CS 4414, Spring 2012
Homework #2

February 23, 2012

Problem 1: Taylor series

Construct a Taylor series for the following function about $x = 0$, and bound the error when truncating after n terms. Hint: expand the integrand in Taylor series, then integrate each term.

$$f(x) = \frac{1}{x} \int_0^x e^{-t^2}\, dt\,. \tag{1}$$

Problem 2: Summation

Write a computer program to form the sum $\sum_{j=1}^{n} \frac{1}{j^2}$ in two ways: (1) from smallest to largest, (2) from largest to smallest. Comment on the accuracy of the results for different (large) values of n.

Problem 3: Iterative methods

Implement Jacobi iterations in Matlab. You should provide a matlab function

```
x = my_jacobi(A,b,x0,n)
```

that performs n Jacobi iterations to solve the system $Ax = b$, starting from the value x_0.

Implement Gauss-Seidel iterations in Matlab. You should provide a matlab function

```
x = my_gs(A,b,x0,n);
```

that performs n Gauss-Seidel iterations to solve the system $Ax = b$, starting from the value x_0.

Choose a system (A and b) of dimension 10. Find its solution

```
xref = A\b;
```

For each of the above implementations, compute the error norm `err(n) = norm(x-xref)` for the solution obtained after n iterations.

Plot the error against the number of iterations using Matlab's `semilogy` function. Plot both curves (Jacobi and Gauss Seidel) on the same plot. Discuss the results.