King Fahd University of Petroleum and Minerals
Department of Electrical Engineering

EE570 Stochastic Processes

Major Examination #1	Time allowed: 75 minutes	Date: November 12, 2007

Student Name:	Student Number:

Part I - Short Questions (18 Marks)

Question 1

List at least three properties of a distribution function.

1.
2.
3.
4.
5.

Question 2

A_1, A_2,...., An is an infinite sequence of sets in *F*. What conditions should be attached to it so that it is declared a Borel set?

Question 3

Given that an arbitrary random variable, **x** has a continuous distribution, what is the probability of an event **x** = *b*?

Question 4

The probability of a bit error in a communications line is 10^{-4}. Find the probability that a block of 10000 bits has a maximum of three errors.

Question 5

Moment generating function can be found for

1. Continuos random variable ranging from $-\infty$ to ∞.
2. Continuos random variable ranging from 0 to ∞
3. Discrete random variable with possible values ranging from $-\infty$ to ∞
4. Discrete random variable with possible values ranging from 0 to ∞

Question 6

Given that $F_{xy}(x,y)$ is a continuous function whose joint *pdf* is defined as

$$f_{xy}(x, y) = \frac{\partial^2}{\partial x \partial y} F_{xy}(x, y)$$

What inference would you draw about the nature of $f_{xy}(x,y)$ if interchanging the order of differentiation does not result in identical answers?

Part II Long Questions (32 Marks)

Question 1

Probabilities to the regions of a triangle as follows:

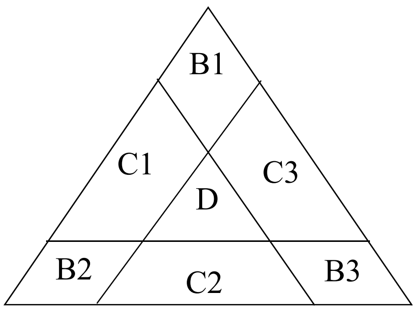

Figure 1Assignment of probabilities

$$Pr[B1] = Pr[B2] = Pr[B3] = 0.09$$
$$Pr[C1] = Pr[C2] = Pr[C3] = 0.12 \quad (1)$$
$$Pr[D] = 0.37$$

These probabilities sum to unity. Now define events $F=B1+C1+B2$, $G=B2+C2+B3$, and $H=B3+C3+B1$.

(a) Find probabilities Pr[F], Pr[G], and Pr[H].

(b) Are events F, G, and H are pairwise independent?
(c) What is the probability of $F \cap G \cap H$?
(d) Are events F, G, and H independent?

Question 2

Only 1% if all produced components of a certain kind fulfill the exacting requirements for a high precision component. How many components must be ordered to obtain at least one component of the required quality with a probability of at least 95%?

Question 3

Find the distribution function and its complement of the random variable **x** if the distribution of the latter is (*a*) normal, (*b*) uniform. (*c*) Rayleigh

$$\underbrace{\frac{1}{2\pi\sigma^2}\exp\left(-\frac{(x-a)^2}{2\sigma^2}\right)}_{\text{Normal}} \qquad \underbrace{\begin{cases}\frac{1}{b-a} & a \le x \le b \\ 0 & \text{otherwise}\end{cases}}_{\text{Uniform}} \qquad \underbrace{\frac{2x}{\alpha}\exp\left(-\frac{x^2}{2\sigma^2}\right)}_{\text{Rayleigh}}$$

Question 4

A normally distributed noise voltage *V* is applied to the terminals of a resistor *R*. Find the distribution of the noise power.