Math 247 Take Home Test Key

Sugar (grams) data:

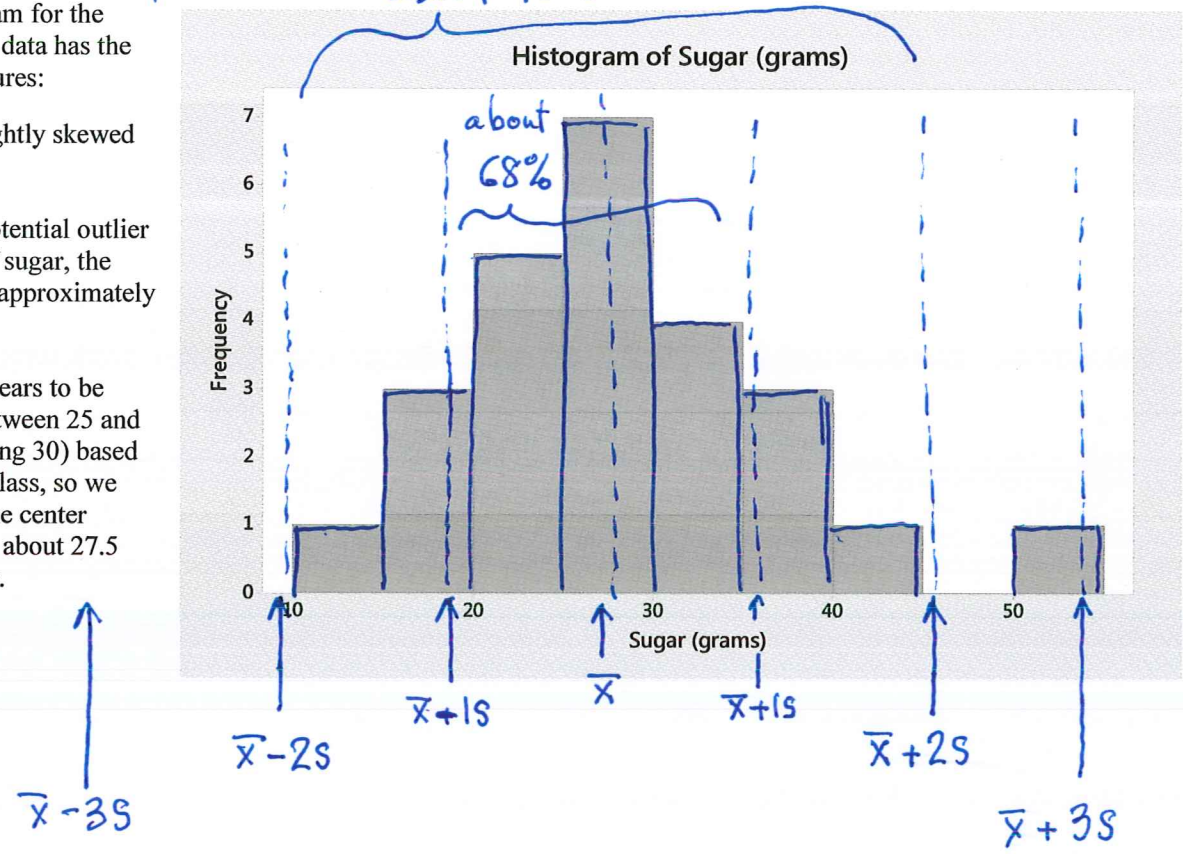
13	15	16	18	20	22	22	22	24	25
26	26	26	27	27	28	32	32	33	34
35	35	39	40	52					

1. The histogram for the Sugar Content data has the following features:

The data is slightly skewed to the right.

Without the potential outlier of 52 grams of sugar, the data would be approximately symmetric.

The center appears to be somewhere between 25 and 30 (not including 30) based on the modal class, so we can estimate the center (median) to be about 27.5 grams of sugar.



Descriptive Statistics: Sugar (grams)

Variable	N	N*	Mean	SE Mean	StDev	Minimum	Q1	Median	Q3	Maximum
Sugar (grams)	25	0	27.56	1.77	8.84	13.00	22.00	26.00	33.50	52.00

2. According to the Descriptive Statistics values found using Minitab (see printout above), the mean amount of sugar in these drinks is 27.56 grams of sugar and the standard deviation is 8.84 grams of sugar.

