Problems

- (2.4.1) Here are the data from Exercise 2.3.10 on the number of virus-resistant bacteria in each of 10 aliquots: $[14, 15, 13, 21, 15, 14, 26, 16, 20, 13]$
  - Determine the median and the quartiles.
  - Determine the interquartile range.
  - How large would an observation in this data set have to be in order to be an outlier?
- (2.6.6) Ten patients with high blood pressure participated in a study to evaluate the effectiveness of the drug Timolol in reducing their blood pressure. The accompanying table shows systolic blood pressure measurements taken before and after 2 weeks of treatment with Timolol. Calculate the mean and SD of the change in blood pressure (note that some values are negative). (Note: The changes are $[-13, -29, -7, 2, -10, -43, 4, 15, -13, -30]$.)
- (2.6.11) Listed in increasing order are the serum creatine phosphokinase (CK) levels (U/l) of 36 healthy men. (They are 25, 42, 48, 57, 58, 60, 62, 64, 67, 68, 70, 78, 82, 83, 84, 92, 93, 94 ,95, 95, 100, 101, 104, 110, 110, 113, 118, 119, 121, 123, 139, 145, 151, 163, 201, 203.) The sample mean CK level is 98.3 U/l and the SD is 40.4 U/l. What percentage of the observations are within
  - 1 SD of the mean?
  - 2 SDs of the mean?
  - 3 SDs of the mean?
- (2.7.2) The mean and SD of a set of 47 body temperature measurements were as follows: $y = 36.497\,°\mathrm{C}$, $s = 0.172\,°\mathrm{C}$. If the 47 measurements were converted to °F,
  - What would be the new mean and SD?
  - What would be the new coefficient of variation?

1. Sort them from the smallest to the largest: $13, 13, \underset{\underset{Q_1}{\uparrow}}{14}, 14, 15, \vdots\, 15, 16, \underset{\underset{Q_3}{\uparrow}}{20}, 21, 26.$

median $= 15$

$Q_1 = 14$, $Q_3 = 20$, $IQR = Q_3 - Q_1 = 6$.

Outlier: (use the method given by the textbook)

Lower fence $= Q_1 - 1.5 \times IQR = 5$

Upper fence $= Q_3 + 1.5 \times IQR = 29$

So that in order to be an outlier the minimal observation is 29.

2. $$\text{mean} = \frac{1}{10}\left(\sum_{i=1}^{10} Y_i\right) = -12.4$$

$$SD = \sqrt{\frac{1}{10-1}\sum_{i=1}^{10}(Y_i - \bar{Y})^2} = 17.59$$

3. mean $= 98.3$, $SD = 40.4$

(1) the interval of mean ± 1·SD = [57.9, 138.7]
And there are 26 observations out of 36
with in this interval, hence the percentage is
$26/36 = 72.2\%$ (Empirical 68%)

(2) mean ± 2·SD = [17.5, 179.1]
there are 34 out of 36 observations,
percentage is $34/36 = 94.4\%$. (Empirical 95%)

(3) mean ± 3·SD = [−22.9, 219.5].
All observations are in this region, hence
percentage is 100%. (Empirical >99%)

4. The transformation is

$$Z = 1.8Y + 32.$$

We know that

$$\bar{z} = 1.8\bar{y} + 32 = 1.8 \times 36.497 + 32 = 97.695$$

$$s(z) = 1.8 \cdot s(y) = 1.8 \times 0.172 = 0.310.$$

(The definition of coefficient of Variation
is $(s/\bar{y}) \times 100\%$).

Hence the new coefficient of variation
is

$$100\% \times s(z)/\bar{z} = 0.32\%.$$