5.1 Discrete Random Variables and Probability Distributions

Random variable - a quantitative variable whose value depends on chance.

Discrete random variable - random variables whose possible values can be listed.

x, y, z to denote variables.

X, Y, Z to denote random variables.

$P(X = 2)$

Notations:

$\{X = x\}$ the event that the random variable X is equal to x.

$P(X = x)$ the probability that the random variable X equals x.

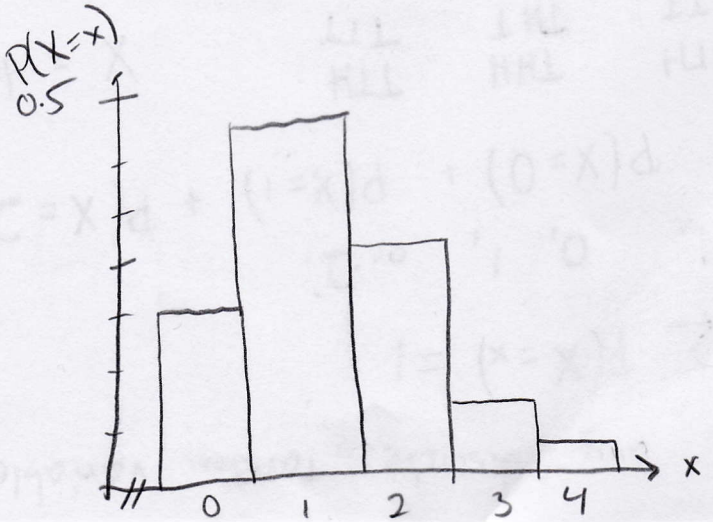
Probability distributions and histograms.

Probability distribution - a list of the possible values and the corresponding probabilities.

Probability histogram - a graph of the probability distribution, displays the possible values on the horizontal axis and the probabilities on the vertical axis.

Ex

Siblings x	Probability $P(X=x)$
0	0.200
1	0.425
2	0.275
3	0.075
4	0.025



Property: For any discrete random variable X,

$$\sum P(X=x) = 1$$

If X can be 0, 1, or 2.

Then $P(X=0) + P(X=1) + P(X=2) = 1$.

Ex

HHH	HTH	THH	TTH
HHT	HTT	THT	TTT

X = total number of heads

a) exactly 2 heads $P(X=2)$

b) $P(X=2) = \frac{3}{8}$

c)

No. of heads x	$P(X=x)$
0	1/8 = 0.125
1	3/8 = 0.375
2	3/8 = 0.375
3	1/8 = 0.125

totals to 1

d) event that # of heads less than or equal to 2.

$\{X \leq 2\}$

e) $P(X \leq 2) = P(X=0) + P(X=1) + P(X=2)$

$= 0.875$

Interpreting a probability distribution

In a large number of independent observations of a random variable X, the proportion of times each possible value occurs will approximate the probability distribution of X.