



# COLLEGE OF ENGINEERING & TECHNOLOGY

Department : Electronics & Communications Engineering

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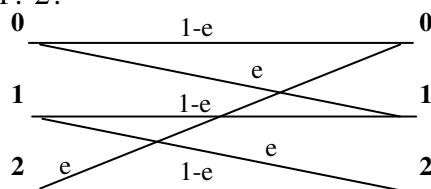
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Course : Communication System II

Course Code : EC 421

## Sheet (1)- Probability Laws

- 1- Three balls numbered 1 to 3 in a box are drawn at random one at a time until the box is empty. The sequence of the ball numbers is noted.
  - a. Find the sample space
  - b. Find the sets  $A_k$  corresponding to the events "ball number  $k$  is selected in the  $k^{\text{th}}$  draw" for  $k=1,2,3$ .
  - c. Find the set  $A_1 \cap A_2 \cap A_3$  & describe it in words
  - d. Find the set  $A_1 \cup A_2 \cup A_3$
  - e. Find the set  $(A_1 \cup A_2 \cup A_3)^c$
- 2- Show that  $P[A \cup B \cup C] = P[A] + P[B] + P[C] - P[A \cap B] - P[A \cap C] - P[B \cap C] + P[A \cap B \cap C]$
- 3- A number  $x$  is selected at random in the interval  $[-1, 1]$ , let the events  $A = \{x < 0\}$ ,  $B = \{|x-0.5| < 1\}$ ,  $C = \{x > 0.75\}$   
Find  $P[B]$ ,  $P[A]$ ,  $P[C]$ ,  $P[A \cap B]$ ,  $P[A \cap C]$ ,  $P[A \cup C]$ ,  $P[A \cup B \cup C]$
- 4- A number is selected at random in the interval  $[-1, 1]$ ; Numbers from the subinterval  $[0,1]$  occur twice as frequently as those from  $[-1,0]$ 
  - a. Find the probability assignment for an interval completely within  $[-1,0]$ , completely within  $[0,1]$  & partly in each of the above intervals
  - b. Repeat problem 3 with this probability assignment
- 5- A number  $x$  is selected at random in the interval  $[-1,1]$ , let  $B$  be the event  $\{|x-0.5| < 1\}$  and let  $C = \{x > 0.75\}$ . Find  $P[B/C]$ ,  $P[C/B]$
- 6- A ternary communication channel is shown in Figure 1. Suppose that the input symbol 0,1,2 occur with probabilities 0.5, 0.25, 0.25 respectively
  - a. Find the probability of the output symbols
  - b. Suppose that a 1 is observed as an output, what is the probability that the input was 0? 1? 2?



- 7- A block of 100 bits is transmitted over a binary communication channel with probability of bit error  $P=10^{-3}$ . Find the probability that a block contains 3 or more errors.