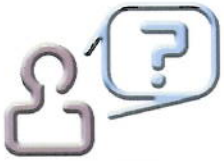


Do you KNOW what you are asking?

Have you ever played Jeopardy? Can you determine form a set of answers what the question must be?

Game Format: You will be wearing a question on your back. As other participants read your question, they will give you an answer. Record all of the answers you receive. **Remember: you are also to respond to other people's questions. Do not give units and you must answer each question.**

1. What are some factors that might influence the answers you receive to your question?

2. How might you incorporate these factors into the data collection process?

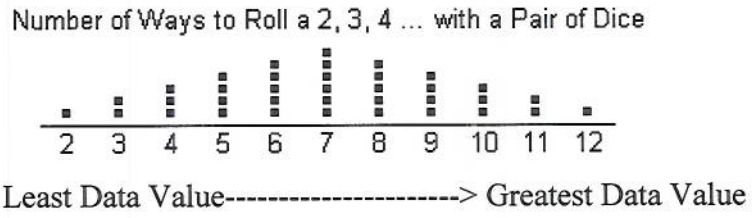
Collect data from 10 different people:

3. What do you think your question could possibly be? Explain.

4. If all of your data values are relatively close or exactly the same, what does this mean about your question?

5. Organize your data to help make conjectures about your question. You should either make a bar graph or a dot plot.

Example of a Dot Plot:



6. If there is no pattern to your data, what does this mean about your question?

7. Calculate the mean , median and mode for your data.

Mean Median Mode

Which measure of central tendency best describes your data? Explain.

8. Look at your question. Were you surprised? What clues should have led you to this question?

How old is a child entering kindergarten?	How many years have you been in school?	What size shoe do you wear?
How many U.S. Presidents have held office?	What is the U.S. minimum wage in dollars?	What is the average posted speed limit on the highway?
How many times a day do you eat? Include snacks.	About how many pairs of shoes do you own?	How many books do you read in an average year?
Does your family use Netflix?	How many cups of coffee do you drink in an average day?	How many inches are in a yard?

How many stars are on the U.S. flag?	What is your favorite color of Skittles?	How many pets do you have?
What temperature is the thermostat set on in your house in the winter?	How many hours of sleep did you get last night?	How many months is school in session?
How many text messages do you send in a day?	What is the average temperature used to bake cookies?	What is the most money you have ever paid for a haircut?
What is your favorite number?	How many Harry Potter books have you read?	What is the longest time in minutes that you have spent on Facebook?

What is the longest distance that you have ever run or walked?	How many musical instruments do you play?	How many sports do you play?
How many televisions are in your house?	Do you watch the show Big Bang Theory?	How many times per week do you go shopping?
How many sporting events do you watch in a week? Include television and in person.	How many judges on the U.S. Supreme Court are female?	What is the longest time that you spent away from your cell phone?

Exploring Data-Making Analysis Inquiry-Based

Nicole Williams, April Kerby
Winona State University

Bird Counting: Using Proportions and Geometry to Obtain the Best Population Estimate

How do you count a large flock of birds that are on the river? In this activity, we will explore how to count birds using two different techniques, area and proportions. Then, we will check our estimates using geometry 3-D models as a third technique.

Materials needed:

1) Beans- 1 pounds bags work the best
2) Container to hold the beans- jars (cylinders) or square containers (prisms)
3) Markers
4) Masking tape for the containers
5) River- formed of paper. The paper can be gridded or you ask the student to grid the paper.

Objectives:

Students will estimate a bird population on a river by three techniques:

1) collecting samples and calculating area.

2) proportional reasoning and the capture-recapture technique.

3) calculating the volume of a 3-D shape.

118 –Picture From **Bird Counting 101:** http://ebird.org/content/ak/news/bird-counting-101. The capture-recapture idea was adapted from the http://illuminations.nctm.org site.

Bird Counting: Using Probability and Geometry to Obtain the Best Population Estimate

Flock of Tundra Swans on the River

Obtain a container of beans, which represent the total number of birds on a river.

River Estimate- Place **all** of the birds on your river. Remember these two principles:

1) Birds tend to flock together.
2) Larger flocks will be on land and the birds will be scattered in the river water.

