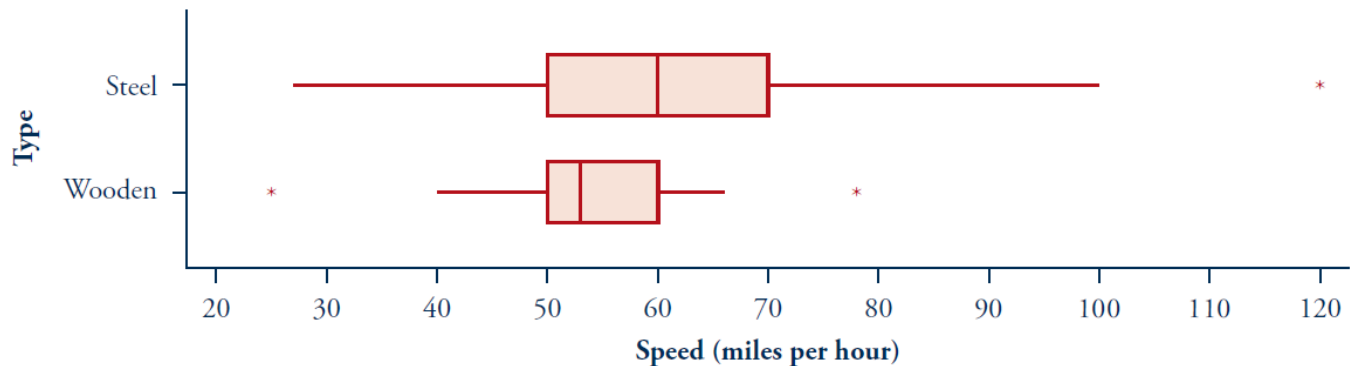


Rollercoaster Boxplots

The following boxplots display the distributions of top speeds (in miles per hour) for roller coasters in the United States, classified by whether the coaster is wooden or steel:



Observational unit: rollercoasters in the United States.

Explanatory variable: Material made of Type: Categorical - Binary

Response variable: Top Speed Type: Quantitative

- a. What proportion of the steel coasters have a top speed of 60 miles per hour (mph) or greater? Explain how you can tell from the boxplots.

50 percent of the steel coasters have a top speed of 60 miles per hour, or greater. We see this since the median is at 60, and therefore half of the data points are greater than 60.

- b. What proportion of the wooden coasters have a top speed of 60 mph or greater? Explain how you can tell from the boxplots.

25 percent of wooden coasters have a top speed of 60 miles per hour or greater. We can see this since the upper quartile is at 60, and therefore one quarter of the data points are greater than 60.

- c. Which type of coaster (steel or wooden) has a higher proportion of coasters with a top speed greater than 50 miles per hour, or are the 2 types of coasters the same, or is it possible to determine from the boxplots? Explain how you can tell (or why you cannot tell) from the boxplots.

The proportion of coasters with top speed over 50 miles per hour are the same for both types of coasters. We can see this on the box plots since 50 miles per hour occurs at the lower quartile for both types of coasters. Meaning that 75 percent of all coasters have Speeds over 50 miles per hour, regardless of whether they are wooden or steel.

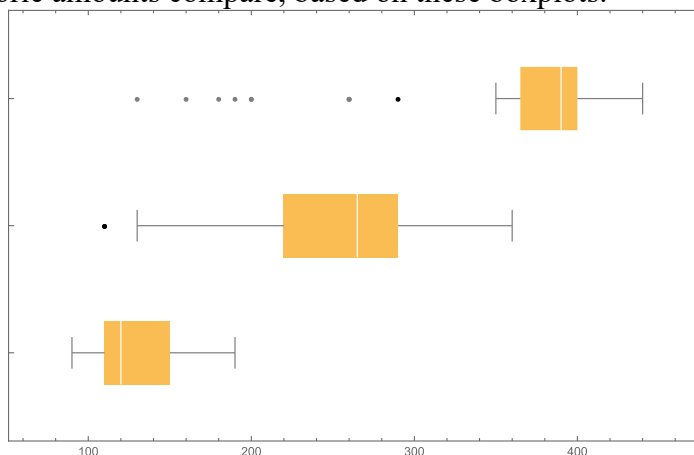
Food products are required by law to provide nutritional information on their labels, and many companies post such data on their websites. Data on calorie amounts per serving can be found at (bit.ly/introstatsdata) under “Data: IceCream.” There you will find info for various flavors of Ben & Jerry’s, Cold Stone Creamery, and Dreyer’s ice cream. A few of these values (for the first five flavors) are listed alphabetically below.

