



COLLEGE OF ENGINEERING & TECHNOLOGY

Department : Electronics & Communications Engineering

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Course : Communication System II

Course Code : EC 421

Mid Term Exam, Wednesday 7th November 2007

Question one:

Suppose you choose at random two numbers between zero and one according to the uniform probability law. Consider the following events:

A={The magnitude of the difference of the two numbers is greater than 0.3}

B= {at least one of the numbers is greater than 2/3}

C={the sum of the two numbers is 1}

D={the first number is greater than 2/3}

Find the following probabilities: $P(A)$, $P(B)$, $P(C)$, $P(D)$, $P(A \cap B)$, $P(A \cap D)$

Question two:

A communication system transmits bits in such a fashion that -5 is sent for zero and +5 is sent for one. The channel adds a zero mean Gaussian noise with variance σ^2 to transmitted bits. Suppose that the probability of sending one is "p", and the received signal is

$Y=X+W$, where X is the transmitted bit and W is the Gaussian noise.

- What is the probability of error if the receiver makes his decision based on threshold value γ . If Y is bigger than γ then it decides that one was sent otherwise it decides that zero was sent. Where γ is between -5 and 5.
- What value of γ that minimizes the probability of error found in part (a)?

Let Φ such that

$$\Phi(x) = \frac{1}{\sqrt{2\pi}} \int_{-\infty}^x e^{-t^2/2} dt.$$

Question Three:

Consider the following random variable X with pdf

$$f_X(x) = \left\{ \begin{array}{ll} \frac{1}{8} & 1 \leq x < 2 \text{ or } 3 \leq x < 4 \\ \frac{3}{4} & 2 \leq x \leq 3 \\ 0 & \text{otherwise} \end{array} \right.$$

Let X_i denote the experimental value of random variable X on trial i. all X_i 's are independent of each other.

- Find the cdf of X and sketch cdf and pdf of X.
- Find the probability that five numbers of trials are needed before a value greater than 7/2 is observed.