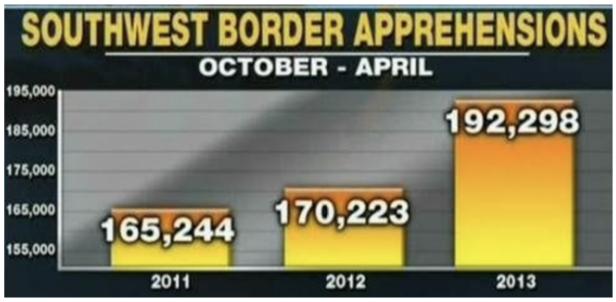
Deep Thoughts
Unit 1: One Variable Data

1. The following graph was displayed by a national news organization. Explain why the graph may be misleading, and sketch a corrected version of the graph.



Solution: The vertical axis doesn't start at 0, so the different heights are exaggerated.

2. A real estate agent is collecting data on the number of houses built in his towns three neighbourhoods during three different decades. The table below gives information.

	1960s	1970s	1980s
Shady Lane	40	30	10
Oakcrest	60	15	5
Pinewood Estates	0	45	15

(a) What proportion of houses were built in Pinewood Estates?

Solution: 60/200=0.27

(b) Find the distribution of Decade Built for the houses in this town using relative frequencies.

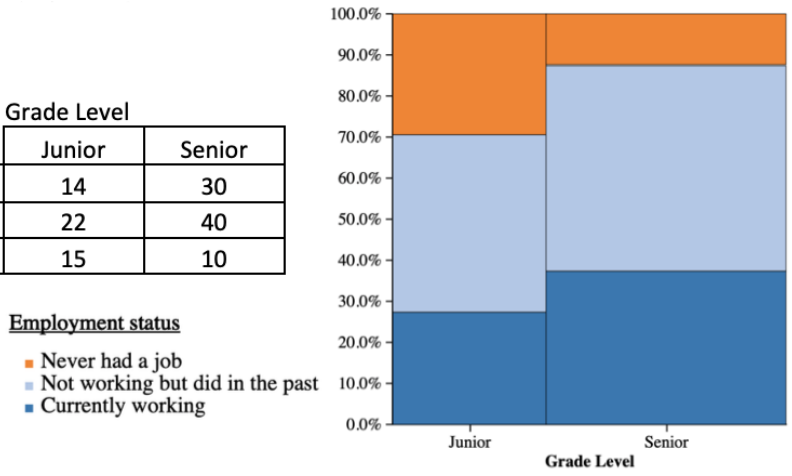
Solution: 60's: 45.5%, 70's: 90/220=40.9%, 80's: 30/220=13.6%

(c) What percent of homes were built in Oakcrest and in the 1960s?

Solution: 60/220=27.3%

3. The following table gives the result of a random sample of upper level students at Rocky Vista University (the Fighting Prarie Dogs!), along with a mosaic plot.

Employment Status	Grade Level: Junior	Grade Level: Senior
Currently working	14	30
Not working but have had a job	22	40
Never had a job	15	10



(a) Calculate the proportion of Junior that are currently working, not working but have had a job, and never had a job.

Solution: Currently Working: 14/51=0.27
Not working but have had job: 22/50=0.43
Never had a job: 15/51=0.29

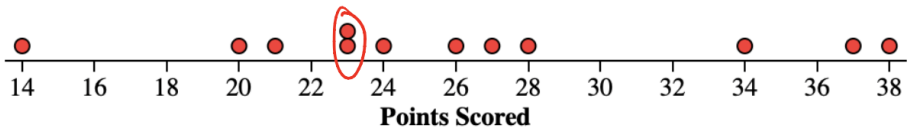
(b) Calculate the proportion of Seniors that are currently working, not working but have had a job, and never had a job.

Solution: Currenty Working: 30/80=0.38
Not working but have had a job: 40/80=0.50
Never had a job: 10/80=0.13

(c) Write a few sentences summarizing what the display in part (a) reveals about the association between grade level and job experience for the students the sample.

