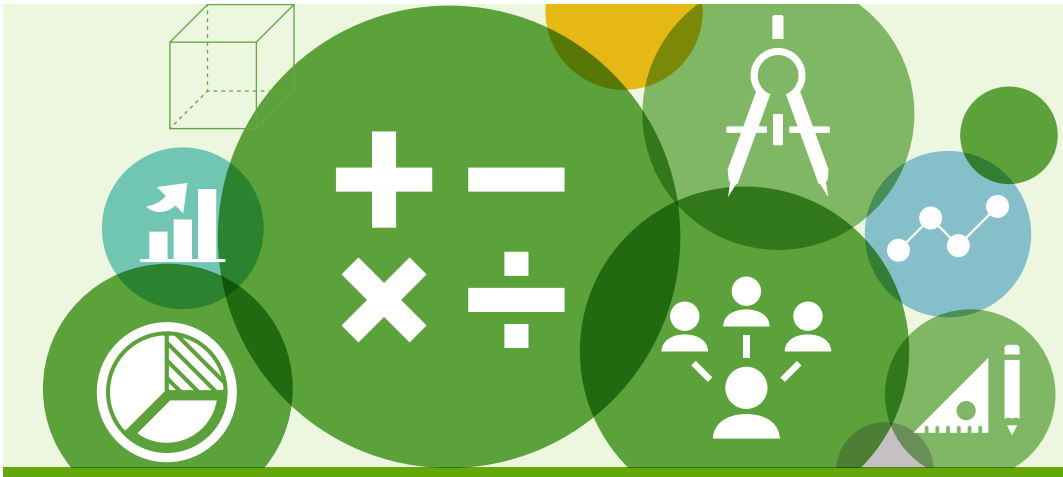


STUDENT VERSION

UNDERSTANDING DISTRIBUTIONS OF DATA – PET FOOD MANUFACTURING

Activity Items:

The following items are part of this activity and appear at the end of this student version.

- Item 1: Unsorted Raw Data, Dog and Cat Food Manufacturers by State: 2012
- Item 2: Sorted Raw Data, Dog and Cat Food Manufacturers by State: 2012
- Item 3: Dot Plot of Data
- Item 4: Histograms of Data With Varying Intervals
- Item 5: Box Plot of Data
- Item 6: Dog and Cat Food Manufacturers With 0 To 4 Employees, by State: 2012

Student Learning Objectives:

- I will be able to describe a data distribution by its center, shape, spread, and outliers.
- I will be able to compare different data formats (including graphs) of a data distribution.

NAME:_____ DATE:_____

Part 1 – Identify Variability Measures in Different Data Formats

With your group, complete the section below that matches your assigned item from the end of this activity. Your group will then share your answers with the class; as other groups present, fill in the answers to the other four sections of part 1.

Refer to **Item 1: Unsorted Raw Data, Dog and Cat Food Manufacturers by State: 2012** to answer these questions:

1. Based on what you see in this data format, can you easily identify the center of the data set? Why or why not?

2. About how many manufacturers are in a "typical" state?

3. What appears to be the spread of the data in this format?

4. How are the data distributed as displayed in this format?

5. Do there appear to be any outliers in this data set as it is presented in this format? What are they, and how do you know they are outliers?

Refer to **Item 2: Sorted Raw Data, Dog and Cat Food Manufacturers by State: 2012** to answer these questions:

1. Based on what you see in this data format, can you easily identify the center of the data set? Why or why not?

2. About how many manufacturers are in a "typical" state?

3. What appears to be the spread of the data in this format?

4. How are the data distributed as displayed in this format?

5. Do there appear to be any outliers in the data set as it is presented in this format? What are they, and how do you know they are outliers?

Refer to **Item 3: Dot Plot of Data** to answer these questions:

1. Based on what you see in this data format, what appears to be the center of the data set? Calculate the median to support your answer.

2. About how many manufacturers are in a "typical" state?

3. What appears to be the spread of the data in this format?

4. How are the data distributed as displayed in this format?

5. Do there appear to be any outliers in this data set as it is presented in this format? What are they, and how can you tell they are outliers?

