# G.H.Raisoni College of Engineering and Management

Gat No. 1200, Wagholi, Pune – 412 207

(An Autonomous Institute Affiliated to Savitribai Phule Pune University)

TAE2: Powerpoint Presentation

# Linear Algebra and Statistics

## Topic: Distribution Function of Discrete Random Variable

By

| TAE Assesment Sheet for FY Btech | | | | | |
|---|---|---|---|---|---|
| SR.NO | ROLL NO | DIVISION | NAME OF THE STUDENT | TAE NO | POSTER/PRESENTATION |
| 1 | A69 | A | Soham Yugraj Tiwari | 2 | Presentation |
| 2 | A70 | A | Amaan Ayyub Nalband | | |
| 3 | A71 | A | Shravan Vijaypratap Singh | | |
| 4 | A72 | A | Pratik Rajesh Jade | | |

| Rubrics For Assesement | | | | | |
|---|---|---|---|---|---|
| CATEGORY | Contents | Presentation | Spelling and pronunciation | Oral Presentation | TOTAL |
| MARKS | 2 | 1 | 1 | 1 | 5 |
| | | | Teacher sign (With name and date) | | |
| | | | | | |

Faculty Name: Ms.Urmila Navghan

# Random Variables

**Definition:** A random variable X on a sample space S is a rule that assigns a numerical value to each outcome of S or in other words a function from S into the set R of real numbers.

$$X : S \to R$$

x : value of random variable X

RX : The set of numbers assigned by random variable X, i.e. range space

# Types of Random Variables

There are Two types of Random Variables

1.Discrete Random Variable (DRV)

2.Continous Random Variable(CRV)

# Discrete Random Variable

- **Discrete Random Variables:** Random variables which can take on only a finite number, or a countable infinity of values, i.e. Rx is finite or countable infinity.
- A discrete random variable has **a countable number of possible values.** The probability of each value of a discrete random variable is between 0 and 1, and the sum of all the probabilities is equal to 1

# Probability Distributions for Discrete Random Variables

Probabilities assigned to various outcomes in the sample space S, in turn, determine probabilities associated with the values of any particular random variable defined on S.

The probability mass function (pmf) of X , p(X) describes how the total probability is distributed among all the possible range values of the r.v. X: p(X=x), for each value x in the range of X Often,

p(X=x) is simply written as p(x) and by definition

$$p(X = x) = P(\{s\ 2\ S \mid X(s) = x\}) = P(X1(x))$$

Note that the domain and range of p(x) are real numbers.

## Example: Discrete Random Variable

Consider the experiment consisting of 4 tosses of a coin then sample space is

S = {HHHH, HHHT, HHTH, HTHH, THHH, HHTT, HTTH, TTHH, THTH, HTHT, THHT, TTTH, TTHT, THTT, HTTT, TTTT}

Let X assign to each (sample) point in S the total number of heads that occurs. Then X is a random variable with range space

RX = {0, 1, 2, 3, 4}

Since range space is finite, X is a discrete random variable

# Continous Random Variable

A continuous random variable is a random variable whose cumulative distribution function is continuous everywhere.There are no "gaps", which would correspond to numbers which have a finite probability of occurring. Instead, continuous random variables almost never take an exact prescribed value *c*,but there is a positive probability that its value will lie in particular intervals which can be arbitrarily small. Continuous random variables usually admit probability density functions (PDF), which characterize their CDF and probability measures; such distributions are also called absolutely continuous; but some continuous distributions are singular, or mixes of an absolutely continuous part and a singular part.

