1. **Problem**

   A machine fills milk into 1000ml packages. It is suspected that the machine is not working correctly and that the amount of milk filled differs from the setpoint $\mu_0 = 1000$. A sample of 220 packages filled by the machine are collected. The sample mean $\bar{y}$ is equal to 1026.5 and the sample variance s_{n-1}^2 is equal to 532.89.

   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:

   $$t = \frac{\bar{y} - \mu_0}{\sqrt{\frac{s_{n-1}^2}{n}}} = \frac{1026.5 - 1000}{\sqrt{\frac{532.89}{220}}} = 17.027.$$

   The absolute value of the t-test statistic is thus equal to 17.027.

2. **Problem**

   A machine fills milk into 200ml packages. It is suspected that the machine is not working correctly and that the amount of milk filled differs from the setpoint $\mu_0 = 200$. A sample of 132 packages filled by the machine are collected. The sample mean $\bar{y}$ is equal to 187.8 and the sample variance s_{n-1}^2 is equal to 51.5.

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

   (a) -24.056

   (b) -19.532

   (c) 7.699

   (d) -5.650

   (e) 11.760

   Solution

   The t-test statistic is calculated by:

   $$t = \frac{\bar{y} - \mu_0}{\sqrt{\frac{s_{n-1}^2}{n}}} = \frac{187.8 - 200}{\sqrt{\frac{51.5}{132}}} = -19.532.$$
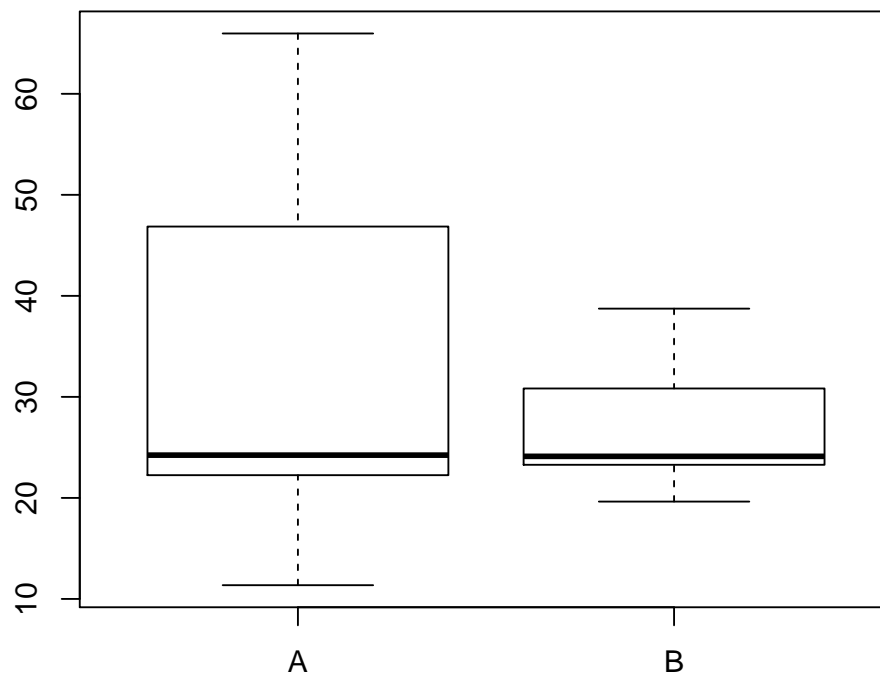
   The t-test statistic is thus equal to -19.532.

   (a) False

   (b) True

   (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 A is right-skewed.

Solution

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

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

(c) True. The interquartile range in sample A is clearly bigger than in B.

(d) True. The skewness of both distributions is similar, both are right-skewed.

(e) True. Distribution A is right-skewed.

4. **Problem**
   What is the name of the R function for extracting the fitted log-likelihood from a fitted (generalized) linear model object?

   Solution
   `logLik` is the R function for extracting the fitted log-likelihood from a fitted (generalized) linear model object. See `?logLik` for the corresponding manual page.

5. **Problem**
   For the 50 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 smaller than which value?

Solution
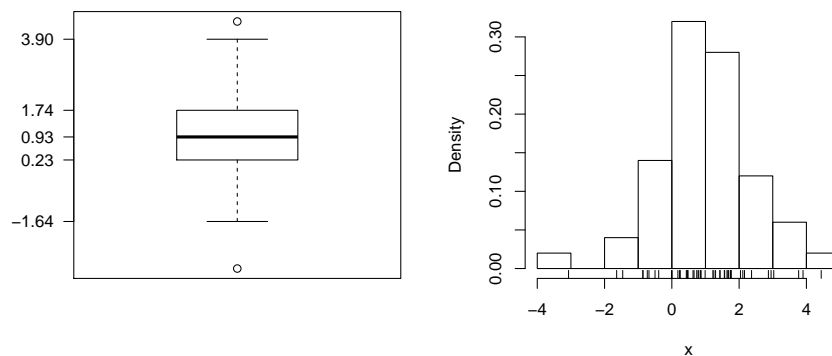
(a) True. / False.

(b) True. / False. / False.

(c) True. / False.

(d) 0.23.

(e) 1.74.

(f) 0.93.

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 35 shares, how much are they worth in £?

Solution
The worth in £ is the number of shares × stock price × exchange rate, i.e., $35 \times 84.8492 \times 0.8431 \approx 2503.773$.