AP Statistics **CHAPTER 6 GUIDED NOTES**

6.1 Discrete Random Variables

Read 340-344

What is a random variable? Give some examples.

What is a probability distribution?

What is a discrete random variable? Give some examples.

Alternate Example: *How many languages?*
Imagine selecting a U.S. high school student at random. Define the random variable X = number of languages spoken by the randomly selected student. The table below gives the probability distribution of X, based on a sample of students from the U.S. Census at School database.

Languages:	1	2	3	4	5
Probability:	0.630	0.295	0.065	0.008	0.002

(a) Show that the probability distribution for X is legitimate.
(b) Make a histogram of the probability distribution. Describe what you see.
(c) What is the probability that a randomly selected student speaks at least 3 languages? More than 3?

Alternate Example: Roulette
One wager players can make in Roulette is called a "corner bet." To make this bet, a player places his chips on the intersection of four numbered squares on the Roulette table. If one of these numbers comes up on the wheel and the player bet \$1, the player gets his \$1 back plus \$8 more. Otherwise, the casino keeps the original \$1 bet. If X = net gain from a single \$1 corner bet, the possible outcomes are $x = -1$ or $x = 8$. Here is the probability distribution of X:

Value:	–\$1	\$8
Probability:	34/38	4/38

If a player were to make this \$1 bet over and over, what would be the player's average gain?

In the long run, the player loses \$1 in 34 of every 38 games and gains \$8 in 4 of every 38 games. Imagine a hypothetical 38 bets. The player's average gain is:

$$\mu_X = \frac{-1+-1+ \quad -1+8+8+8+8}{38} = \frac{34(-1)+4(8)}{38} = (-1)\left(\frac{34}{38}\right)+(8)\left(\frac{4}{38}\right) = -\$0.05$$

If a player were to make \$1 corner bets many, many times, the average gain would be about –\$0.05 per bet. In other words, in the long run, the casino keeps about 5 cents of every dollar bet in roulette.

Read 344-346

How do you calculate the mean (expected value) of a discrete random variable? Is the formula on the formula sheet?

How do you interpret the mean (expected value) of a discrete random variable?

Alternate Example: Calculate and interpret the mean of the random variable *X* in the languages example on the previous page.

Does the expected value of a random variable have to equal one of the possible values of the random variable? Should expected values be rounded?

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6.1 continued

Read 346–348

How do you calculate the variance and standard deviation of a discrete random variable? Are these formulas on the formula sheet?

How do you interpret the standard deviation of a discrete random variable?

The "red/black" and "corner" bets in Roulette both had the same expected value. How do you think their standard deviations compare? Calculate them both to confirm your answer.

Use your calculator to calculate and interpret the standard deviation of X in the languages example.

Are there any dangers to be aware of when using the calculator to find the mean and standard deviation of a discrete random variable?

Must show some work to get credit. First couple of terms is fine.
Must turn the "Freq" back to 1 after graphing a probability histogram.

What is a continuous random variable? Give some examples.Is it possible to have a shoe size = 8? Is it possible to have a foot length = 8 inches?

How many possible foot lengths are there? How can we graph the distribution of foot length?

How do we find probabilities for continuous random variables?

For a continuous random variable X, how is $P(X < \text{a})$ related to $P(X \leq \text{a})$?

Alternate example: Weights of Three-Year-Old Females
The weights of three-year-old females closely follow a Normal distribution with a mean of μ = 30.7 pounds and a standard deviation of σ = 3.6 pounds. Randomly choose one three-year-old female and call her weight *X*.

(a) Find the probability that the randomly selected three-year-old female weighs at least 30 pounds.

(b) Find the probability that a randomly selected three-year-old female weighs between 25 and 35 pounds.

(c) If $P(X < k) = 0.8$, find the value of *k*.

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