Name: _____ College Number: _____

EE501: An Introduction to the Theory of Statistical Communications

Tuesday, 28 September 2010

First Quiz

REMARKS:

1. Hand held calculator is allowed,
2. Open book quiz (no solutions to the problems),
3. Marks distribution:
   Question #1: 3 points
   Question #2: 4 points
   Question #3: 3 points
4. Justify all your answers.

# 1	
# 2	
# 3	

1. [1] An experiment consists of throwing a fair die until two successive results are the same. Determine the probability of stopping with the n-th toss, $n = 2, 3, 4, \ldots$

2. In this problem we consider a discrete communication system with a binary source producing one of two messages m_0 and m_1, with unequal *a priori* probabilities $P(m_0) = 1/3, P(m_1) = 2/3$. The message is transmitted on a discrete communication channel having the following transitions probabilities

$$\begin{aligned} P(RX = 0 \mid TX = m_0) &= 0.99 \\ P(RX = 1 \mid TX = m_0) &= 0.01 \\ P(RX = 0 \mid TX = m_1) &= 0.01 \\ P(RX = 1 \mid TX = m_1) &= 0.99 \end{aligned}$$

   where TX and RX respectively denote the transmitted message and the received symbol. The receiver estimates the message m_0 whenever $RX = 0$ and the message m_1 whenever $RX = 1$. With this receiver, it has been found that $P(\text{error} \mid RX = 1) = P(TX = m_0 \mid RX = 1) = 1/199 \approx 0.0050251$. Calculate

   (a) $P(\text{error} \mid RX = 0) = P(TX = m_1 \mid RX = 0)$,

   (b) $P(\text{error})$ of the communication system.

[1] Problem 2.7 in the textbook by W&J.

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3. Calculate the probability distribution function $F_x(\alpha)$ of a random variable x with probability density function:

$$p_x(\alpha) = \begin{cases} \frac{9-\alpha^2}{36} & ; \quad -3 \leq \alpha < 3 \\ 0 & ; \quad \text{elsewhere} \end{cases}$$

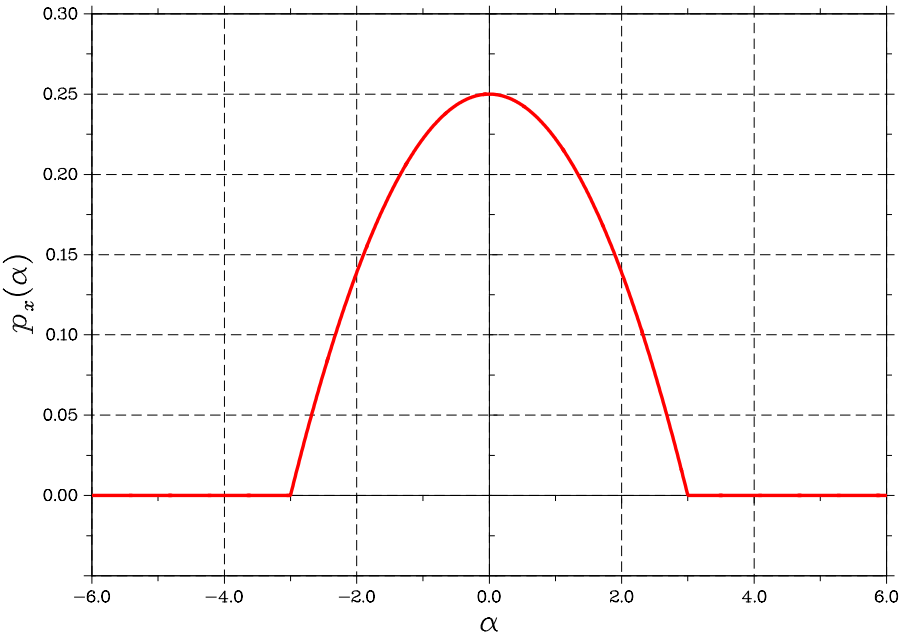

Figure 1:

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