

HW key

Statistics Chapter 4: Practice Shifting and Scaling – KEY

How much sugar is in your breakfast cereal? Here are several cereals selected from the list posted at <http://www.acaloriecounter.com/breakfast-cereal.php>

1. In column B, convert the sugar content in grams to teaspoons by multiplying each value by 0.22
2. In column C, calculate the number of grams of sugar in a serving of cereal with one cup of milk by adding 11 grams to column A
3. In column D, convert the grams of sugar in a serving of cereal and milk to teaspoons by multiplying column C by 0.22
4. Complete the statistics for each column

	^{L1} A	^{L2} B	^{L3} C	^{L4} D
MIN	1	0.22	12	2.64
Q1	9	1.98	20	4.4
MED	11	2.42	22	4.84
Q3	13	2.86	24	5.28
MAX	17	3.74	28	6.16
RANGE	16	3.52	16	3.52
MEAN	10.167	2.237	21.167	4.657
IQR	4	0.88	4	0.88
Std Dev	4.246	0.934	4.246	0.934

^{L1} A	^{L2} B	^{L3} C	^{L4} D
grams sugar	teaspoons sugar (A x 0.22)	grams sugar w/milk (A + 11)	teaspoons sugar w/milk (C x 0.22)
1	0.22	12	2.64
3	0.66	14	3.08
4	0.88	15	3.3
6	1.32	17	3.74
9	1.98	20	4.4
9	1.98	20	4.4
10	2.2	21	4.62
10	2.2	21	4.62
11	2.42	22	4.84
11	2.42	22	4.84
12	2.64	23	5.06
13	2.86	24	5.28
13	2.86	24	5.28
13	2.86	24	5.28
13	2.86	24	5.28
14	3.08	25	5.5
14	3.08	25	5.5
17	3.74	28	6.16

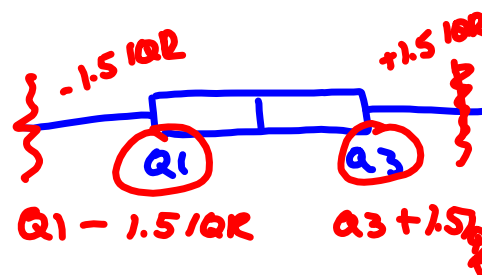
1. Examine parallel boxplots of each column on your calculator. Using the boxplots and your answers to question 4, describe how the shape, center, and spread change when the values are rescaled (A to B and C to D) and when the values are shifted (A to B).

	Rescaled (x.22)	Shifted
Shape	Unchanged	Unchanged
Center	Multiplied by 0.22	Increased by 11
Spread	Multiplied by 0.22	unchanged

11. Vineyards.

$$\begin{aligned}
 \text{Upper Fence: } Q3 + 1.5(IQR) &= 55 + 1.5(55 - 18.5) \\
 &= 55 + 54.75 \\
 &= \underline{109.75}
 \end{aligned}$$

$$\begin{aligned}
 \text{Lower Fence: } Q1 - 1.5(IQR) &= 18.5 - 1.5(55 - 18.5) \\
 &= 18.5 - 54.75 \\
 &= -36.25
 \end{aligned}$$



The maximum of 250 acres is well above the upper fence of 109.75 acres. Therefore, there is at least one high outlier, 250 acres. Since the lower fence is negative, there are no low outliers, since it is certainly impossible to have a vineyard with negative size.

14. Fruit flies.

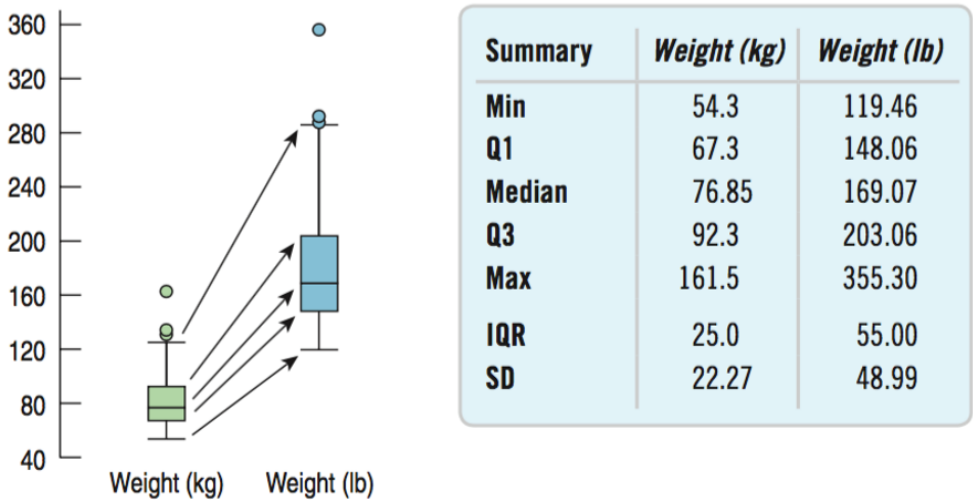
- a) The most fruit flies died around day 16. Over 60,000 fruit flies died that day.
- b) At around day 50, the number of fruit flies wasn't changing by very much day to day.

16. Cell phones.

- a) The minimum and maximum are measures of position, so they would each increase by \$3. The range is a measure of spread, and would remain the same.
- b) The median and quartiles are measures of position, so they would each increase by \$3. The IQR is a measure of spread, and would remain the same.
- c) The mean is a measure of center, so it would increase by \$3. The standard deviation is a measure of spread, and would remain the same.

Rescaling Data (cont.)

- What does the boxplot indicate about all measures?



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What Can Go Wrong? (cont.)

- Avoid inconsistent scales, either within the display or when comparing two displays.
- Label clearly so a reader knows what the plot displays.
 - Good intentions, bad plot:
- Beware of outliers.

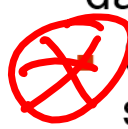



What have we learned?

- We've learned the value of comparing data groups and looking for patterns among groups and over time.
- We've seen that boxplots are very effective for comparing groups graphically.
- We've experienced the value of identifying and investigating outliers.
- We've graphed data that has been measured over time against a time axis and looked for long-term trends both by eye and with a data smoother.

What have we learned? (cont.)

- We've learned that the story data can tell may be easier to understand after shifting or rescaling the data.

 Sometimes we shift data by adding or subtracting the same amount, changing the center, but not the spread.

 Sometimes we scale the data by multiplying or dividing by a constant, which changes all our summary statistics.

Homework: Read Pg. 101 In Your World
and answer the following questions:

1. Many of the bars in the histogram for incomes of high school graduates are taller than those for the college graduates. Why isn't that a good thing?

2. What do the two graphs show about the prospects of earning a high income?