Homework №2

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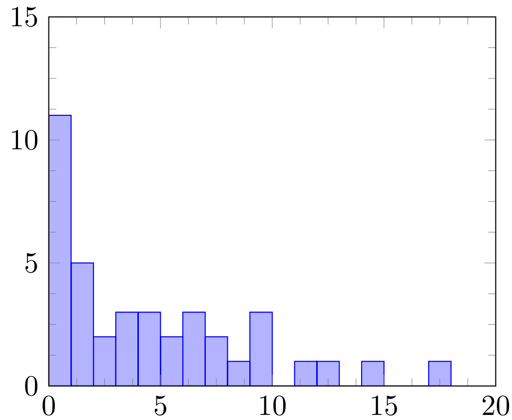
2.4 Well, since \$270, 900 is nowhere near \$340, 300, it means that the distribution is not symmetric. Now, since the distribution is not symmetric, it means that it is skewed. In this case, it would be a right-skewed distribution and therefore the mean will be greater than the median. Finally, we have that the mean is \$340, 300 and the median is \$270, 900.

2.5 The mean is the sum of CO_2 emission for all states divided by 39. After a tedious calculation, one will get that the mean is approximately 4.606. The median, in this case, will be the 20^{th} element in the list of this data in the sorted order. The data in the sorted order looks like this:

```
data = [0.0746, 0.1113, 0.1522, 0.1732, 0.3038,
        0.3109, 0.3716, 0.4932, 0.4941, 0.8731,
        0.9321, 1.5994, 1.6295, 1.6662, 1.7281,
        1.8032, 2.1503, 2.6228, 3.3315, 3.7034,
        3.7636, 4.131, 4.4469, 4.471, 5.5554,
        5.8535, 6.1949, 6.6449, 6.7177, 7.6765,
        7.9251, 8.3086, 9.1148, 9.1857, 9.2041,
        11.4869, 12.2255, 14.6261, 17.5642]
```

Then it is easy to see that the 20^{th} element is 3.7034 and therefore the median is 3.7034.

Here is the histogram for the given data:



The mean is larger than the median since we have a right-skewed distribution with outliers.

2.6 (a) The stemplot for the data of defensive linemen is

24	2	
25	2	4
26	0	
27	4	
28		
29	7	
30	0	3
31	1	
32	3	

Five-number summary

Minimum is 242.

Q_1 is 254.

Median is $\frac{274+297}{2} = 285.5$.

Q_3 is 303.

Maximum is 323.

(b) The stemplot for the data of offensive linemen is

29	8		
30	1	5	
31	0	5	8
32	0	1	
33	2		

Five-number summary

Minimum is 298.

Q_1 is $\frac{301+305}{2} = 303$.

Median is 315.

Q_3 is $\frac{320+321}{2} = 320.5$.

Maximum is 332.

(c) The stemplot for offensive linemen is symmetric and has not outliers. The stemplot for defensive linemen is almost symmetric and also does not have any outliers. The group of offensive linemen are heavier since its datapoints have higher values

2.7 (a) **Five-number summary**

Minimum is 11.

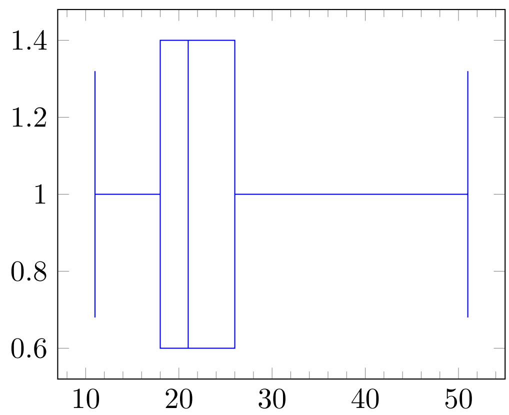
Q_1 is 18.

Median is 21.

Q_3 is 26.

Maximum is 51.

(b) Here is the boxplot for the given data:



It is easy to see that the distribution is right-skewed. This is due to the box being more to the left of the graph. There are no unusually small observations. There are some unusually large observations, namely 43, 45, 47, 50 and 51.

2.9

- Which of these are suspected outliers by the $1.5 \times \text{IQR}$ rule?