Refer to **Item 4: Histograms of Data With Varying Intervals** to answer these questions:

1. Based on what you see in this data format, can you easily identify the center of the data set? Why or why not?

2. Is it easy to identify how many manufacturers are in a "typical" state? Why or why not?

3. What appears to be the spread of the data in this format?

4. How are the data distributed as displayed in this format?

5. Do there appear to be any outliers in this data set as it is presented in this format? What are they, and how can you tell they are outliers?

6. Which histogram (Graph A, B, or C) represents the data best? Defend your answer.

Refer to **Item 5: Box Plot of Data** to answer these questions:

1. Based on what you see in this data format, can you easily identify the center of the data set? Why or why not?

2. About how many manufacturers are in a "typical" state?

3. What appears to be the spread of the data in this format?

4. How are the data distributed as displayed in this format?

5. This is considered a modified box plot, meaning that instead of including outliers in its whiskers, these values are graphed separately as individual data points. How many values are shown as outliers in this modified box plot, and are they much greater than or much less than most other values in the data set?

6. The data inside the box (the interquartile range) represent one-half of all the values in the data set. Given this information, complete the sentence below.

   One-half of all states have between _____ and _____ dog and cat food manufacturers.

Part 2 – Compare the Utility of Data Formats for Assessing Variability

1. Looking at **Items 1** and **2**, which one helps you identify the following measures of variability best and why?

   - Center

   - Spread

   - Shape

   - Outliers

2. What is a major advantage of the data format in **Item 1** over that in **Item 2** in terms of assessing variability?

3. What is a major advantage of the data format in **Item 2** over that in **Item 1** in terms of assessing variability?

4. Now consider **Items 3 – 5**. Which of these graphical representations helps you identify the following measures of variability best and why?

   - Center

   - Spread

- Shape

- Outliers

5. List one major advantage to each type of graphical representation (**Items 3–5**) in terms of assessing variability:

   - Dot plot:

   - Histogram:

   - Box plot:

Part 3 – Apply Your Knowledge: What Would You Do?

A new method of manufacturing is being developed that will speed up the production of dog and cat food. It has been recommended that this method be adopted by any manufacturer that employs fewer than five people. Fortunately, the Economic Census included businesses with 0–4 employees in its data collection on dog and cat food manufacturers (see **Item 6: Dog and Cat Food Manufacturers With 0 to 4 Employees, by State: 2012**). Examine **Item 6** to answer the following questions:

1. What graphical representation would you choose to display this distribution? Explain your reasoning, including why your choice is better than others for finding the center, shape, and spread.

2. Create the graphical representation you chose in question 1 to display the distribution. Be sure to label your axes and give your graph a title. To determine if a value is an outlier, check to see if it is more than 1.5 times the IQR above the third quartile, or 1.5 times the IQR below the first quartile (show your work).

Item 1: Unsorted Raw Data, Dog and Cat Food Manufacturers by State: 2012

State	Number of Businesses Manufacturing Dog and Cat Food
Alabama	4
Alaska	2
Arizona	5
Arkansas	3
California	33
Colorado	7
Connecticut	1
Delaware	2
Florida	5
Georgia	5
Hawaii	0
Idaho	1
Illinois	16
Indiana	11
Iowa	10
Kansas	12
Kentucky	4
Louisiana	0
Maine	0
Maryland	3
Massachusetts	2
Michigan	6
Minnesota	5
Mississippi	2
Missouri	16
Montana	0
Nebraska	10
Nevada	1
New Hampshire	3
New Jersey	5
New Mexico	1

Item 1: Unsorted Raw Data, Dog and Cat Food Manufacturers by State: 2012 (Continued)

State	Number of Businesses Manufacturing Dog and Cat Food
New York	7
North Carolina	7
North Dakota	0
Ohio	12
Oklahoma	7
Oregon	4
Pennsylvania	14
Rhode Island	1
South Carolina	4
South Dakota	5
Tennessee	4
Texas	19
Utah	3
Vermont	5
Virginia	3
Washington	13
West Virginia	1
Wisconsin	15
Wyoming	0

