

## Lesson: Introduction to Probability Distribution

Definitions:

Random Variable

- "X" (Capital letter X)
- a single value for each outcome in an experiment

Discrete Variable (cannot break it smaller than 1)

- values separate from each other
- finite number of outcomes
- data is counted

Continuous Variable (can break it smaller than 1)

- possible values of x are elements of real numbers
- infinite number of outcomes
- data is measured

Examples:

Classify each of the following random variables as discrete or continuous:

Random Variables	Discrete OR Continuous
1) the number of phone calls made by a person	D
2) the length of time the salesperson spent on the telephone	C
3) a company's annual sales \$	C / # of transaction D
4) the distance from earth to the sun	C
5) the number of <del>widgets</del> apps sold by a company	D

Uniform Probability Distribution outcomes of the distribution are equally likely in any single trial

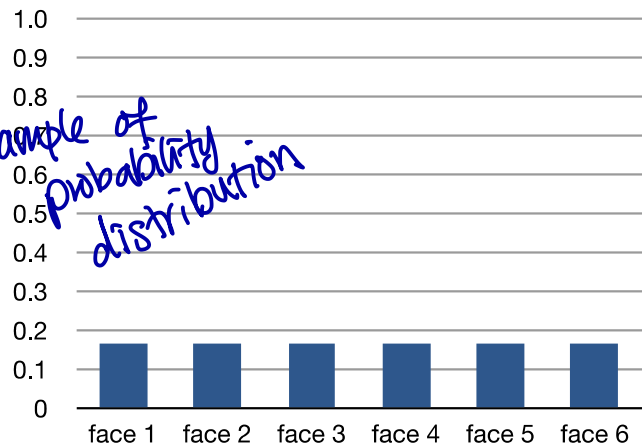
- the sum of the probability is one

Example:

Random Variable, X	Probability, P(X)
1	$\frac{1}{6}$
2	$\frac{1}{6}$
3	$\frac{1}{6}$
4	$\frac{1}{6}$
5	$\frac{1}{6}$
6	$\frac{1}{6}$

↓  
table to list all the outcomes with their associated probabilities.

example of probability distribution



## Expected Value.

- $E(X)$
- predicted average of all possible outcomes of a probability experiment

$E(X)$  ← expected value of random variable

we don't round the value to the nearest one even if it is discrete variable

To calculate probability distribution

$$P(x) = \frac{1}{n}$$

$$E(X) = \sum_{i=1}^n x_i \cdot P(x_i)$$

random variable      probability of that random variable

$$E(X) = \sum (x \cdot P(x))$$

Examples:

Given the following probability distribution, determine the expected values:

(a)

Random Variable, X	Probability, P(x)
5	0.3
10	0.25
15	0.45
$E(X) = 10.75$	

$$E(X) = x \cdot P(x) + x \cdot P(x) + x \cdot P(x)$$

$$= 5 \times 0.3 + 10 \times 0.25 + 15 \times 0.45$$

$$= 10.75$$

(b)

Random Variable, X	Probability, P(x)
1 000	0.25
100 000	0.25
1 000 000	0.25
10 000 000	0.25
$E(X) = 2\,775\,250$	

$$E(X) = 0.25 (1\,000 + 100\,000 + 1\,000\,000 + 10\,000\,000)$$

(c)

Random Variable, X	Probability, P(x)
1	$\frac{1}{6}$
2	$\frac{1}{5}$
3	$\frac{1}{4}$
4	$\frac{1}{3}$
5	$\frac{1}{20}$
$E(X) = 2.9$	

$$E(X) = 1\left(\frac{1}{6}\right) + 2\left(\frac{1}{5}\right) + 3\left(\frac{1}{4}\right) + 4\left(\frac{1}{3}\right) + 5\left(\frac{1}{20}\right)$$

$$= \frac{29}{10}$$

$$= 2.9$$