1. **Problem**
   A machine fills milk into 500ml packages. It is suspected that the machine is not working correctly and that the amount of milk filled differs from the setpoint $\mu_0 = 500$. A sample of 135 packages filled by the machine are collected. The sample mean $\bar{y}$ is equal to 495.2 and the sample variance s^2_{n-1} is equal to 504.94.

   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:

$$t = \frac{\bar{y} - \mu_0}{\sqrt{\frac{s^2_{n-1}}{n}}} = \frac{495.2 - 500}{\sqrt{\frac{504.94}{135}}} = -2.482.$$

   The absolute value of the t-test statistic is thus equal to 2.482.

2. **Problem**
   A machine fills milk into 500ml packages. It is suspected that the machine is not working correctly and that the amount of milk filled differs from the setpoint $\mu_0 = 500$. A sample of 247 packages filled by the machine are collected. The sample mean $\bar{y}$ is equal to 487.2 and the sample variance s^2_{n-1} is equal to 294.02.

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

   (a) 31.622
   (b) -39.019
   (c) -11.732
   (d) 17.396
   (e) -12.227

   Solution
   The t-test statistic is calculated by:

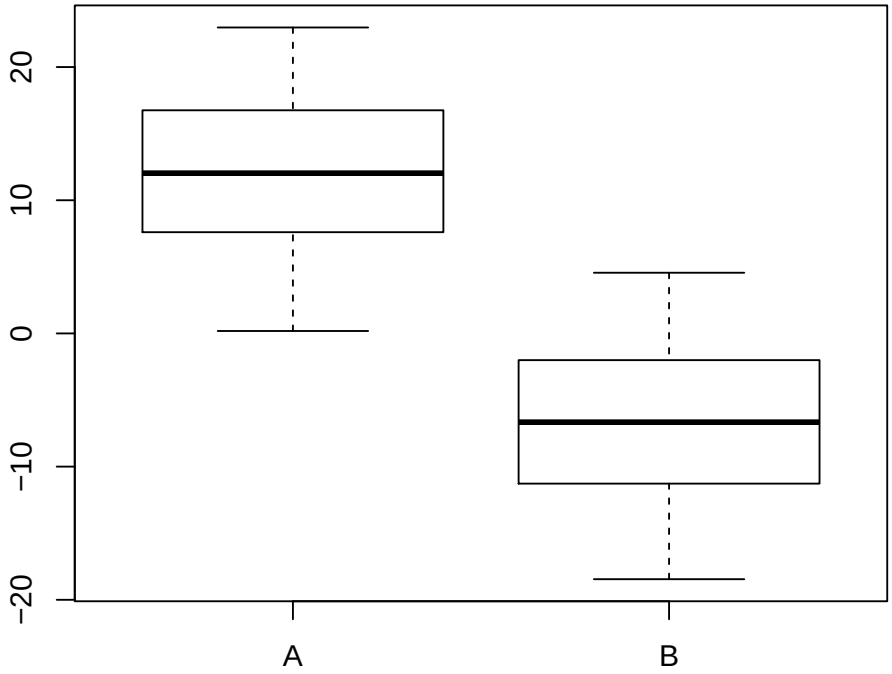
$$t = \frac{\bar{y} - \mu_0}{\sqrt{\frac{s^2_{n-1}}{n}}} = \frac{487.2 - 500}{\sqrt{\frac{294.02}{247}}} = -11.732.$$

   The t-test statistic is thus equal to -11.732.

   (a) False
   (b) False
   (c) True
   (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 left-skewed.

Solution

(a) False. Distribution A has on average higher values than distribution B.

(b) True. Both distributions have no observations which deviate more than 1.5 times the interquartile range from the box.

(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) False. 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 46 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.

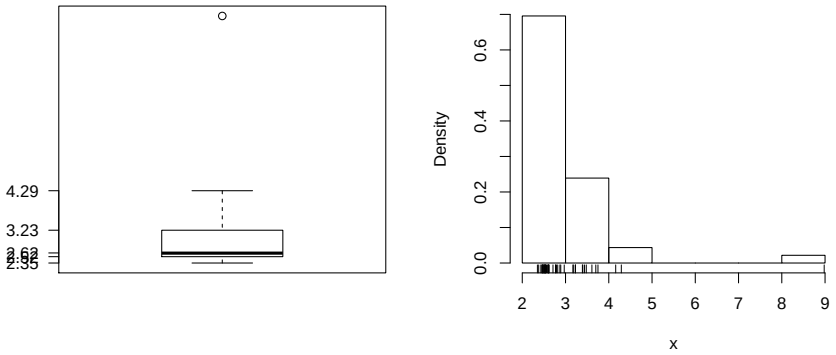
(c) The boxplot shows outliers. / The boxplot shows *no* outliers.

(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) 2.52.

(e) 3.23.

(f) 2.62.

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 48 shares, how much are they worth in £?

Solution
The worth in £ is the number of shares × stock price × exchange rate, i.e., $48 \times 84.8492 \times 0.8431 \approx 3433.745$.