)=(b(i)-sum)/A(i,i);
        err=x-xold;
    end
end
x
```

Command Window

```
x =

   -8.9807
   -9.4762
   10.0430
```