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```
% AERO 300 - Lab 4 - Joshua Oates
% sections 1 and 2 will use test code provided in class examples, section 3
% will use my own test cases
```

Section 0 - clean up

```
clear all
close all
clc
```

Section 1 - test Jacobi against same test cases as used in example

```
disp(" ")
disp("-----Section 1-----")
disp(" ")
```

```
%For all cases, set the tolearance to
TOL = 0.5 *10^(-6);
```

```
% Case 1: A is strictly diagonally row dominant
A = [4, 2;...
     -1, 2];
```

```
b = [3; 2];
x_0 = [1; 1];
[x1, X1, k1] = JoshJacobi(A, b, x_0, TOL);
% Case 2: A is NOT strictly diagonally dominant but Jacobi converges
```

```
A = [10, -2, -1;...
     -1, 5, 3;...
     2, 2, -2];
```

```
b = [1; 2; 3];
x_0 = [1; 1; 1];
[x2, X2, k2] = JoshJacobi(A, b, x_0, TOL);
```

```
% Case 3: A is NOT strictly diagonally dominant and Jacobi does not converge
A = [10, -2, -1;...
     -1, -5,  3;...
     2,  2, -2];
```

```
b = [1; 2; 3];
x_0 = [1; 1; 1];
[x3, X3, k3] = JoshJacobi(A, b, x_0, TOL);
[x4, X4, k4] = JoshJacobi(A, b, x_0, TOL,200);

str = "In " + k1 + " iterations x1 was found to be: ";
disp(str)
disp(num2str(x1, '%.7f'))

str = "In " + k2 + " iterations x2 was found to be: ";
disp(str)
disp(num2str(x2, '%.7f'))

str = "In " + k3 + " (default) iterations x3 was found to not converge,
However;";
disp(str)

str = "In " + k4 + " iterations x3 was found to be: ";
disp(str)
disp(num2str(x4, '%.7f'))
```

```
-----Section 1-----
```

```
Warning: A is not strictly diagonally row dominant, it may not converge.
Warning: A is not strictly diagonally row dominant, it may not converge.
Warning: Convergence failed
Warning: A is not strictly diagonally row dominant, it may not converge.
In 23 iterations x1 was found to be:
0.1999998
1.1000000
In 46 iterations x2 was found to be:
0.1987180
0.7628203
-0.5384613
In 100 (default) iterations x3 was found to not converge, However;
In 117 iterations x3 was found to be:
-1.7083325
-4.9583313
-8.1666634
```

Section 2 - test GuassSeidel against same test cases as used in example

```
disp(" ")
disp("-----Section 2-----")
```

```

disp(" ")

%For all cases, set the tolearance to
TOL = 0.5 *10^(-6);

% Case 1: A is strictly diagonally row dominant
A = [4, 2;...
     -1, 2];

b = [3; 2];
x_0 = [1; 1];
[x1, X1, k1] = JoshGuassSeidel(A, b, x_0, TOL);
% Case 2: A is NOT strictly diagonally dominant but Jacobi converges

A = [10, -2, -1;...
     -1, 5, 3;...
     2, 2, -2];

b = [1; 2; 3];
x_0 = [1; 1; 1];
[x2, X2, k2] = JoshGuassSeidel(A, b, x_0, TOL);

% Case 3: A is NOT strictly diagonally dominant and Jacobi does not converge
A = [10, -2, -1;...
     -1, -5, 3;...
     2, 2, -2];

b = [1; 2; 3];
x_0 = [1; 1; 1];
[x3, X3, k3] = JoshGuassSeidel(A, b, x_0, TOL);

str = "In " + k1 + " iterations x1 was found to be: ";
disp(str)
disp(num2str(x1, '%.7f'))

str = "In " + k2 + " iterations x2 was found to be: ";
disp(str)
disp(num2str(x2, '%.7f'))

str = "In " + k3 + " iterations x3 was found to be: ";
disp(str)
disp(num2str(x3, '%.7f'))

