

Introduction to Random Variables and Probability Distributions
§5.1

Discrete random variable – when the observations of a quantitative random number can take on only a finite number of values or a countable number of values, we say it is a discrete random variable.

Examples

- Number of eggs in a nest
- Number of eggs produced by a hen
- Number of students taking Probability

Continuous random variable – when the observation of a quantitative random number can take on any of the countless number of values in a line interval, we say it is a continuous random variable.

Examples

- Height of students in class
5'0" \longrightarrow 6'10"
- Tire Pressure
12 \longrightarrow 50 lbs

Determine if each is a discrete or continuous random variable.

Example 1

The time it takes for a student to finish test.

Example 2

The number of bad checks at a store

Example 3

The number of those running for president

Example 4

The amount of gas needed to drive 200 miles

Probability distribution – an assignment of probability to the specific values of the random variable or to a range of values of the random variable (whether discrete or continuous).

1. The probability distribution of a discrete random variable has a probability assigned to each value of the random variable.
2. The sum of these probabilities must be 1.

Example 5

Boredom Tolerance Test

20,000 Subjects

Score	# of Subjects	Relative Frequency
0	1400	.07
1	2600	.13
2	3600	.18
3	6000	.30
4	4400	.22
5	1600	.08
6	400	.02



Introduction to Random Variables and Probability Distributions
§5.1 (Day 2)

Mean and Standard Deviation of a discrete probability distribution.

$$\text{Mean}(\mu) = \sum xP(x)$$

$$\text{Standard Deviation}(\sigma) = \sqrt{\sum (x - \mu)^2 P(x)}$$

x = value of a random variable

$P(x)$ = probability of that number

\sum = sum

The mean of a probability distribution is often called the expected value because it represents a central point for the entire distribution.

Example – number of times viewers see an infomercial before buying the product.

$x(\text{viewing})$	$P(x)$	$xP(x)$	$x - \mu$	$(x - \mu)^2$	$(x - \mu)^2 P(x)$
1	.27				
2	.31				
3	.18				
4	.09				
5	.15				

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Binomial Probabilities
§5.2

Binomial Experiment

1. There are a fixed number of trials(n).
2. The n trials are independent and repeated under identical conditions.
3. Each trial only has 2 outcomes: success(p) and failures(q).
4. For each individual trial, the probability of success is the same. The probability of success is denoted by p and failure q :

$$p + q = 1 \quad q = 1 - p \quad p = 1 - q$$

5. The central problem of a binomial experiment is to find the probability of r successes out of n trials.

Example 1

1 spin on the “Wheel of Fortune.” There is one gold slot out of 36 worth \$100,000. 100 contestants get one spin. Sponsors want to know the probability that 3 people will win.

Example 2

3 multiple choice questions each with 4 possible answers. Find the probabilities of each possible outcome if you randomly guess.

OR

Use Formula

$$P(r) = C_{n,r} p^r q^{(n-r)}$$

$$P(r) = \frac{n!}{r!(n-r)!} p^r q^{(n-r)}$$

Binomial Probabilities
§5.2

Formula for Binomial Probability Distribution

$$P(r) = \frac{n!}{r!(n-r)!}$$

Example 1

20% of houses have Playstation. Find the probability that if we sample 12 houses, exactly 5 will have Playstation.

Example 1b

20% of houses have Playstation. Find the probability that if we sample 12 houses, exactly 5, 6, or 7 will have Playstation.

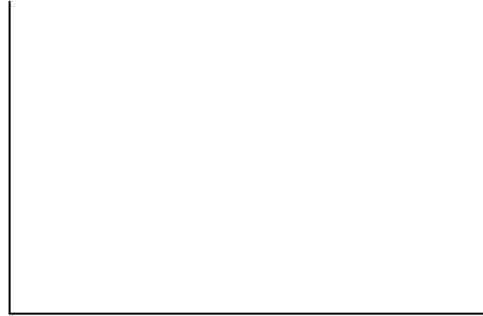
Look at chart

Mean and Standard Deviation of Binomial Distribution
§5.3

Example 1

The probability that a person dining alone will leave a tip is 0.7. A waiter serves 6 lone diners during a lunch hour. Make a graph of the binomial probability distribution which shows the probability that 0, 1, 2, 3, 4, 5, or all 6 diners leave a tip.

Histogram



The balance point of the distribution is the mean(μ) or expected value.

The measure of spread of the distribution is the standard deviation(σ).

$$\mu = np$$
$$\sigma = \sqrt{npq}$$

Example

Go back to waiter problem