Source: U.S. Census Bureau 2012 Economic Census

Item 2: Sorted Raw Data, Dog and Cat Food Manufacturers by State: 2012

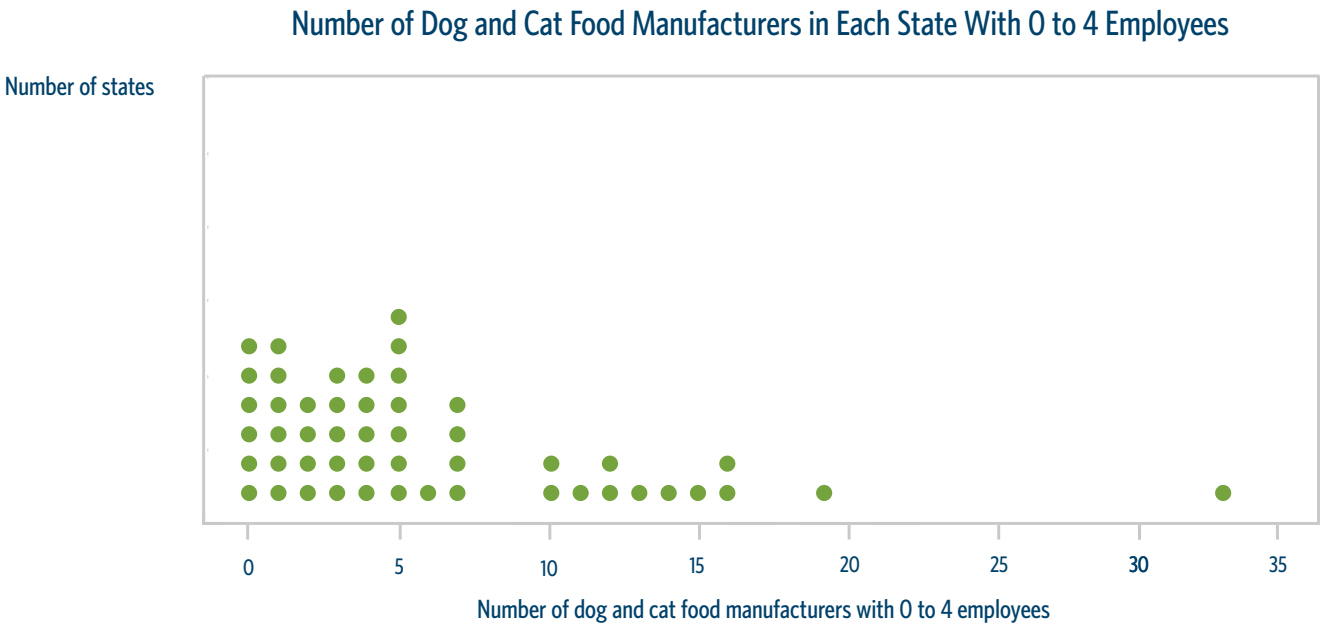
State	Number of Businesses Manufacturing Dog and Cat Food
Hawaii	0
Louisiana	0
Maine	0
Montana	0
North Dakota	0
Wyoming	0
Connecticut	1
Idaho	1
Nevada	1
New Mexico	1
Rhode Island	1
West Virginia	1
Alaska	2
Delaware	2
Massachusetts	2
Mississippi	2
Arkansas	3
Maryland	3
New Hampshire	3
Utah	3
Virginia	3
Alabama	4
Kentucky	4
Oregon	4
South Carolina	4
Tennessee	4
Arizona	5
Florida	5
Georgia	5
Minnesota	5
New Jersey	5

Item 2: Sorted Raw Data, Dog and Cat Food Manufacturers by State: 2012 (Continued)

State	Number of Businesses Manufacturing Dog and Cat Food
South Dakota	5
Vermont	5
Michigan	6
Colorado	7
New York	7
North Carolina	7
Oklahoma	7
Iowa	10
Nebraska	10
Indiana	11
Kansas	12
Ohio	12
Washington	13
Pennsylvania	14
Wisconsin	15
Illinois	16
Missouri	16
Texas	19
California	33

