261: 2nd Assessment
Deadline: Friday 4th April 2003

Questions 1 and 2 are paper and pen exercises. Leave your completed solutions in the box outside room G29 of the O'Reilly Institute. (To get to room G29, enter the ORI from the hamilton concourse, go through the double doors on your left and go right the way down the the end of the corridor.)

1) Calculate the l_1 norm, l_2 norm and infinity norms of the following vectors.

$$a)\begin{pmatrix} 2 \\ 5 \\ 2 \\ 1 \end{pmatrix} \qquad b)\begin{pmatrix} 2 \\ 4 \\ 3 \\ 1 \end{pmatrix}$$

2) Calculate the condition numbers of the following matrices. Use the infinity norm, where appropriate.

$$a)\begin{pmatrix} 1 & 0 & 1 \\ 1 & 1 & 2 \\ 2 & 3 & 1 \end{pmatrix} \qquad b)\begin{pmatrix} 1 & 2 & 3 \\ 4 & 5 & 6 \\ 1 & 2 & 2 \end{pmatrix}$$

3) Write a program using 'C' that reads in a matrix, A, from one file and a vector, b, from another file and uses the conjugate gradient algorithm to solve the matrix equation

$$Ax = b$$

for x.

As in the previous assessment, use the '#define' command to declare a variable at the beginning of your program that contains the dimension of your system (ie the number of components in b). When you need to refer to the dimension, in the body of the program, do so through this variable. This will help minimize the number of changes that you will need to make when the matrix equation, in question, changes size.

Try testing the program on the following example.

$$A = \begin{pmatrix} 1 & 2 & 3 \\ 4 & 2 & 2 \\ 3 & 1 & 1 \end{pmatrix} \qquad b = \begin{pmatrix} 8 \\ 10 \\ 6 \end{pmatrix}$$

Email your completed solutions to watterss@maths.tcd.ie, marking the subject line '261'