Multivariate Data Analysis: Tasks for Week 1

(Released 29/09/11, see §0.0–§1.5 & A0.1)

1) Read the Study Guide for this course if you have not already done so.
2) Verify the final result referred to in Chapter 0, §0.9.1 Notes that if A is any p×q matrix then var(X′A)=A′var(X′)A=A′SA.
3) Access the Iris Dataset which is on the PAS6011 MOLE pages and on the PAS470 web pages stored as an **R** data set `irisnf.Rdata`
   - i) Find the 4-vector which is the mean of the four dimensions `Sepal.l, Sepal.w, Petal.l, Petal.w` and the 4×4 matrix which is their variance (see 'Further example' in §0.10).
   - ii) Plot sepal length against sepal width using:
     - a) the default choices
     - b) using different symbols for each variety (with `pch=` and `col=`)
   - iii) Construct a matrix plot of all four dimensions, using first the default choices and then enhancing the display as above.
   - iv) Try the commands

```
var(irisnf)
diag(var(irisnf))
```

4) Try these simple exercises both 'by hand' and using **R**:

Let $a = \begin{pmatrix} 1 \\ 2 \\ 3 \end{pmatrix}$, $A = \begin{pmatrix} 1 & 2 & 3 \\ 4 & 5 & 6 \end{pmatrix}$, $B = \begin{pmatrix} 1 & 2 \\ 3 & 4 \\ 5 & 6 \end{pmatrix}$,

Find AB, B′A′, BA, a′A, a′Aa

5) Read through the sections on eigenvalues and eigenvectors, differentiation w.r.t. vectors and use of Lagrange Multipliers in Appendix 0: Background Results in course booklet. This material will be used in Chapter 2. At least some of the material will be familiar to almost all of you but probably the vector differentiation will be novel: the only cases that are required in this course are those listed in that section. The important point to appreciate in the eigenanalysis section is that if we are trying to determine some vector x and we can shew that this vector must satisfy an equation of the form $Sx = \lambda x$ (S a matrix and λ a scalar) then we have essentially solved the problem and x is determined as one of the eigenvectors of S. This is equivalent to establishing that an unknown scalar x satisfies the equation $ax^2+bx+c=0$ means that x must be one of the roots of the quadratic. In **R** we can find roots of polynomials by the function `polyroot()` and similarly we can solve an eigenvalue problem with the function `eigen()`. Try `help(polyroot)` and `help(eigen)`.

6) Read the Study Guide for this course [again] if you have not already done so [or have done so only once].