UNIVERSITY OF THE WITWATERSRAND, JOHANNESBURG
School of Computer Science and Applied Mathematics

Numerical Methods
Lab 2

01 April 2021

SECTION 1

Main Exercises

Because of the possibility of the sequence of iterates not converging (that is, they diverge), it may be necessary to set a maximum number of iteration, say N, such that the code terminates at the iteration count N. If by N iterations, convergence is not reached, it is highly unlikely that it will be reached.

1.1

Exercise 1

Program the Jacobi iterative procedure. Your function should take in a coefficient matrix A, a single $\mathbf{b}$ vector, an initial solution vector $\mathbf{x_0}$ and some tolerance `tol`. Your function should return the solution vector $\mathbf{x}$, as well as the number of iterations required to convergence. The first line of your function should look like:

```
function [x,iterationCount] = JacobiMethod(A,b,x_0,tol)
```

1.2

Exercise 2

Program the Gauss-Seidel iterative procedure. Your function should take in a coefficient matrix A, a single $\mathbf{b}$ vector, an initial solution vector $\mathbf{x_0}$ and some tolerance `tol`. Your function should return the solution vector $\mathbf{x}$, as well as the number of iterations required to convergence. The first line of your function should look like:

```
function [x,iterationCount] = gaussSeidel(A,b,x_0,tol)
```

1.3

Exercise 3

Program the SOR iterative procedure. Your function should take in a coefficient matrix A, a single $\mathbf{b}$ vector, an initial solution vector $\mathbf{x_0}$ and some tolerance `tol`. Your function should return the solution vector $\mathbf{x}$, as well as the number of iterations required to convergence. The weight ω is to be obtained using the formular in your note. The first line of your function should look like:

```
function [x,iterationCount] = SOR(A,b,x_0,tol)
```