Solution: There is an association between grade level and job experience. Knowing the grade level of the student helps us predict job experience

4. Mr. Kevin is a huge fan of University of Michigan football. His favourite season was the 1997 season. The dotplot shows the number of points scored by the U of M team in the 12 games that season.



(a) Use the dots to create a stemplot of the distribution.

Solution:

1 | 4
2 | 0 1 3 3 4 6 7 8
3 | 4 7 8

Points scored

Key: 1|4 means 14.

(b) Are there any potential outliers? Why?

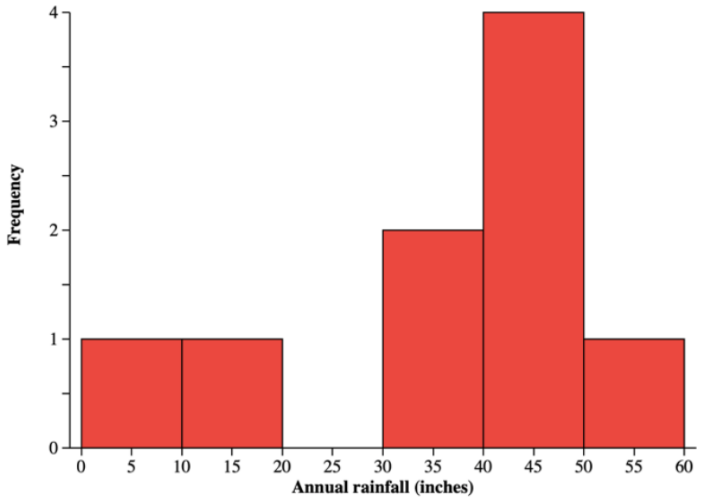
Solution: 37 and 38 are both far from the center

(c) What measure of center is the most appropriate to describe the distribution? Explain.

Solution: Mean, the distribution is roughly symmetric so the mean is appropriate.

5. A researcher is interested in how much annual rainfall is typical in the United States. She takes a random sample of 9 cities in the U.s. and records the annual rainfall, in inches.

8.2
10.3
33.5
39.1
40.5
41.9
42.4
44.9
53.7



(a) Calculate the mean annual rainfall for these cities.

Solution: 34.94 inches

(b) Find the median annual rainfall for these cities.

Solution: 40.5 inches.

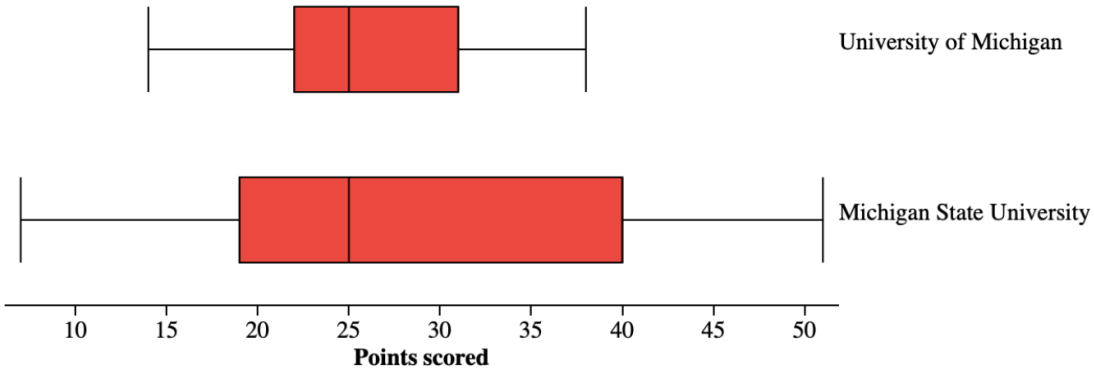
(c) Would you use the mean or the median to summarize the typical annual rainfall for a U.S. city? Explain

Solution: Median as the distribution of rainfall is skewed left.

(d) The standard deviation of the annual rainfall for these 9 cities is 15.52 inches. Interpret this value.

