Lesson 14: Summarizing a Distribution Using a Box Plot

Classwork

A box plot is a graph that is used to summarize a data distribution. What does the box plot tell us about the data distribution? How does the box plot indicate the variability of the data distribution? These questions are explored in this lesson.

Example 1: Time to Get to School

Consider the statistical question, “What is the typical amount of time it takes for a person in your class to get to school?” The amount of time it takes to get to school in the morning varies for the students in your class. Take a minute to answer the following questions. Your class will use this information to create a dot plot.

Write your name and an estimate of the number of minutes it took you to get to school today on a sticky note.

What were some of the things you had to think about when you made your estimate?

Exercises 1–4

Here is a dot plot of the estimates of the times it took students in Mr. S’s class to get to school one morning.

Mr. S’s Class

1. Put a line on the dot plot that you think separates the times into two groups—one group representing the longer times and the other group representing the shorter times.
2. Put another line on the dot plot that separates out the times for students who live really close to the school. Add another line that separates out the times for students who take a very long time to get to school.

3. Your dot plot should now be divided into four sections. Record the number of data values in each of the four sections.

4. Share your marked-up dot plot with some of your classmates. Compare how each of you divided the dot plot into four sections.

**Exercises 5–7: Time to Get to School**

The times (in minutes) for the students in Mr. S’s class have been put in order from smallest to largest and are shown below.

5 5 5 5 7 8 8 10 10 12 12 12 15 15 15 15 22 22 25 25 25 30 30 35 45 60

5. What is the value of the median time to get to school for students in Mr. S’s class?

6. What is the value of the lower quartile? The upper quartile?
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7. The lines on the dot plot below indicate the location of the median, the lower quartile, and the upper quartile. These lines divide the data set into four parts. About what fraction of the data values are in each part?

Example 2: Making a Box Plot

A box plot is a graph made using the following five numbers: the smallest value in the data set, the lower quartile, the median, the upper quartile, and the largest value in the data set.

To make a box plot:

- Find the median of all of the data.
- Find Q1, the median of the bottom half of the data, and Q3, the median of the top half of the data.
- Draw a number line, and then draw a box that goes from Q1 to Q3.
- Draw a vertical line in the box at the value of the median.
- Draw a line segment connecting the minimum value to the box and a line segment that connects the maximum value to the box.

You will end up with a graph that looks something like this:
Now, use the given number line to make a box plot of the data below.

20, 21, 25, 31, 35, 38, 40, 42, 44

The five-number summary is as follows:

Min = 
Q1 = 
Median = 
Q3 = 
Max = 

Exercises 8–11: A Human Box Plot

Consider again the sticky note that you used to write down the number of minutes it takes you to get to school. If possible, you and your classmates will form a human box plot of the number of minutes it takes students in your class to get to school.

8. Find the median of the group. Does someone represent the median? If not, who is the closest to the median?

9. Find the maximum and minimum of the group. Who are they?

10. Find Q1 and Q3 of the group. Does anyone represent Q1 or Q3? If not, who is the closest to Q1? Who is the closest to Q3?

11. Sketch the box plot for this data set.
Lesson Summary

You learned how to make a box plot by doing the following:

- Finding the median of the entire data set.
- Finding Q1, the median of the bottom half of the data, and Q3, the median of the top half of the data.
- Drawing a number line and then drawing a box that goes from Q1 to Q3.
- Drawing a vertical line in the box at the value of the median.
- Drawing a line segment connecting the minimum value to the box and one that connects the maximum value to the box.

Problem Set

1. Dot plots for the amount of time it took students in Mr. S’s and Ms. J’s classes to get to school are below.

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Mr. S's Class

Ms. J's Class
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a. Make a box plot of the times for each class.

b. What is one thing you can see in the dot plot that you cannot see in the box plot? What is something that is easier to see in the box plot than in the dot plot?

2. The dot plot below shows the vertical jump of some NBA players. A vertical jump is how high a player can jump from a standstill. Draw a box plot of the heights for the vertical jumps of the NBA players above the dot plot.
3. The mean daily temperatures in degrees Fahrenheit for the month of February for a certain city are as follows:
   a. Make a box plot of the temperatures.
   b. Make a prediction about the part of the United States you think the city might be located. Explain your reasoning.
   c. Describe the temperature data distribution. Include a description of center and spread.

4. The box plot below summarizes data from a survey of households about the number of dogs they have. Identify each of the following statements as true or false. Explain your reasoning in each case.

   a. The maximum number of dogs per house is 8.
   b. At least \( \frac{1}{2} \) of the houses have 2 or more dogs.
   c. All of the houses have dogs.
   d. Half of the houses surveyed have between 2 and 4 dogs.
   e. Most of the houses surveyed have no dogs.