GR5261/GU4261 Statistical Methods in Finance
Homework 1 (due on Feb 1, 2018; online submission only)

Questions from the textbook (Ruppert/Matteson, 2015)

Page 15: Problems 9, 11, 12

Pages 16-17: Exercises 1, 3, 10

Pages 40-43: Exercises 1, 3, 8, 11, 12 , 16, 22

Other questions:

(1) If X is a continuous random variable with a strictly increasing distribution function F, find the distribution of $U = F(X)$.

(2) Let X have a normal distribution with mean μ and variance σ^2 and let $Y = e^X$. Y is said to have a lognormal distribution with parameters μ and σ^2 (since $X = \log Y$ has a normal distribution).

    (a) Find the density f_Y. (Hint: compute $F_Y(y) = \mathbb{P}(Y \leq y)$).

    (b) Find the mean and the variance of Y. (Hint: if $X \sim \mathcal{N}(\mu, \sigma^2)$, then $\mathbb{E}(e^{tX}) = e^{\mu t + \frac{1}{2}\sigma^2 t^2}$).

(3) Find the largest eigenvalue of the following matrices:

    (i) $\begin{pmatrix} 1 & \rho \\ \rho & 1 \end{pmatrix}$.

    (ii) $\begin{pmatrix} 1 & \rho & 0 \\ \rho & 1 & 0 \\ 0 & 0 & 1 \end{pmatrix}$.

(4) Suppose that X and Y are independent and identically distributed (iid) exponentially distributed random variables with $\mathbb{P}(X \geq t) = \mathbb{P}(Y \geq t) = e^{-t}$. Are $X + Y$ and $X - Y$ uncorrelated? Are $X + Y$ and $X - Y$ independent? Explain your answer.