Solution: The annual rainfall for a city typically varies by 15.52 from the mean of 34.94 inches.

6. Mr. Wilcox is a huge fan of University of Michigan football. His favorite season was the 1997 season (a perfect season!). Here is a back-to-back boxplot of the points scored by the 1997 University of Michigan football team and the archrival Michigan State University football team. Write a few sentences comparing the distributions.



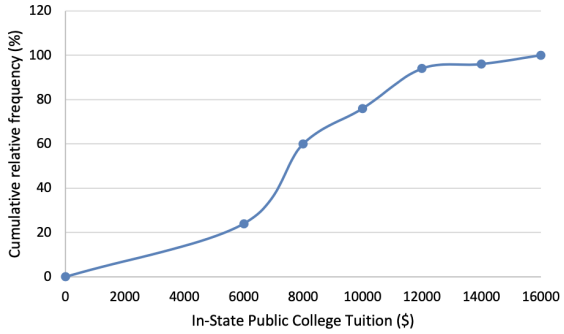
Solution: The distribution of points scored by U of M is roughly symmetric while the distribution of points scored by MSU is slighly skewed right. The centers of both U of M and MSU are the same with medians of 25 points. MSU has much greater variability that U of M, with an IQR of about 22 as opposed to U of M's IQR of about 9 points. Never U of M or MSY have any outliers.

Deep Thoughts
Unit 1: One Variable Data

1. According to a 2019 article at inder.com. the state of Pennsylvania was at the 82nd percentile for Pre-K to 12th grade education and was at the 0th percentile for higher education. Explain what these values mean.

Solution: 82% of states have a Pre-K to 12th grade rating that is less than or equal to Pennsylvania. There are no states with a higher education rating less than or equal to Pennsylvania.

2. The graph displays the cumulative relative frequency of the cost of in-state public college education for each of the 50 states.



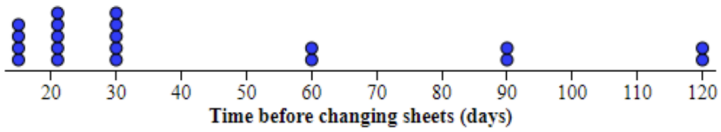
(a) About what percent of states have in state public college tuition less than or equal to \$8000? More than \$8000?

Solution: About 60% of states have tuition less than of equal to \$8000.
About 40% of states have tuition more than \$8000.

(b) Estimate Q_1, Q_3, and the IQR of the distribution of phone in state public tuition.

Solution: $Q_1 \approx \$6000$, $Q_3 \approx \$10000$. $IQR = 10000 - 60000 = \$4000$

3. According to an article at Yahoo news, you should change your sheets every 7 days at minimum. To investigate the sheet changing habits of adults, a random sample of 20 adults reported how often they change their sheets using an anonymous survey. Here is a dotplot and summary statistics of the results.



n	mean	SD	min	Q_1	med	Q_3	max
20	42.75	34.984	15	21	30	60	120

(a) Suppose you convert the time before changing sheets from days to weeks.Describe the shape, mean, and standard deviation of the distribution of time before changing sheets in weeks.

Solution: Shape: The shape of the distribution in weeks is the same as in days, skewed right.
Mean: 42.75 days / 7 = 6.107 weeks.
SD: 3.4984/7=4.998 weeks.

(b) The adults in the study are given an article explaining the health benefits that would arise from changing their sheets more often. After reading the article each person agrees to change their sheets one week sooner than they used to. How does the shape, center, and variability, of this distribution compare with the distribution of time in part (a)?

Solution: Shape: Stays the same, skewed to the right.
Center: 6.107-1=5.107 weeks
SD: Stays the same: 4.998 weeks.

(c) Now suppose you convert the time before changing the sheets from part (b) to z scores. What would be the shape, mean, and standard deviation of the distribution. Explain your answers.

Solution: Shape: Stays the same
Mean: (5.107-5.107)/4.998=0weeks.
SD: 4.998/4.998 = 1 week

ALL standardized distributions have a mean of 0 and standard deviation of 1.