1. Look at the birds on the river at your table. Without actually counting, estimate the total number of birds. Discuss your estimate with your other group members. If necessary, revise your estimate.

Final Bird Count Prediction: _____ birds

When there are large numbers of birds on the move it becomes impractical to count them individually, and then you must move on to counting by increments. With our birds on the river, they may not "flock" together in the same amount of clumps.

2. Make a strategy for picking out samples. Each sample will come from a single gridded area. Should all of the samples be large flocks of birds?

3. Pick out ten samples (each group member should pick at least one) and count them. Then find the average sample size by adding the counts from all of your samples and dividing by 10.

Sample #1 Count: _____ Sample #5 Count_____ Sample #9 Count: _____

Sample #2 Count: _____ Sample #6 Count: _____ Sample #10 Count: _____

Sample #3 Count: _____ Sample #7 Count: _____

Sample #4 Count: _____ Sample #8 Count: _____

Total of all Birds in Samples: _____

4. What is the average sample size? _____birds

5. Calculate the area of the river using the grids. What is the area? _____

6. Estimate the population of birds on the river using the area and the average sample size. Show your work.

   Area of River × Average Sample Size = Number of Birds

   _____ birds

Capture and Recapture- Tagging Birds to Estimate the Population

7. Capture as many birds as feel that are needed. It should be a multiple of ten (10, 20, 30, …) Count the number of birds that you captured. Record this number below and on the masking tape on the plastic container. Replace the birds with tagged birds (black beans).

   How many birds did you capture? _____birds

8. Put all of the birds marked and unmarked into the container. Shake or stir the container so that all of the birds are mixed together. Collect a sample of birds (recapture) by grabbing a handful. Circle which of the following we do not know (what are we trying to find?)

$$\frac{\text{marked beans (handful)}}{\text{total beans (handful)}} = \frac{\text{total marked beans (in jar)}}{\text{total beans (in jar)}}$$

   With your handful of beans, count the beans and then set up your proportion to estimate the bird population. Which part of the proportion will always be the same?

$$\frac{[\ ]}{[\ ]} = \frac{[\ ]}{[\ ]}$$

   _____ Birds

9. Which part of the proportion will always be the same? What will it be? On the next page fill this part of the proportion in for all samples.

10. We are now going to collect ten samples of birds (recapture). Include your first sample from before as Sample #1. Fill in the table for each sample.

Sample Number	Number of Marked Beans	Total Number of Beans	Proportion	Bird Population Estimate
#1			$\frac{[\ ]}{[\ ]} = \frac{[\ ]}{[\ ]}$	
#2			$\frac{[\ ]}{[\ ]} = \frac{[\ ]}{[\ ]}$	
#3			$\frac{[\ ]}{[\ ]} = \frac{[\ ]}{[\ ]}$	
#4			$\frac{[\ ]}{[\ ]} = \frac{[\ ]}{[\ ]}$	
#5			$\frac{[\ ]}{[\ ]} = \frac{[\ ]}{[\ ]}$	
#6			$\frac{[\ ]}{[\ ]} = \frac{[\ ]}{[\ ]}$	
#7			$\frac{[\ ]}{[\ ]} = \frac{[\ ]}{[\ ]}$	
#8			$\frac{[\ ]}{[\ ]} = \frac{[\ ]}{[\ ]}$	
#9			$\frac{[\ ]}{[\ ]} = \frac{[\ ]}{[\ ]}$	
#10			$\frac{[\ ]}{[\ ]} = \frac{[\ ]}{[\ ]}$	

11. What do you think is a "good" sample or a "bad" sample? Explain your thinking.

12. In your group make a decision of the best way to determine the number of birds in the population. Explain your choice. You can select from:
    A. Median Proportion B. Mean Proportion C. "Best" Proportion

13. Using whatever method you think is the most accurate, calculate the total number of birds in the population.

    _____ birds

Volume of Container- Estimate the Population

1. What 3-D shape is the container? _____ How could you calculate the bird population using the volume of the container?

2. Calculate the volume of "birds" in your container. _____ birds
   Show work and explain your thinking.

Compare all three of your estimated bird populations. Which do you think is the most accurate? Explain your thinking.