  Notice that $1.5 \times \text{IQR} = 1.5 \times (26 - 18) = 12$ and therefore an outlier would be a datapoint with the value less than 6 or greater than 38. Therefore, the outliers would be the datapoints 40, 40, 40, 43, 45, 47, 50, and 51.

- In this case, the cars producing the high outliers share a common feature. What do you think that is?

  There might be a lot of reasons actually. For instance, it might be that these cars were malfunctioning (wrong gears, worn out tyres etc.) or it might be that they were overspeeding etc.

2.10 (a) $\dfrac{6.2 + 12.8 + 7.6 + 15.4}{4} = \dfrac{19 + 23}{4} = \dfrac{42}{4} = 10.5.$

(b)

$$
\begin{aligned}
s &= \sqrt{\frac{1}{4-1}((10.5-6.2)^2+(10.5-12.8)^2+(10.5-7.6)^2+(10.5-15.4)^2)} \\
&= \sqrt{\frac{1}{3}(4.3^2+(-2.3)^2+2.9^2+(-4.9)^2} \\
&= \sqrt{\frac{1}{3}(18.49+5.29+8.41+24.01)} \\
&= \sqrt{\frac{56.2}{3}} \approx \sqrt{18.73} \approx 4.327
\end{aligned}
$$

(c) I entered the data into the calculator and the results agree with my hand calculations. Follow this link to verify – `https://www.calculator.net/standard-deviation-calculator.html?numberinputs=6.2%2C+12.8%2C+7.6%2C+15.4&x=26&y=29`.

2.11 $\overline{x_A} \approx 7.5$ and $s_A \approx 2.03$.
$\overline{x_B} \approx 7.5$ and $s_B \approx 2.03$.

Indeed, $\overline{x_A} \approx \overline{x_B}$ and $s_A \approx s_B$.

Here are the stemplots for the datasets A (to the left) and B (to the right):

Data A				
3	10			
4	74			
5				
6	13			
7	26			
8	10	14	74	77
9	13	14	26	

Data B			
5	25	56	76
6	58	89	
7	71	04	91
8	47	84	
9			
10			
11			
12	50		

where $3 \mid 10 = 3.10$, $4 \mid 74 = 4.74$ etc.

Data A is left-skewed while Data B is right-skewed (also looks like uniform one with 50 being an outlier).

2.12 (a) No since the distribution is not symmetric.

(b) Yes since the distribution is symmetric.

(c) No since the distribution is not symmetric.

2.13
- State: Is logging the cause of decline in number of trees?
- Plan: We have to find the mean and the standard deviation.
- Solve: $\overline{x_{\text{Group 1}}} = 23.75$, $\overline{x_{\text{Group 2}}} = 14.08$, $\overline{x_{\text{Group 3}}} = 15.78$.
  $s_{\text{Group 1}} = 5.06$, $s_{\text{Group 2}} = 4.98$, $s_{\text{Group 3}} = 5.76$.
- Conclude: It appears that logging indeed has a negative effect on the number of trees. If no logging is present, the average number of trees is higher.

2.29
- Do the boxplots fail to reveal any important information visible in the stemplots of Figure 2.5?

  Generally speaking, no since the boxplot still shows us the shape of the distribution. However, in this case, boxplots did not show the gap in the south between the rates of DC and Georgia. Therefore, boxplots did not fail to show the general overview, but they did fail to reveal some particular information.
- Which plots make it simpler to compare the regions?

  Boxplots since one could compare the spread and the center right away which is not possible in stemplots.

33. (a) Symmetric distributions are best summarized with $\overline{x}$ and s. Since the distribution in the exercise 1.38 is symmetric, $\overline{x}$ and s are indeed appropriate measures in this case.

(b) With the datapoint 229, we get that $\overline{x} \approx 59.71$ and $s \approx 63.03$.
Without the datapoint 229, we get that $\overline{x} \approx 51.25$ and $s \approx 50.97$.

Hence, we got that the mean decreased by approximately 8.46 and that the standard deviation decreased by approximately 12.06.

(c) With the outlier, we get that $M = 61$ and without it, we get that $M = 57.5$. Therefore, we got that the median decreased by 3.5. Since the mean decreased by approximately 8.46 and the median decreased by 3.5, it is clear that the median is more resistant than the mean.