MACM 316 Assignment 2 Date: September 25, 2006 Date due: 5pm, Friday, October 6, 2006

Please submit your answers, stapled together with your name and student id, in the assignment box marked MACM 316.

This is a computer assignment. You can use any programming language but no software package. Print out your program and computed results.

- 1. It is well known that the series $1 + \frac{1}{4} + \frac{1}{9} + \frac{1}{16} + \dots$ converges to $\pi^2/6$.
 - (a) Write a program to sum the series, terminating if the sum is unchanged by the addition of a term. How good is the result using single and double precision?
 - (b) What are the absolute and relative errors? Explain the results.
- 2. The **Hilbert matrix** of order n is defined by $a_{ij} = (i + j 1)^{-1}$ for $1 \leq i, j \leq n$. It is often used for test purposes because of its ill-conditioned nature. Define $b_i = \sum_{j=1}^n a_{ij}$. Then the solution of the systems of equations $\sum_{j=1}^n a_{ij}x_j = b_i$ for $1 \leq i \leq n$ is $x = (1, 1, ..., 1)^T$. Select some values of n in the range $2 \leq n \leq 15$.
 - (a) Do the case n=2 by hand. Explain what difficulties are likely to occur when using floating point arithmetic.
 - (b) Solve the system of equations for x using Gaussian algorithm using scaled partial pivoting. Your program should implement the algorithm. The computation is done using the single and double precision arithmetic. Explain the results.