MATH1309 – Practice Problems 2

By hand

1) The following measurements were taken on variables x_1, x_2 and x_3:

x_1	9	2	6	5	8
x_2	12	8	6	4	10
x_3	3	4	0	2	1

Find the arrays $\bar{x}$, S^* and R

2) Let

$$\mathbf{X} = \begin{bmatrix} 9 & 1 \\ 5 & 3 \\ 1 & 2 \end{bmatrix}$$

Calculate the generalised sample variance $|\,S\,|$

We can also work with data in a temporary matrix environment to allow for easy manipulation. We start this using the procedure IML

PROC IML

The procedure IML allows you to define matrices, vectors and scalars to perform calculations and manipulations. The procedure uses the information in memory, so you need to also ensure you print the outputs required.

Define matrix

You can assign a name to a matrix and then enter the data inside of curly brackets, row by row. Indicate the end of row by using a comma.

```
proc iml; /* Activate IML(Interactive Matrix Language) */

A={3 1,
1 3}; /* Define matrix A (2x2)*/
```

Print information

Adding in the line print reset will print all temporary outputs, or you can select specific items to print by listing them after a print command. Listing an item allows you to also specify the format and labels of the item printed.

```
proc iml;
reset print; /* This line will cause all temporary items to be
printed to your results tab*/
A={3 1,
1 3};
```

Alternatively,

```
proc iml;
A={3 1,
1 3};
print A [label='Matrix A']; /* This will print matrix A with your
label*/
```

Matrix calculations

The PROC IML can also call many of the functions that we use to manipulate matrices.

Transpose	`A'` or `T(A)`
Trace	`trace(A)`
Inverse	`inv(A)`

Determinant   `det(A)`

Eigenvalue   `eigval(A)`

Eigenvector   `eigvec(A)`

Identity   `I(p) /* Where p is the size of the matrix required*/`

It is also possible to use the standard mathematical functions in the IML procedure as well.

1) Check your hand calculations from last week using PROC IML in SAS

Given the matrices
$$A = \begin{bmatrix} -1 & 3 \\ 4 & 2 \end{bmatrix}, B = \begin{bmatrix} 4 & -3 \\ 1 & -2 \\ -2 & 0 \end{bmatrix} \text{ and } C = \begin{bmatrix} 5 \\ -4 \\ 2 \end{bmatrix}$$

Perform the indicated multiplications

   a) 5A
   b) BA
   c) A'B'
   d) C'B
   e) AB

Let
$$A = \begin{bmatrix} 9 & -2 \\ -2 & 6 \end{bmatrix}$$

   a) Find the eigenvalues and the eigenvectors of A

We will continue to use PROC IML going forward to check characteristics of our datasets.