KFUPM - COMPUTER ENGINEERING DEPARTMENT

COE-540 – Computer Networks
Quiz 03 – Due Sunday Nov 7th, 2010

Student Name:
Student Number:

<u>Problem 1: (10 points)</u> Let X be a *non-negative integer valued* random variable (RV), show that

$$E[X] = \sum_{k=0}^{\infty} P(X > k):$$

<u>Problem 2: (20 points)</u> Consider a Geometric RV whose probability mass function (PMF) is given by $\text{Prob}[X = k] = (1-p)^{k-1} p$ for k = 1, 2, … and 0 <p <1.

a) Compute the mean, the variance, and the coefficient of variation for the Geometric RV
b) Compute the CDF $F_X(k)$ for all k.
c) Show that the identity in Problem 1 is valid for the case of the specified Geometric RV.

<u>Problem 3: (20 points)</u> Let X and Y be Normal (Gaussian) RVs such that $X \sim N(0,1)$ and $Y \sim N(0,2)$. The notation $X \sim N(\mu, \sigma)$ means that X is a Normal RV with mean μ and standard deviation equal to σ.

a) Plot the PDFs for X and Y on the same figure using Matlab. Comment on the spread of the density functions.

b) Generate 10000 samples of each of these RVs. Plot the samples of each RV in a separate plot (but put the plots side by side with proper labels and titles). Comment on the range (or spread) of the sample values.

c) Let the i^{th} sample of a NEW RV, Z be $Z_i = X_i + Y_i$. Perform the following using Matlab:

c.1) Estimate the mean and standard deviation of the new RV Z using its samples.

c.2) Match the empirical distribution of Z to the distribution of $N(0, \sqrt{5})$.

Hint: use the random number generator "randn()" to generate samples of a <u>standard</u> Normal random variable.