EEL 4930 Stats – Lecture 18

RANDOM VARIABLES (RVS)

- What is a random variable?

- We define a random variable is defined on a probability space $(S, \mathcal{F}, P)$ as a _____ [1] from __ [2] to ___ [3]

EX Create a binary RV from tossing a fair coin

EX Create a binary RV from tossing a fair coin twice

EX Create another RV from tossing a fair coin twice

DISCRETE RANDOM VARIABLES

A _____ [4] has nonzero probability at a countable number of values.

PROBABILITY MASS FUNCTION

For a discrete RV, the *probability mass function* (pmf) is

EX: Roll a fair 6-sided die

X= # on top face

$$P(X=x)=\begin{cases}1/6, & x=1,2,\ldots,6\\ 0, & \text{o.w.}\end{cases}$$

EX: Flip a fair coin until heads occurs

X = # of flips

$$P(X=x)=\begin{cases}\left(\frac{1}{2}\right)^x, & x=1,2,\ldots\\ 0, & \text{o.w.}\end{cases}$$

CUMULATIVE DISTRIBUTION FUNCTION

If $(S,\mathcal{F},P)$ is a prob. space with $X(s)$ a real RV on S, the **cumulative distribution function** (_____ [5]), denoted _____ [6] is

- $F_X(x)$ is also sometimes called the *probability distribution function (PDF)*, but I will avoid this terminology to avoid confusion with another function we will use, called the probability density function (pdf)
- $F_X(x)$ is a prob. measure
  - Thus $F_X(x)$ inherits all the properties of a probability measure (axioms and corollaries still apply)

EX Find and plot the cdfs for the previous two examples

Notes

[1] function
[2] S
[3] $\mathcal{R}$
[4] discrete random variable
[5] cdf
[6] $F_X(x)$