1. **Problem**

A machine fills milk into 250ml packages. It is suspected that the machine is not working correctly and that the amount of milk filled differs from the setpoint $\mu_0 = 250$. A sample of 180 packages filled by the machine are collected. The sample mean $\bar{y}$ is equal to 230.7 and the sample variance s_{n-1}^2 is equal to 81.36.

Test the hypothesis that the amount filled corresponds on average to the setpoint. What is the absolute value of the t-test statistic?

Solution

The t-test statistic is calculated by:

$$t = \frac{\bar{y} - \mu_0}{\sqrt{\frac{s_{n-1}^2}{n}}} = \frac{230.7 - 250}{\sqrt{\frac{81.36}{180}}} = -28.707.$$

The absolute value of the t-test statistic is thus equal to 28.707.

2. **Problem**

A machine fills milk into 125ml packages. It is suspected that the machine is not working correctly and that the amount of milk filled differs from the setpoint $\mu_0 = 125$. A sample of 214 packages filled by the machine are collected. The sample mean $\bar{y}$ is equal to 135.6 and the sample variance s_{n-1}^2 is equal to 7.13.

Test the hypothesis that the amount filled corresponds on average to the setpoint. What is the value of the t-test statistic?

(a) 58.072

(b) 58.828

(c) 53.966

(d) 57.775

(e) −54.044

Solution

The t-test statistic is calculated by:

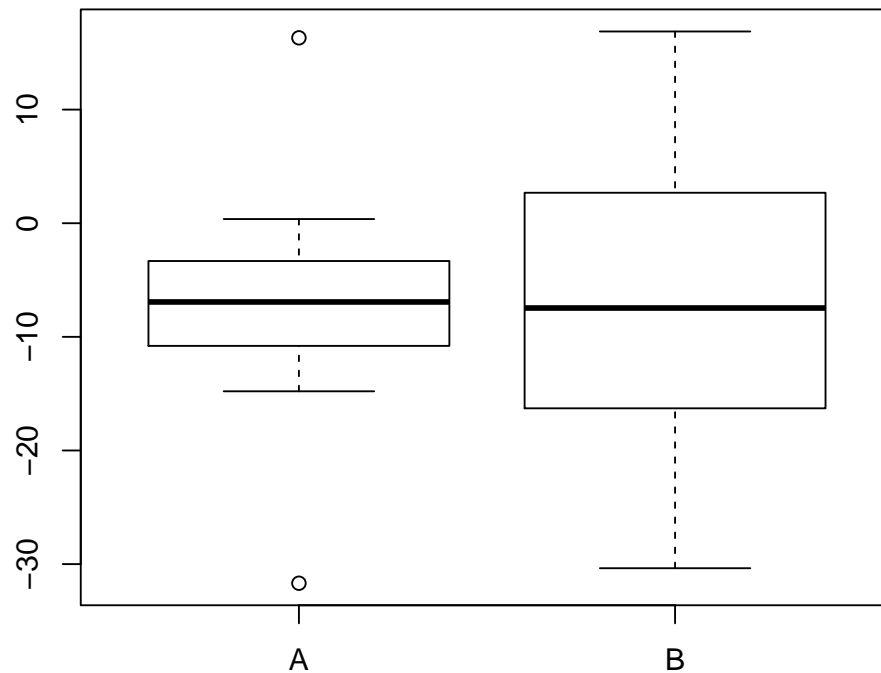$$t = \frac{\bar{y} - \mu_0}{\sqrt{\frac{s_{n-1}^2}{n}}} = \frac{135.6 - 125}{\sqrt{\frac{7.13}{214}}} = 58.072.$$

The t-test statistic is thus equal to 58.072.

(a) True

(b) False

(c) False

(d) False

(e) False

3. **Problem**

In the following figure the distributions of a variable given by two samples (A und B) are represented by parallel boxplots. Which of the following statements are correct? *(Comment:*

The statements are either about correct or clearly wrong.)

(a) The location of both distributions is about the same.

(b) Both distributions contain no outliers.

(c) The spread in sample A is clearly bigger than in B.

(d) The skewness of both samples is similar.

(e) Distribution B is about symmetric.

Solution

(a) True. Both distributions have a similar location.

(b) False. There are observations which deviate more than 1.5 times the interquartile range from the median.

(c) False. The interquartile range in sample A is *not* clearly bigger than in B.

(d) True. The skewness of both distributions is similar, both are about symmetric.

(e) True. Distribution B is about symmetric.

4. **Problem**
   What is the name of the R function for least-squares regression?
   Solution
   `lm` is the R function for least-squares regression. See `?lm` for the corresponding manual page.
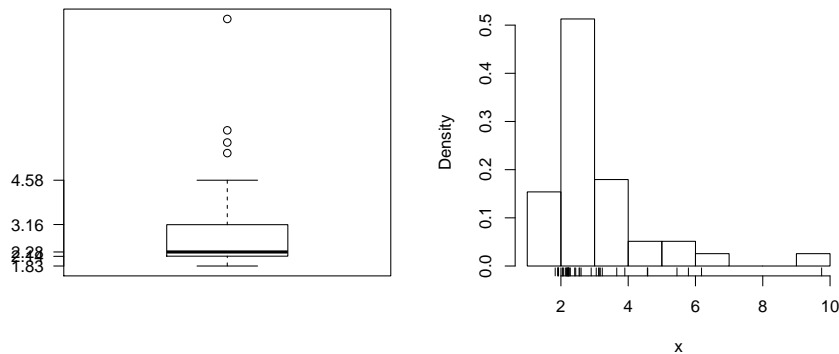
5. **Problem**
   For the 39 observations of the variable `x` in the data file `boxhist.csv` draw a histogram, a boxplot and a stripchart. Based on the graphics, answer the following questions or check the correct statements, respectively. *(Comment: The tolerance for numeric answers is ± 0.3, the true/false statements are either about correct or clearly wrong.)*

   (a) The distribution is unimodal. / The distribution is *not* unimodal.

(b) The distribution is symmetric. / The distribution is right-skewed. / The distribution is left-skewed.

(c) The boxplot shows outliers. / The boxplot shows *no* outliers.

(d) A quarter of the observations is smaller than which value?

(e) A quarter of the observations is greater than which value?

(f) Half of the observations are greater than which value?

Solution

(a) True. / False.

(b) False. / True. / False.

(c) True. / False.

(d) 2.14.

(e) 3.16.

(f) 2.28.

6. **Problem**

On 2013-05-03 one Euro (€) was buying 1.3109 US Dollars ($) and 0.8431 British Pounds (£). At Frankfurter Börse around noon adidas AG was the largest winner compared with the day before with a price of € 84.8492 per share. If you buy 95 shares, how much are they worth in €?

Solution

The worth in € is the number of shares × stock price × exchange rate, i.e., $95 \times 84.8492 \times 1 \approx 8060.674$.