Source: U.S. Census Bureau 2012 Economic Census

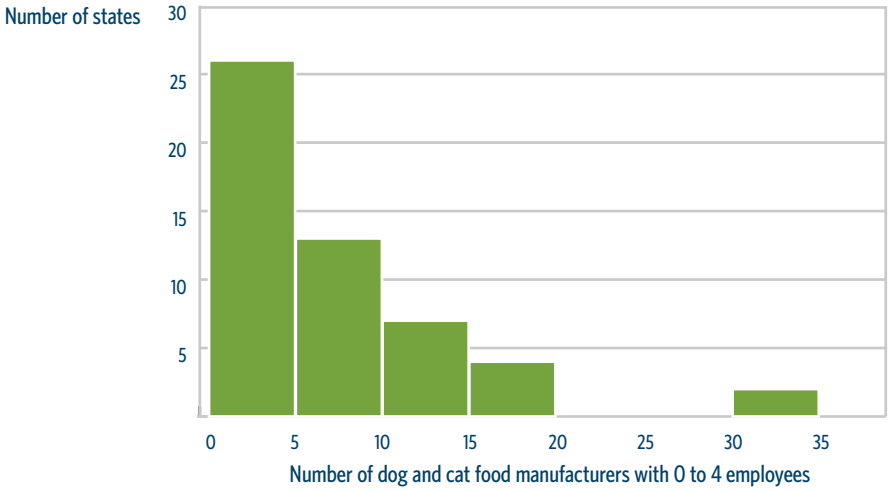
Item 3: Dot Plot of Data



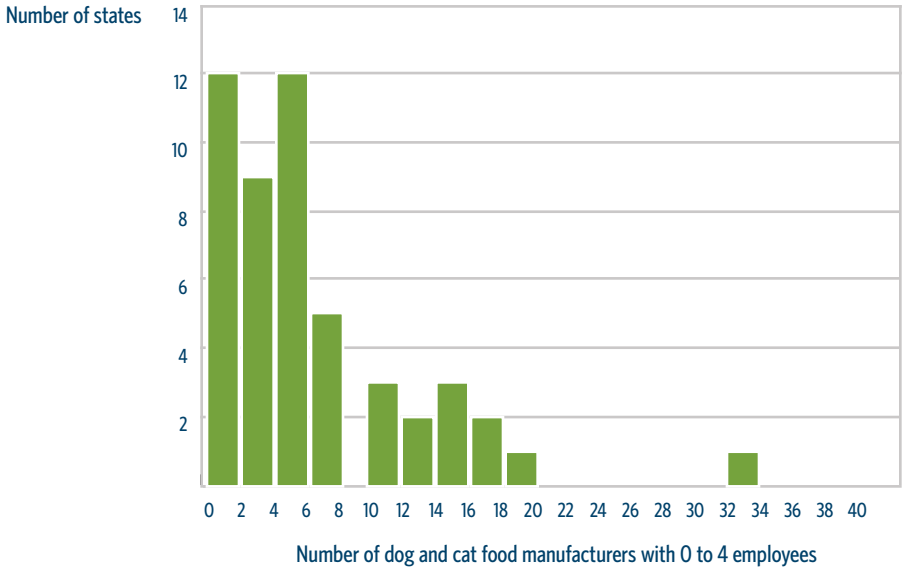
Source: U.S. Census Bureau 2012 Economic Census

Item 4: Histograms of Data With Varying Intervals

Graph A: Number of Dog and Cat Food Manufacturers With 0 to 4 Employees in Each State (Intervals of 5)

