

## Random Variables

Defn: A random variable is a numeric function of the outcome.

- Ex:
1. # of heads in 20 coin flips
  2. Sum of 2 die throws
  3. # of coin tosses until the first head.

Defn: If a random variable has a countable number of possible values (either finite or countably infinite), it is called discrete.

Defn: If  $X$  is a discrete r.v. with values in a countable set  $T$ , the probability mass function (pmf) of  $X$  is

$$P_X(a) = \begin{cases} P(X=a), & \text{if } a \in T \\ 0, & \text{otherwise} \end{cases}$$

Note:  $\sum_{a \in T} P_X(a) = 1$

Defn: For a discrete r.v.  $X$  with pmf  $P_X$ , the expectation (or expected value or mean) of  $X$  is  $E[X] = \sum_a a P_X(a)$ .

For finite, equally likely outcomes, this is the average of the possible values of  $X$ .

In general, it is a weighted average, with each value weighted by its probability.