

FISH Application Exercise 1

One variable (univariate) application

Refer to your *FISH User's Guide* as you work through this example. Once you are finished, you can check your answers with the key on page 4.

Instructional Objectives:

1. Using technology, find, compare, and interpret the measures of center (mean, mode, and median) and measures of spread (range and standard deviation) for two data sets (NCTM, 2000).
2. Explain the mean's sensitivity to extremes and its use in comparison with the median and mode (NCTM, 2000).

Directions:

1. Open FISH and enter the following data. This is daily attendance data two weeks in August at a small water park. You just purchased the water park and you want to get some information on average attendance, how much the attendance changes from one day to the next, etc. so that you can better plan for summer staffing and programming next year. The attendance books aren't very good, but you were able to get the staff to collect accurate attendance data for this sample of summer days.

Note: When entering your data into FISH, remember to reset the "N=" to 14 and "1 variable" under the "Set # of cases and variables" box (see User's Guide).

Water park attendance data (note: enter only the attendance numbers into FISH—not the dates):

Attendance Data Set 1:

<u>Date</u>	<u>Attendance</u>
Monday, August 1	226
Tuesday, August 2	248
Wednesday, August 3	260
Thursday, August 4	204
Friday, August 5	280
Saturday, August 6	340
Sunday, August 7	338
Monday, August 8	220
Tuesday, August 9	200
Wednesday, August 10	190
Thursday, August 11	236
Friday, August 12	230
Saturday, August 13	360
Sunday, August 14	340

2. Calculate the mean, median, mode, range and standard deviation. Jot these down under *Data Set 1 descriptives* in the summary table on the page 2.

- Suppose your sample was from two weeks in July and your data looked like Attendance Data Set 2. Enter this data set into FISH and calculate the mean, median, mode, range and standard deviation. Jot these down under *Data Set 2 descriptives* in the summary table on page 2.

Attendance Data Set 2:

<u>Date</u>	<u>Attendance</u>
Monday, June 29	226
Tuesday, June 30	248
Wednesday, July 1	260
Thursday, July 2	204
Friday, July 3	280
Saturday, July 4	750
Sunday, July 5	550
Monday, July 6	220
Tuesday, July 7	200
Wednesday, July 8	190
Thursday, July 9	236
Friday, July 10	230
Saturday, July 11	360
Sunday, July 12	340

Summary Table of Water Park Attendance Statistics

Statistic	Attendance Data Set 1	Attendance Data Set 2
Mean		
Median		
Mode		
Range		
Standard Deviation		

Questions/topics for discussion:

- Compare the means of Attendance Data Set 1 and Attendance Data Set 2. What caused this difference?
- Compare the medians of Attendance Data Set 1 and Attendance Data Set 2. Why are they the same?
- Why is examining both measures of central tendency (mean and median) useful in this situation?
- Is the mode a useful statistic to examine for these data? Which data set has a modal score?
- Compare the ranges of Attendance Data Set 1 and Attendance Data Set 2. What caused this difference? Is the range a useful statistic to examine in this situation?
- Compare the standard deviations of Attendance Data Set 1 and Attendance Data Set 2. What caused this difference. How might the standard deviation help you in your quest to figure out a summer staffing plan for the water park?

Answers/topics for discussion:

Here's the completed summary table (statistics are reported at two decimal places and not rounded). If your answers differ, check to make sure you entered your data into FISH correctly.

Summary Table of Water Park Attendance Statistics

Statistic	Attendance Data Set 1	Attendance Data Set 2
Mean	262.28	306.71
Median	242	242
Mode	340	No modal value
Range	170	560
Standard Deviation	58.98	158.46

1. It looks like there were a couple of outliers in Data Set 2. Perhaps the combination of really hot weather and the 4th of July holiday falling on a weekend caused attendance on July 4 and 5 to be much higher than the other sampled days in July. Since the mean uses all the values in its calculation, it is affected by outliers or extreme values.
2. The median only uses the middle value (or two middle values) of the data (sorted by rank) in its calculation, so it is not affected by extreme values.
3. It is often useful to look at both the mean and median. Big differences in the mean and median might tell you to examine the scores for outliers or extreme scores which can “skew” the mean and make it less useful as a measure of central tendency.
4. In this case, the mode is not that useful as a measure of central tendency. The first data set had a modal attendance of 340 (occurring on two weekend days), which was considerably higher than the mean or median attendance. The second data set does not even have a modal score. You probably shouldn't use the modal attendance figure to plan staffing.
5. The range, like the mean, is affected by outliers or extreme values. By definition, the range is the difference between the highest and lowest value, so it obviously uses the most extreme values. The range might be somewhat useful in your situation—the large range in attendance tells you that your staffing needs to be flexible, as your attendance can vary by a large amount from day to day.
6. The standard deviation is likely an even more useful measure of variability for your situation. The standard deviation of data set two is much larger than that of data set one. Remember that the standard deviation is calculated using the deviation scores (the amount that each individual value differs from the mean). In order to illustrate this, go back to FISH and, using one of the two data sets in this exercise, click through steps 3 through 7 and watch the software calculate the standard deviation. The standard deviation gives you a picture of how much, on average, the values are spread out from the mean. Remember also that the standard deviation (unlike the variance) is in the same unit of measurement as the original data. For instance, the standard deviation in Attendance Data Set 1 is 59 people. So think about how you would use the standard deviation, along with the mean, to inform your staffing plan.

References

National Council of Teachers of Mathematics. (2000). *Principles and standards for school mathematics*. Reston, VA: National Council of Teachers of Mathematics Inc.