Ben & Jerry’s		Cold Stone Creamery		Dreyer’s	
Flavor	Calories Per Serving	Flavor	Calories Per Serving	Flavor	Calories Per Serving
Black & Tan	230	Amaretto	390	Almond Praline	150
Brownie Batter	310	Banana	370	Andes Cool Mint	170
Butter Pecan	280	Black Cherry	390	Butter Pecan	170
Cherry Garcia	250	Bubble Gum	390	Cherry Chocolate Chip	160
Chocolate	260	Butter Pecan	390	Cherry Vanilla	140

- a) Use technology to calculate the five-number summary of the calorie amounts for **ALL** flavors in each brand. Use “Applets: Dotplots” at bit.ly/introstatsdata. There, you will be able to cut/paste the data from “Data: IceCream.” Paste them one company at a time. Then, after clicking “Use Data,” you can then click the “Actual” check boxes for “Mean”, “Median”, and “IQR”. This will give you access to the 5 numbers. In particular, the upper and lower quartiles will be seen in blue, to the right of the graph, as part of the IQR calculation. Report these in the following table:

	Min	LQ	Median	UQ	Max
Ben & Jerry’s	110	220	265	290	360
Cold Stone	130	360	390	400	440
Dryer’s	90	110	120	150	190

- b) Click “Add Boxplot” and “Show outlier” to construct (modified) boxplots of the distribution of calorie amounts for the three brands. Reproduce them below, but on the same axis for comparison. Discuss how the three brands’ calorie amounts compare, based on these boxplots.



- c) Can you speculate about a possible problem with making comparisons of calorie amounts among the three brands based on these data? [Hint: You were not given a particularly relevant piece of information regarding “servings” at the beginning of the activity.]
What’s a serving? Are they defined the same in all three cases?

Five-number summaries and boxplots can be useful for making comparisons. There is one important problem with the previous analysis, though. Ben & Jerry’s and Dreyer’s both consider a serving to be $\frac{1}{2}$ cup of ice cream. Adapted from Workshop Statistics—Rossman/Chance. Prepared by Dr. Jodin Morey. Materials for Other Courses Found at MathTalker.org

cream, so their calorie amounts are directly comparable. But Cold Stone Creamery considers a serving to be 170 grams.

d) How could you adjust for this discrepancy (in principle, anyway)?

Find a conversion constant for the units, then apply that to each data pt.

One difficulty with converting these calorie amounts to a common serving size is that $\frac{1}{2}$ cup is a measure of volume and 170 grams is a measure of mass. The conversion is, therefore, not as simple as, say, converting inches to centimeters (both measures of length). The website (Inchcalculator.com/convert/cup-to-gram) has a “gram conversion calculator” that applies to individual food items. Gourmetsleuth.com suggests that the conversion rate for ice cream is roughly 132 grams per cup.

e) How would you use this conversion information to convert Cold Stone’s calorie amounts to a “per half cup” amount, comparable to Ben & Jerry’s and Dreyer’s?

$$\text{(CS Number)} \frac{\text{cal}}{170 \text{ g}} * 132 \frac{\text{g}}{\text{cup}} * \frac{1}{2} \frac{\text{cup}}{\text{half cup}} = \text{(CS Number)} * \frac{33}{85} \frac{\text{cal}}{\text{half cup}}$$