Area of River _____

Capture-Recapture_____

Volume of Container _____

Exploring Data: Making Analysis Inquiry-Based
Nicole Williams, April Kerby
Winona State University

Jumping Frogs Activity

Adapted from *Activity-Based Statistics*, 2nd edition, by Scheaffer, et al. (2004)

Purpose: The purpose of this activity is to introduce students to data collection and descriptive statistics. Students will fold origami frogs using two types of paper (construction and computer). Then the students will jump the frogs and record how far each type of frog travelled. The students will then summarize the class data. The data from this activity may also be used later in the course when discussing hypothesis testing.

Learning Outcomes: Students who complete this activity will

- develop a basic understanding of the data collection process
- gain experience using appropriate descriptive statistics
- develop a basic understanding of independent versus dependent samples

Required Materials:

- Construction paper cut into 6x6 inch squares
- Computer paper cut into 6x6 inch squares
- Tape measures or meter sticks

Have you ever wanted to participate in the Olympics? Well here's your chance! Even the most consistent athletes do not perform exactly the same every time they play. We reason that their performance is affected by several factors such as the strength of their opponent, their own schedules, or the state of their health. We can use statistics to estimate the effects of such factors on the outcomes. For this activity you get to train an Olympic caliber jumping origami frog. In particular, we want to find out how the type of paper used to make the origami frog affects "jumping" distance.

Questions:

1. Will we be conducting an experiment or an observational study? Explain.

Teacher's Note: If you have not talked about experiments and observational studies you will want to discard this question. If you have already talked about these concepts this is a good recap/discussion point.

Fold your origami frog using the directions given below.

Teacher's Note: You may either have each student make both types of frogs or have each student make one type of frog. The directions outlined below are for each student making only one frog.

Step 1: Draw a card from the bowl to determine which type of paper you will use to make your origami frog. Each of you will either receive a 6x6 inch square sheet of either construction or computer paper depending on which type was drawn. The directions for making an origami frog can be found on the following website:

http://seagrant.wisc.edu/Frogs/origami_instr.html

Step 2: Once you make your frog practice with it five times. Record the length of the last jump (in inches – use the closest integer) and put it on the board. Be sure to record your results in the correct place on the board.

Questions:

2. Why should each person perform practice jumps before recording the distance the frog jumps?

3. Are there other things we should take into consideration when jumping the frogs? What might these be? Explain.

Step 3: Record the data from the class in the table below:

Type of Paper	
Construction Paper	Computer Paper

Questions:

4. Using the class data, compute the mean jump distance for each type of paper frog.

5. Using the class data, find the Five Number Summary for jump distance for each type of paper frog.

6. Using the Excel boxplot template, create side by side boxplots of the jump distance data.

   Teacher's Note: You could also have students create this graph by hand or using some other technology which they've used before.

7. What can you conclude about the type of paper a frog is made out of and how far it will jump? Use your answers for questions 4 - 7 to help answer this.

Extensions:

1. The size of the frog may also have an impact on the distance jumped. Perhaps as a follow-up assignment students could make frogs using two different sizes and then compare the jump distance based on the size of the frog.

2. This activity can be revisited later in the course when conducting hypothesis tests for a difference in means. If each student folded both types of frogs the hypothesis test would be conducted using dependent samples. If the students randomly drew which type of paper to use the hypothesis test would be conducted using independent samples. Students could discuss whether they want to test for a difference or maybe they feel like one type of paper frog might jump a certain distance more than the other.

3. If you teach a higher level statistics class you could have four conditions and run a factorial experiment where the conditions would be (small, construction), (small, computer), (large, construction), and (large, computer). You could also talk about blocking if each student made all four different frogs.

Is Your Frog
Olympic Gold Medal Worthy?

Have you ever wanted to participate in the Olympics? Well here's your chance! Even the most consistent athletes do not perform exactly the same every time they play. We reason that their performance is affected by several factors such as the strength of their opponent, their own schedules, or the state of their health. We can use statistics to estimate the effects of such factors on the outcomes. For this activity you get to train an Olympic caliber jumping origami frog. In particular, we want to find out how the type of paper used to make the origami frog affects "jumping" distance.

Questions:

1. Will we be conducting an experiment or an observational study? Explain.

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