# *KFUPM - COMPUTER ENGINEERING DEPARTMENT*

## COE-543 – Mobile Computing and Wireless Networks

**Quiz # 2 – Due Sat March 27th, 2010 – class time.**

**Student Name:**
**Student Number:**

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**1) (40 points)** On the subject of normal RV variables.

Consider a normal random variable $X \sim N(\mu, \sigma)$.

a) Specify the PDF for the RV *X*, $f_X(x)$.

b) Calculate the mean and variance of the RV *X*. You are to write the definitions of the mean and variance and then show the calculations leading to the result.

c) Specify the CDF for the RV, $F_X(x)$. Write the CDF $F_X(x)$ in terms of the CDF for the standard normal RV, $\psi(y) = \frac{1}{2\pi}\int_{-\infty}^{y} e^{-r^2/2}\, dr$.

d) For $\mu = 1$ and $\sigma = 1$, calculate the probability that *X* is less or equal to 2, and the probability that *X* is greater than -1.

e) Plot the CDF of the RV *X* defined in part (d) using normal probability paper and use the plot to provide answers for part (d) highlighting on the plot the points needed.

**2) (60 points)** On the subject lognormal RV:

Consider the normal RV $X \sim N(\mu, \sigma)$. Let Z be the RV defined as $Z = e^X$. *Z* is referred as the lognormal RV with *parameters* $\mu$ and $\sigma$. Note $\mu$ and $\sigma$ are **NOT** the mean and standard deviation, respectively, for the RV *Z*. Finally, note that *Z* now ranges from $0^+$ to $\infty$ whereas the original range for *X* is from $-\infty$ to $\infty$.

a) Specify the PDF for the RV *Z*.

b) Write expressions for the mean and variance of the RV *Z*.

c) Specify the CDF for the RV *Z*, $F_Z(z)$, in terms of the CDF for the standard normal RV, $\psi(y) = \frac{1}{2\pi}\int_{-\infty}^{y} e^{-r^2/2}\, dr$ as given in class noted.

d) For $\mu = 1$ and $\sigma = 1$, calculate the probability that *Z* is less or equal to 2, the probability that *Z* is greater than 3, and the probability that *Z* is greater than 3 but less than 10.

e) Plot the CDF of Z defined in part (d) using normal probability paper and use the plot to provide answers for part (d) highlighting on the plot the points needed.

f) If the RV *W* is defined as $W = 10^{X/10}$, then *W* is also a lognormal RV. What is the relation between *W* and *Z*. What are the parameters of the lognormal RV *W*?