

Homework #6 -- due Wednesday, 26 March 2008 \*\*\* turn in just starred (\*) questions \*\*\*

Exercises at the end of Appendix A: 72, 73

Exercises at the end of Chapter 5: 1\*(parts (i), (j) \*optional\*), 2, 3, 4, 7\*, 11\*, 14, 21\*, 22, 23

x) Let  $\mathbf{u}(t) = \begin{bmatrix} \cos(2\pi t) \\ \sin(2\pi t) \end{bmatrix}$ ,  $\mathbf{v}(t) = \begin{bmatrix} \sin(2\pi t) \\ -\cos(2\pi t) \end{bmatrix}$ , where  $t \sim \text{uniform}(0, 1/8)$ , so that  $\mathbf{u}$  and  $\mathbf{v}$  are random vectors.

a) Are  $\mathbf{u}$  and  $\mathbf{v}$  orthogonal?

b) Find the mean vectors for  $\mathbf{u}$  and  $\mathbf{v}$ .

c) Find the  $(4 \times 4)$  covariance matrix for  $(u_1, u_2, v_1, v_2)^T$ .

d) Find the correlation or covariance between  $\mathbf{a}^T \mathbf{u}$  and  $\mathbf{a}^T \mathbf{v}$  where  $\mathbf{a} = \begin{bmatrix} 1 \\ 1 \end{bmatrix}$ .

e) Find the correlation or covariance between  $\mathbf{b}^T \mathbf{u}$  and  $\mathbf{b}^T \mathbf{v}$  where  $\mathbf{b} = \begin{bmatrix} 1 \\ -1 \end{bmatrix}$ .

\*\* Feel free to modify some features of the problem, such as  $1/8$ , sum, difference, to make it more interesting, as long as you conclude that the two linear combinations are NOT uncorrelated. \*\*