Matrix Operations

Issue date: Tuesday 7th October 2008
Hand-in date: Tuesday 21th October 2008 (*** **1pm** ***)

1.   For two matrices

$$\mathbf{A} = \begin{bmatrix} 5 & 8 & -3 & 4 \\ 7 & 3 & 2 & 5 \\ -6 & 1 & 0 & 3 \\ 9 & 8 & 1 & 2 \end{bmatrix} \text{ and } \mathbf{B} = \begin{bmatrix} -10 & 1 & 7 & 4 \\ 12 & 5 & 3 & 4 \\ 7 & -1 & 13 & 1 \\ 1 & 2 & 3 & -2 \end{bmatrix}$$

use Excel to show that
        i) $\mathbf{A} \cdot \mathbf{B} \neq \mathbf{B} \cdot \mathbf{A}$
        ii) $\det(\mathbf{A} \cdot \mathbf{B}) = \det(\mathbf{B} \cdot \mathbf{A})$

Describe the demonstration process.

2.   Solve the simultaneous linear equation

$$\begin{cases} 1.2x_1 + 2.9x_2 + 4.2x_3 - 7.8x_4 = 1.5 \\ 2.5x_1 - 3.1x_2 - 4.7x_3 + 5.1x_4 = 6.2 \\ 2.8x_1 + 4.1x_2 + 3.2x_3 + 7.2x_4 = -1.4 \\ 2.6x_1 + 2.5x_2 + 4.3x_3 - 5.0x_4 = 8.5 \end{cases}$$

using
        i)   Excel Solver and
        ii)   Matrix algebra methods.

3.   For two vectors

$$\mathbf{v}_1 = (1, 7, 4)$$
$$\mathbf{v}_2 = (3, -2, 5)$$

write a VBA function

```
Function cross_product(v1 As Range, v2 As Range)
    ...
End Function
```

to create the cross product $\mathbf{v}_1 \times \mathbf{v}_2$.

4.   Let matrix $H_n = (h_{ij})_{n \times n}$, where $h_{ij} = \dfrac{1}{i+j-1}$. Write a VBA function to generate the matrix H_n

```
Function H_matrix(n As Integer)
    ...
End Function
```

Show the value of $\det(H_n)$

```
MDETERM(H_matrix(n))
```

for $n = 2,3,4,5$.