Lab Assignment - 8

Instructor: Dr. Arabin Kumar Dey

1 Due date:

- 15/3/2013.

2 Notes:

- Make a proper documentation preferably in latex or using some other software and submit the printout of the report in .pdf form.
- Each student needs to write his/ her own solutions, even though discussions of the assignments between students are encouraged.

3 Assignments:

Consider the multivariate normal,

$$X = \begin{pmatrix} X_1 \\ X_2 \end{pmatrix} \sim \mathcal{N}(\mu, \Sigma),$$

$$\text{where } \mu = \begin{pmatrix} 5 \\ 8 \end{pmatrix} \text{ and } \Sigma = \begin{pmatrix} 1 & 2a \\ 2a & 4 \end{pmatrix}$$

1. For the cases $a = -0.25, 0, 0.25$, generate 1000 values of X and calculate sample means, sample variances and sample correlations. Make empirical contour plots based on above generated samples.

2. Also, plot the actual and empirical marginal cdfs of X_1 and X_2.

3. Let us recall generating a bivariate normal with the help of conditional distributions. Suppose that $X_1 \sim N(\mu_1, \sigma_1^2)$, $X_2 \sim N(\mu_2, \sigma_2^2)$ and the conditional distribution of X_2 given $X_1 = x$ is $N(\mu_2 + \rho\frac{\sigma_2}{\sigma_1}(x - \mu_1), \sigma_2^2(1 - \rho^2))$ where $|\rho| < 1$ is the correlation coefficient between X_1 and X_2. The vector (X_1, X_2) is said to have a bivariate normal distribution. Simulate the vector for a particular set of parameter values, using this idea of conditional distributions. Estimate the sample quantities (mean, etc.) and compare with actual values.

   Take same μ_1, μ_2, σ_1, σ_2 and ρ.