-----Section 2-----

Warning: A is not strictly diagonally row dominant, it may not converge.
Warning: A is not strictly diagonally row dominant, it may not converge.
In 12 iterations x1 was found to be:
0.2000000
1.1000000

```

```
In 17 iterations x2 was found to be:
0.1987179
0.7628206
-0.5384615
In 67 iterations x3 was found to be:
-1.7083328
-4.9583321
-8.1666648
```

Section 3 - test of both against original test cases

```
disp(" ")
disp("-----Section 3-----")
disp(" ")

%For all cases, set the tolearance to
TOL = 0.5 *10^(-6);

% Case 1
A = [0, 0;...
     0, 0];

b = [3; 2];
x_0 = [1; 1];
[x1J, ~, k1J] = JoshJacobi(A, b, x_0, TOL);
[x1G, ~, k1G] = JoshGuassSeidel(A, b, x_0, TOL);

% Case 2
A = [1, 0, 0;...
     0, 1, 0;...
     0, 0, 1];

b = [1; 2; 3];
x_0 = [0; 0; 0];
[x2J, ~, k2J] = JoshJacobi(A, b, x_0, TOL);
[x2G, ~, k2G] = JoshGuassSeidel(A, b, x_0, TOL);

% Case 3
A = [ 10, -2, -1;...
     -1,  3,  3;...
     2,  2, -2];

b = [1; 2; 3];
x_0 = [1; 1; 1];
[x3J, ~, k3J] = JoshJacobi(A, b, x_0, TOL,10000);
[x3G, ~, k3G] = JoshGuassSeidel(A, b, x_0, TOL);

disp(" ")
```

```

disp("Case 1")
disp("Jacobi:")
disp("  iterations:")
disp(num2str(k1J))
disp("  x:")
disp(num2str(x1J))
disp(" ")
disp("GuassSeidel:")
disp("  iterations:")
disp(num2str(k1G))
disp("  x:")
disp(num2str(x1G))

disp(" ")
disp("as expected, both failed")

disp(" ")
disp("Case 2")
disp("Jacobi:")
disp("  iterations:")
disp( num2str(k2J))
disp("  x:")
disp( num2str(x2J))
disp(" ")
disp("GuassSeidel:")
disp("  iterations:")
disp(num2str(k2G))
disp("  x:")
disp(num2str(x2G))

disp(" ")
disp("as expected, both quickly succeeded")

disp(" ")
disp("Case 3")
disp("Jacobi:")
disp("  iterations:")
disp( num2str(k3J))
disp("  x:")
disp( num2str(x3J))
disp(" ")
disp("GuassSeidel:")
disp("  iterations:")
disp(num2str(k3G))
disp("  x:")
disp(num2str(x3G))

disp(" ")
disp("although it wasn't garaunteed, both converged. GuassSeidel did so much
  quicker")

```

-----Section 3-----

Warning: A is not strictly diagonally row dominant, it may not converge.
Warning: A has zero(s) in its diagonal, it may not converge.
Warning: A is not strictly diagonally row dominant, it may not converge.
Warning: A has zero(s) in its diagonal, it may not converge.
Warning: A is not strictly diagonally row dominant, it may not converge.
Warning: A is not strictly diagonally row dominant, it may not converge.

Case 1

Jacobi:

iterations:

3

x:

NaN

NaN

GuassSeidel:

iterations:

2

x:

Inf

NaN

as expected, both failed

Case 2

Jacobi:

iterations:

3

x:

1

2

3

GuassSeidel:

iterations:

3

x:

1

2

3

as expected, both quickly succeeded

Case 3

Jacobi:

iterations:

219

x:

0.275

0.99167

-0.23333

GuassSeidel:

iterations:

22

 x:
 0.275
 0.99167
-0.23333

although it wasn't guaranteed, both converged. GuassSeidel did so much quicker

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