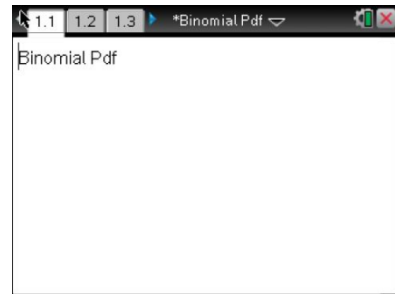# Binomial Pdf Eye Color
Student Activity

Name _____

Class _____

Follow your teacher's directions either to create a .tns file or to open the pre-made file your teacher sends you (*Binomial_Pdf_Eye_Color.tns*).

What's the probability of a success? This activity investigates how to answer that question in a binomial situation.

Several sources indicate that the probability of a person in the United States having blue eyes is approximately 30%. Suppose you randomly sampled 50 people in the United States. One basic question to answer is whether an underlying probability model might describe the probability of the possible numbers of blue-eyed people in your sample.

1. This situation involves binomial trials, so the first step is to check whether the requirements for binomial trials are met: two outcomes per trial; a fixed number of trials; a constant probability of success; and independent trials. Verify that these conditions are met in this context.

   ☐ Two outcomes?

   ☐ Fixed # of trials?

   ☐ Constant probability of success?

   ☐ Independent trials?

2. a. Reflect on how you built the .tns file. What two inputs determined the binomial distribution?

   b. For a random sample of 50 people, what would you expect to be the most likely number of blue-eyed people? Explain your reasoning.

Move to page 1.2.

Press `ctrl` ▶ and `ctrl` ◀ to navigate through the lesson.

3. In terms of the context,
   a. what does the zero represent in cell A1?

   b. what does the value in cell B5 represent?

Move to page 1.3.

If the conditions for binomial trials are met, a binomial model can be used to represent the probabilities, which is the distribution you created on Page 1.3.

4.   a. Describe the distribution in terms of shape, center, and spread.

    b. Describe how the context of the eye color for a sample of randomly chosen people relates to the graph.

    c. Saundra wonders whether the probability of getting 4 blue-eyed people in the sample of 50 was 0. What would you tell her?

5.   Suppose x represents the number of blue-eyed people. Describe how the graph helps you answer each of the following:
    a. What are the most likely outcomes?

    b. What are the least likely outcomes?

    c. If you add the probabilities of every possible outcome, what should be the result?

6.   a. What is the approximate probability that exactly 10 people will have blue eyes, $P(x=10)$?

    b. Ten or 11 people will have blue eyes, $P(x=10,11)$?

    c. Fewer than 10 people will have blue eyes, $P(x<10)$?

    d. At least 10 people will have blue eyes, $P(x\geq 10)$? How could you use your answer to part b to find the answer to this question?

7. Suppose a researcher was checking the number of candies of a certain color chosen from randomly selected bags where each bag has exactly 50 candies. The manufacturer claimed that the probability of getting a green candy was approximately 0.3.
    a. How is this context alike or different from the context involving eye color above?

    b. In a sample size of 50 candy pieces, if the researcher found the number of green candies in the sample indicated below, should he be surprised? Explain your reasoning.
        i. 12

        ii. 8

    c. If the researcher were surprised, what conclusions might he draw?

Extension
Follow your teacher's instructions for the following:
Adding the two sliders to the .tns file as described in the Extension instructions of the Binomial Pdf Eye Color Create document allows you to change both the sample size and the probability of a success.

8. The probability of having green or light brown eyes with green specks is about 12%. In a random sample of 100 people, what is the probability of the following:
    a. Finding exactly 6 people with that eye color?

    b. Finding at least 16 people with that eye color?

    c. Finding anywhere from 7 to 15, including 7 and 15, people with that eye color?

9. a. Before using the arrows to change anything, predict how your answers to question 8 might change if the sample size were 30 people.

    b. Check your prediction by changing the sample size to 30 and using the resulting distribution.

10. a. Predict how your answers to question 7 would change if the sample size remained 100 but the probability of brown eyes was 0.40 or 40%.

   b. Check your prediction by changing *n* and *p* accordingly and using the resulting distribution.

11. a. Describe how the distribution changes as the sample size goes from 100 to 50 people for *p*=0.4.

   b. How would your answer to part a change if the probability of a success was a different value?

   c. Fix the sample size at *n*=50. Change the values of *p*, and describe what happens.

Tech Tip: If you use a large *n* and a large *p*, you might need to select **Menu > Window/Zoom > Window Settings…** and change the **x Max** to a larger value.