

# INTRODUCTION TO PROBABILITY MODELS

Lecture 11

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# RANDOM VARIABLES

## SOME CONCEPTS

**Variable:** a variable is an alphabetic character representing a number, called the value of the variable, which is either arbitrary, not fully specified or unknown

**Quantitative:** Variable that can be expressed as a number, or quantified

**Qualitative:** Variable that can't be expressed as a number, or quantified

## EXAMPLES

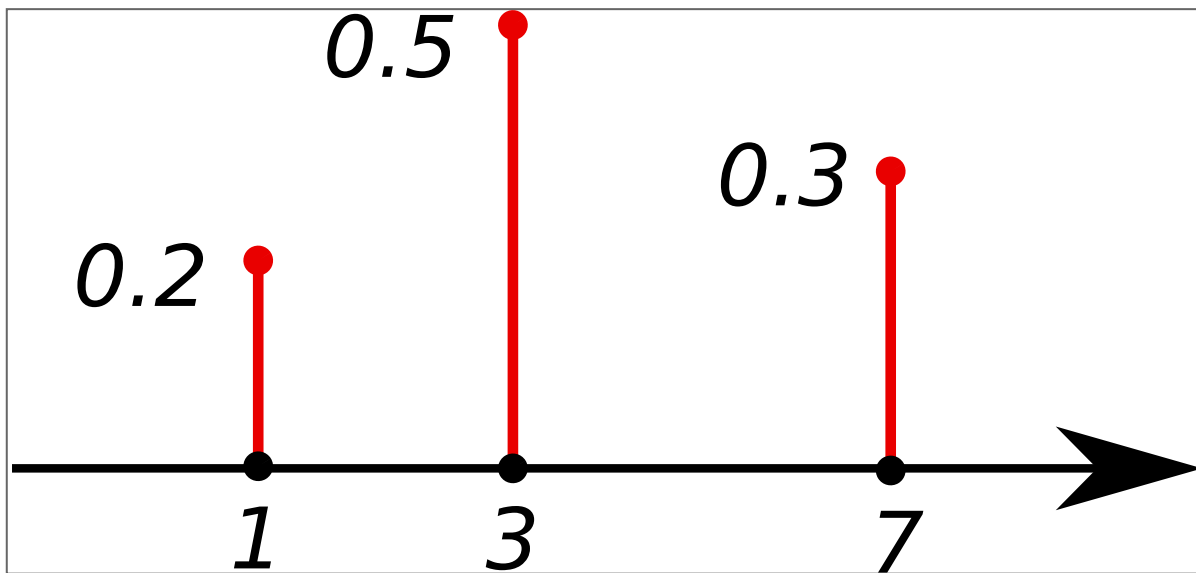
- The age of your car. (Quantitative.)
- The number of hairs on your knuckle. (Quantitative.)
- The softness of a cat. (Qualitative.)
- The color of the sky. (Qualitative.)
- The number of pennies in your pocket. (Quantitative.)

## RANDOM VARIABLE

- **Definition:**the value obtained from an experiment has an associated probability
- It is usually abbreviated as RV
- **Discrete Random Variable:** countable number of values
- **Continuous Random Variable:**can take on any value in a range

# PROBABILITY MASS FUNCTION

- **Definition:** a function that gives the probability that a **discrete** random variable is exactly equal to some value.
- It is usually abbreviated as PMF



## EXAMPLE 1

Flip a fair coin 3 times, let  $X$  = the number of heads

1. Write out the PMF for  $X$ .
2. If the coin is no longer fair and  $P(H) = .7$ , write out the PMF.

## SOME PROPERTIES OF THE PMF

1. For every  $x$ ,  $0 \leq p_X(x) \leq 1$
2.  $\sum_x p_X(x) = 1$



## EXAMPLE 2

$$X \sim p_X(x) = P(X = x) = k(5 - x), x \in \{0, 1, 2, 3, 4\}$$

1. Find the value of  $k$  that makes  $p_X(x)$  a legitimate/valid probability model
2. Find  $P(1 \leq X \leq 3)$
3. Find  $P(X < 3 | X \neq 0)$
4. Find  $P(2 \leq X \leq 4 | 0 < X < 4)$