$\bar{x} = 27.56$ grams $\quad s = 8.84$ grams

Calculations: $\bar{x} - 1s = 27.56 - 1(8.84) = 18.72$, $\quad \bar{x} + 1s = 27.56 + 1(8.84) = 36.4$

$\bar{x} - 2s = 27.56 - 2(8.84) = 9.88$ $\quad \bar{x} + 2s = 27.56 + 2(8.84) = 45.24$

$\bar{x} - 3s = 27.56 - 3(8.84) = 1.04$ $\quad \bar{x} + 3s = 27.56 - 3(8.84) = 54.08$

2 (continued). Discussion of how Empirical Rule fits with data:

Note that we can apply the Empirical Rule since the data is roughly symmetric, though we shouldn't expect perfect agreement since the data isn't perfectly symmetrical.

The Empirical Rule states that we should see approximately 68% of the data fall within 1 standard deviation from the mean. Looking at the histogram, this looks believable. If we look at the actual data we find that 18/25 = 72% of the data falls between 18.72 g and 36.4 g, which is close but not perfect agreement, which is what we suspected.

Again according to the Empirical Rule, we should see about 95% of the data within 2 standard deviations of the mean. Looking at the histogram, again, this seems correct since only one data value is outside of this range. Looking at the actual data we can see that all values but the potential outlier lie within 2 standard deviations, which is 24/25 = 96% of the data values, so almost perfect agreement.

Finally, we should see all or almost the data fall within 3 standard deviations of the mean. Looking at the histogram, we see that this is in fact the case and 100% of the data is within 3 standard deviations, including the outlier of 52 grams of sugar.

3. The Five-Number Summary for these data is 13g, 22g, 26g, 33.5g, 52g

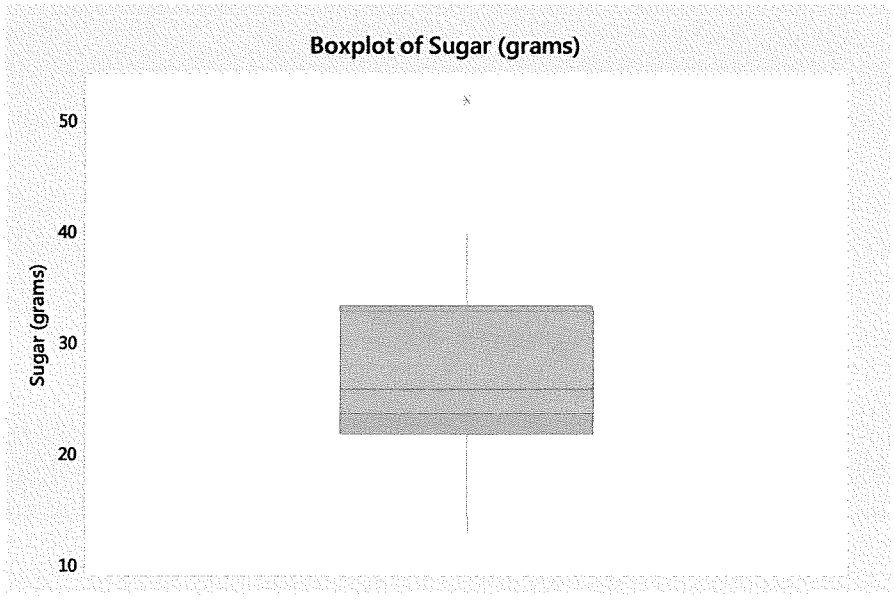
4. IQR = $Q_3 - Q_1 = 33.5 - 22 = 11.5$ grams of sugar

5. Lower Outlier Limit = $Q_1 - 1.5\text{IQR} = 22 - 1.5(11.5) = 4.75$ grams of sugar

   Upper Outlier Limit = $Q_3 + 1.5\text{IQR} = 33.5 + 1.5(11.5) = 50.75$ grams of sugar

6. According to these limits, there are no data values below the lower limit, so no lower outliers (unsurprising), but the data value of 52 grams of sugar is above the upper limit, so it is an outlier.

7. The boxplot graph shows an asterisk for the value of 52 so it confirms the work above that shows this data value is an outlier.



8. z-score for x = 52 grams:

$$z = \frac{x - \bar{x}}{s} = \frac{52 - 27.56}{8.84} = 2.765$$

The outlier of 52 grams of sugar is 2.765 standard deviations from the mean. Since this value is well over 2 standard deviations and actually is closer to 3 standard deviations, we see that it is a very unusual value.