COLLEGE OF ENGINEERING & TECHNOLOGY

Department : Electronics & Communications Engineering

Lecturer : Prof. Mohamed Essam Khedr

GTA : Eng. Hatem Abou-zeid

Course : Communication Systems II

Course Code : EC 421

Sheet (2)- Random Variables

1- A coin is tossed n times. Let the random variable Y be the difference between the number of heads and the number of tails.

a. Describe the sample space of Y, S_Y

b. Find the equivalent event for the event Y=0

c. Find the equivalent event for the event $Y \leq k$ for k a positive integer

2- A dart is thrown onto a square b units wide. Assume that the dart is equally likely to fall anywhere in the square. Let the random variable Z be given by the sum of the two coordinates of the point where the dart lands.

a. Describe the sample space for Z, S_Z

b. Find the region in the square corresponding to the event $Z \leq z$ for $-\infty < x < \infty$

c. Find $P[Z \leq z]$

3- The cdf of the random variable X is given by

$$F_X(x) = \begin{cases} 1/3 + 2/3\,(x+1)^2 & -1 \leq x \leq 0 \\ 0 & x<-1 \end{cases}$$

Find the probability of the events $A\{X > 1/3\}$, $B=\{|X| \geq 1\}$, $C=\{|X-1/3| <1\}$, $D=\{X<0\}$.

4- A continuous random variable X has cdf

$$F_X(x) = \begin{cases} 0 & x \leq -\pi/2 \\ c(1+\sin(x)) & -\pi/2 < x < \pi/2 \\ 1 & x \geq \pi/2 \end{cases}$$

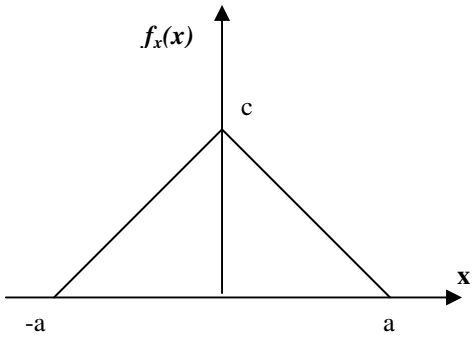
- Find c
- Plot $F_x(x)$

5- A random variable X has the pdf shown below

a. Find $f_x(x)$

b. Find the cdf of X

c. Find b such that P[|X|<b]=1/2



6- A communication channel accepts an arbitrary voltage input v and outputs a voltage Y=v+N, where N is a Gaussian random variable with mean 0 and variance σ^2 =1. Suppose that the channel is used to transmit binary information as follows:

To transmit 0 input -1
To transmit 1 input +1

The receiver decides a 0 was sent if the voltage is negative and a 1 otherwise. Find the probability of the receiver making an error if a 0 was sent; if a 1 was sent.

Web site:
http://www.aast.edu/~khedr/Courses/Undergraduate/Communication%20system%20II/index.htm