Intro to Chapter 8
Binomial Distributions

Suppose you came to class totally unprepared for a quiz. You didn't read the text, you didn't do the practice problems, you didn't take any notes, and you didn't ask any questions in class {*Note: this is purely hypothetical, of course...since we are all AP scholars, we would never dream of being so bold*}. The quiz consists of 10 multiple choice questions. Since you are completely unprepared, you decide to randomly fill in answers on the ScanTron sheet without even reading the questions. Do so below:

1	(A)	(B)	(C)	(D)	(E)
2	(A)	(B)	(C)	(D)	(E)
3	(A)	(B)	(C)	(D)	(E)
4	(A)	(B)	(C)	(D)	(E)
5	(A)	(B)	(C)	(D)	(E)
6	(A)	(B)	(C)	(D)	(E)
7	(A)	(B)	(C)	(D)	(E)
8	(A)	(B)	(C)	(D)	(E)
9	(A)	(B)	(C)	(D)	(E)
10	(A)	(B)	(C)	(D)	(E)

1) Randomly fill in a bubble for each question.

2) Your teacher will show you the answer key.
Grade your quiz.
Number Correct = ___________

3) What is P(get a particular question correct)=________?

4) How many questions would you *expect* to get correct?
5) Is it very likely that you'd get all 10 questions correct?

Our goal is to determine the probability that you'd pass the quiz by guessing. Like most quizzes and tests, let's assume you'd need 60% to pass...that means we'd need to answer at least 6 questions correct by guessing.

We can define a random variable X to describe this situation.

X = # of correct answers by guessing.

What are the possible values of X? Which values are most likely? Which are least likely?

We want to know $P(X \geq 6)$. Let's try to estimate this probability by using a simulation.

Use your random number generator or a random number table to simulate taking 20 quizzes by guessing. To use your calculator, enter RandInt(1,5,10). Let 1=Correct, 2-9=Incorrect. Keep track of how many correct answers you get per quiz and tally your results below.

#Correct	0	1	2	3	4	5	**6**	**7**	**8**	**9**	**10**
Tally											

How many times did you "pass" the quiz?________ Note your results on the board.

Combine your results with the rest of the class:

$$\frac{\text{Total \# Pass}}{\text{Total \# Simulations}} = \_\_\_\_\_\_ =$$

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To find the theoretical probability that we'd pass the quiz, we have to consider all the different ways to get 1 correct, 2 correct, 3 correct, and so on. How can we determine each of these values?

Recall from previous math courses, the number of ways of arranging *k* successes among *n* observations is given by the **binomial coefficient**.

$$\binom{n}{k} = {}_nC_k = \frac{n!}{k!(n-k)!}$$

X = # of correct answers by guessing

k	0	1	2	3	4	5	**6**	**7**	**8**	**9**	**10**
$_nC_k$											
# Possible											
P(X=k)											

Based on this, what is the theoretical probability of passing the test? P(X≥6)=_________

There are four defining characteristics of this situation:
1) Each question has two possible outcomes - correct or incorrect
2) There is a fixed number of questions on the quiz - 10 questions total
3) Each question is independent - P(correct) is not affected by other outcomes
4) The probability of getting a question correct is the same for all questions - P(correct)= 0.20

Situations in which these four characteristics are satisfied are said to be **Binomial Settings**.

Binomial Setting

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☑ If a situation is considered a Binomial Setting, we can describe the distribution of "successes" by considering the number of observations, *n*, and the probability of success on any one observation, *p*. If a variable is binomial, we say it is B(*n*,*p*).

In this chapter, we will learn how to identify binomial settings, how to describe binomial distributions, and how to calculate the probability of a number of "successes" in a binomial situation.