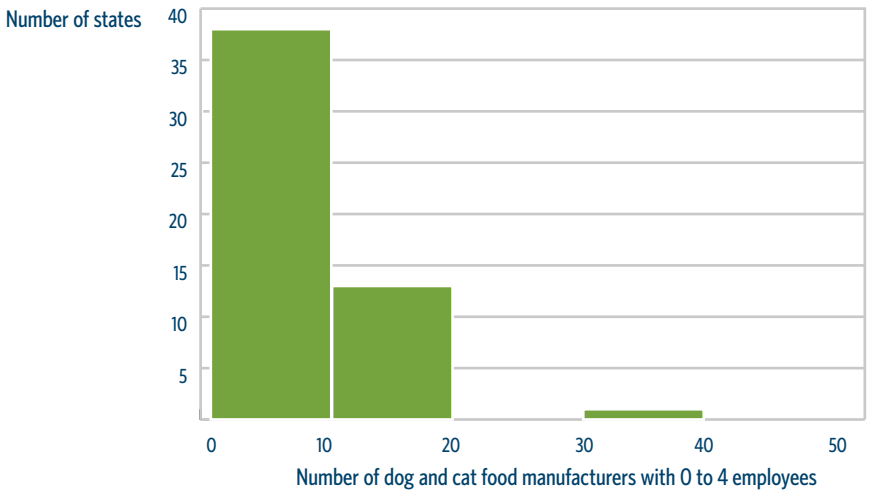


Graph B: Number of Dog and Cat Food Manufacturers With 0 to 4 Employees in Each State (Intervals of 2)



Item 4: Histograms of Data With Varying Intervals (continued)

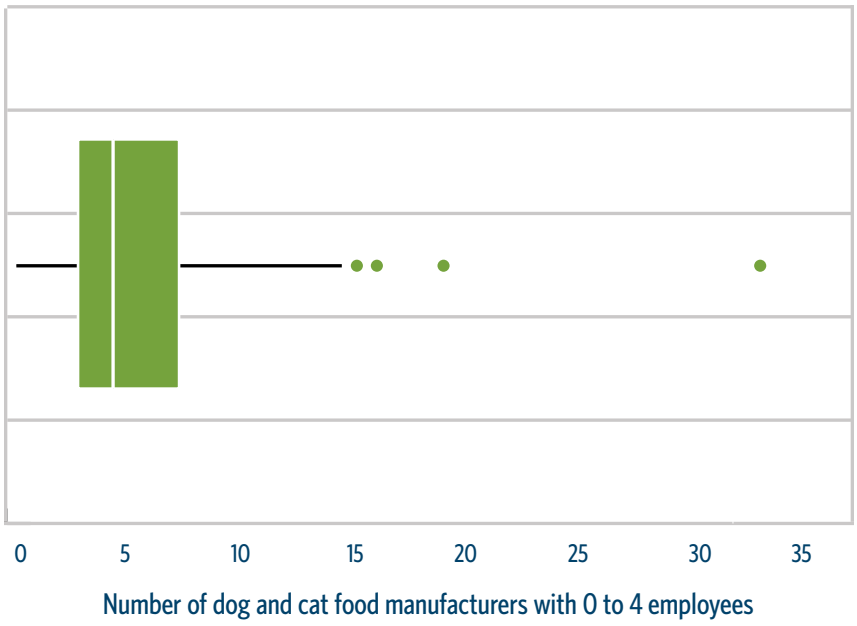
Graph C: Number of Dog and Cat Food Manufacturers With 0 to 4 Employees in Each State (Intervals of 10)



Source: U.S. Census Bureau 2012 Economic Census

Item 5: Box Plot of Data

Number of Dog and Cat Food Manufacturers in Each State With 0 to 4 Employees



Source: U.S. Census Bureau 2012 Economic Census

Item 6: Dog and Cat Food Manufacturers With 0 to 4 Employees, by State, 2012

State	Number of Dog and Cat Food Manufacturers With 0 to 4 Employees
Alabama	1
Alaska	1
Arizona	2
Arkansas	0
California	13
Colorado	4
Connecticut	0
Delaware	1
Florida	4
Georgia	2
Hawaii	0
Idaho	1
Illinois	7
Indiana	4
Iowa	4
Kansas	0
Kentucky	1
Louisiana	0
Maine	0
Maryland	2
Massachusetts	1
Michigan	4
Minnesota	2
Mississippi	1
Missouri	5

State	Number of Dog and Cat Food Manufacturers With 0 to 4 Employees
Montana	0
Nebraska	3
Nevada	0
New Hampshire	3
New Jersey	3
New Mexico	1
New York	3
North Carolina	4
North Dakota	0
Ohio	3
Oklahoma	2
Oregon	4
Pennsylvania	5
Rhode Island	1
South Carolina	1
South Dakota	3
Tennessee	2
Texas	7
Utah	0
Vermont	5
Virginia	1
Washington	8
West Virginia	1
Wisconsin	5
Wyoming	0

Source: U.S. Census Bureau 2012 Economic Census