Course 161/2S3, Tutorial, Trinity Term, April 2006

1. Write a `C` program to generate 6 lottery numbers, using the `rand()` function. Your program should write numbers between 1 and 42 to an array and should ensure that no numbers are repeated.

2. Consider the matrices

$$A = \begin{pmatrix} 3 & 6 & 9 \\ 2 & 5 & -2 \\ 1 & 3 & -1 \end{pmatrix} \text{ and } B = \begin{pmatrix} 4 & 1 \\ 1 & 5 \end{pmatrix}. \tag{1}$$

   Find the condition numbers $\kappa(A)$ and $\kappa(B)$ for the ∞ norm.
   Recall that $\kappa(A)_\infty = ||A||_\infty ||A^{-1}||_\infty$ and $||A||_\infty = max_{1\leq i\leq n} \sum_{j=1}^{n} |a_{ij}|$, ie. the maximum row sum.

   Also recall that for 2×2 and 3×3 matrices the inverse matrix can be determined by the following

$$A = \begin{pmatrix} a & b \\ c & d \end{pmatrix} \Rightarrow A^{-1} = \frac{1}{detA} \begin{pmatrix} d & -b \\ -c & a \end{pmatrix}, \tag{2}$$

   and

$$A = \begin{pmatrix} a_{11} & a_{12} & a_{13} \\ a_{21} & a_{22} & a_{23} \\ a_{31} & a_{32} & a33 \end{pmatrix} \Rightarrow A^{-1} = \frac{1}{detA} \begin{pmatrix} \begin{vmatrix} a_{22} & a_{23} \\ a_{32} & a_{33} \end{vmatrix} & \begin{vmatrix} a_{13} & a_{12} \\ a_{33} & a_{32} \end{vmatrix} & \begin{vmatrix} a_{12} & a_{13} \\ a_{22} & a_{23} \end{vmatrix} \\ & & \\ \begin{vmatrix} a_{23} & a_{21} \\ a_{33} & a_{31} \end{vmatrix} & \begin{vmatrix} a_{11} & a_{13} \\ a_{31} & a_{33} \end{vmatrix} & \begin{vmatrix} a_{13} & a_{11} \\ a_{23} & a_{21} \end{vmatrix} \\ & & \\ \begin{vmatrix} a_{21} & a_{22} \\ a_{31} & a_{32} \end{vmatrix} & \begin{vmatrix} a_{12} & a_{11} \\ a_{32} & a_{31} \end{vmatrix} & \begin{vmatrix} a_{11} & a_{12} \\ a_{21} & a_{22} \end{vmatrix} \end{pmatrix}. \tag{3}$$