**O K L A H O M A   S T A T E   U N I V E R S I T Y**

**SCHOOL OF ELECTRICAL AND COMPUTER ENGINEERING**

# ECEN 5513
# Stochastic Systems
# Fall 2007
## Midterm Exam #1

**PLEASE DO ALL FIVE PROBLEMS**

**Name : ______________________________**

**E-Mail Address:_______________________________________**

**Problem 1**:
In a large hotel it is known that 99% of all guests return room keys when checking out. If 250 engineers check out after a conference, what is the probability that not more than three will fail to return their keys?

**Problem 2**:

The output voltage $X$ from the receiver in a particular binary digital communication system, when a binary zero is being received, is Gaussian (noise only) as defined by $a_X = 0$ and $\sigma_X = 0.3$. When a binary one is being received it is also a Gaussian (signal-plus-noise now), but as defined by $a_X = 0.9$ and $\sigma_X = 0.3$. The receiver's decision logic specifies that at the end of a binary (bit) interval, if $X > 0.45$ a binary one is being received. If $X \leq 0.45$ a binary zero is decided. If it is given that a binary zero is truly being received, find the probabilities that a) a binary one (mistake) will be decided, and b) a binary zero is decided (correct decision).

**Problem 3**:

If $f_X(x)$ is symmetric about the mean, that is $f_X(x+\overline{X}) = f_X(-x+\overline{X})$, show the third central moment, $\mu_3 = 0$.

**<u>Problem 4</u>**:
A certain large city averages three murders per week and their occurrences follow a Poisson distribution. A) What is the probability that there will be five or more murders in a given week? b) How many weeks per year (average) can the city expect the number of murders per week to equal or exceed the average number per week?

**Problem 5**:

Define a function $g(\cdot)$ of a random variable $X$ by

$$g(X) = \begin{cases} 1, & x \geq x_0 \\ 0, & x < x_0 \end{cases},$$

where $x_0$ is a real number $-\infty < x_0 < \infty$. Show that

$$E(g(X)) = 1 - F_X(x_0).$$