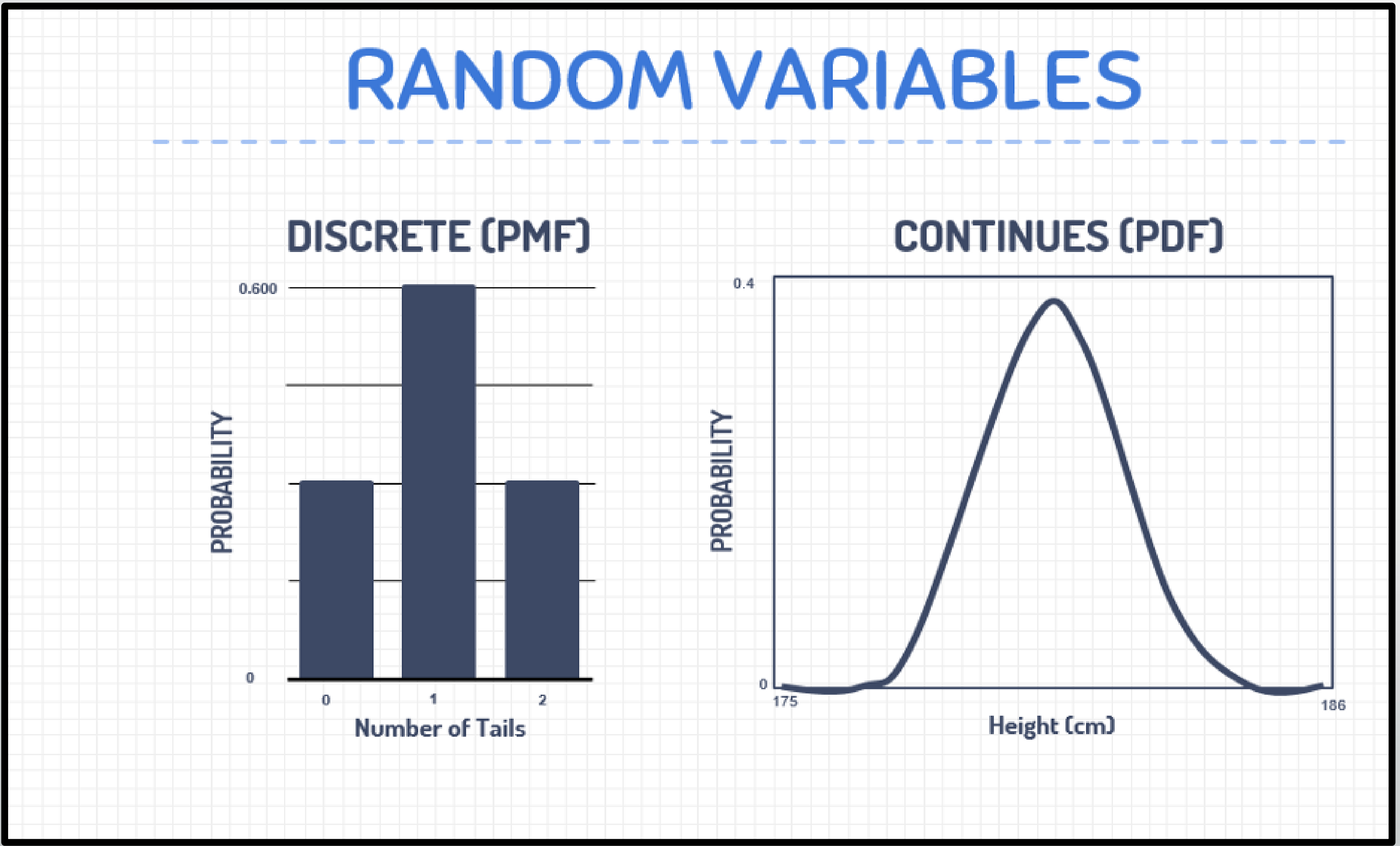
# Example:Continous Random Variable

The following are examples of **continuous random variables:**

- The length of time it takes a truck driver to go from New York City to Miami
- The depth of drilling to find oil
- The weight of a truck in a truck-weighing station
- The amount of water in a 12-ounce bottle

For each of these, if the variable is X, then x>0 and less than some maximum value possible, but it can take on any value within this range.

# Random Variables



# Bernoulli Random Variable

Any random variable whose only possible values are 0 and 1 is called a **Bernoulli random variable.**

This is a discrete random variable – values

This distribution is specified with a single parameter:

$$\pi = p(X=1)$$

# The Geometric Random Variable

Continuing in this way, a general formula for the pmf emerges:

$$p(x) = (1 - p) \quad p \qquad \text{if } x = 1, 2, 3, \ldots$$
$$= 0 \qquad\qquad \text{otherwise}$$

The parameter $p$ can assume any value between 0 and 1. Depending on what parameter $p$ is, we get different members of the *geometric* distribution.

# Example: Geometric Random Variable

Starting at a fixed time, we observe the gender of each newborn child at a certain hospital <u>until</u> a boy ($B$) is born.

Let $p = P(B)$, assume that successive births are independent, and let $X$ be the <u>number of births observed until a first boy is born</u>.

Then

$$p(1) = P(X = 1) = \mathrm{P(B)} = \mathrm{p}$$

And,

$$p(2)=?,\ p(3) = ?$$

# The Cumulative Distribution Function

**Definition**

The **cumulative distribution function** (*cdf*) denoted $F(x)$ of a discrete *r.v.* $X$ with *pmf* $p(x)$ is defined for every real number $x$ by

$$F(x) = P(X \leq x) = \sum_{y\,:\,y<x} p(y)$$

For any number $x$, the cdf $F(x)$ is the probability that the observed value of $X$ will be at most $x$.

# Example

Suppose we are given the following pmf:

$$p(x) = \begin{cases} .500 & x = 0 \\ .167 & x = 1 \\ .333 & x = 2 \\ 0 & \text{otherwise} \end{cases}$$

Then, calculate:
F(0), F(1), F(2)

What about F(1.5)? F(20.5)? Is P(X < 1) = P(X <= 1)?

Thank

You...