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 most 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

Pg 228,1-4,5ab,6a-c,7a-c,8a-c

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

Mean and Standard Deviation of a discrete probability distribution.

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

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

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(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				

Pg 229,5c-e,6de,7de,8de

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Binomial Probabilities
§5.2

<u>Binomial Experiment</u>

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:

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

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

<u>Example 1</u>

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

<u>Example 2</u>

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

OR
Use Formula

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

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

Pg 241,1a-d,2ab

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

Pg 242, 3-8

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

Pg 249,1-2(a-c),3bc,4bd,5-9(b)