R University

Statistics Exam 2015-01-01 **Exam ID 00003**

Name: _____

Student ID: _____

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1. [ ][ ][ ][ ][ ][1] . [6][9][0]
2. (a) [ ] (b) [ ] (c) [ ] (d) [X] (e) [ ]
3. (a) [X] (b) [X] (c) [ ] (d) [X] (e) [X]
4. [glm]
5. (a) (a) [ ] (b) [ ] (c) [X]

   (b) [ ][ ][ ][ ][-][0] . [8][7][3]
6. [ ][ ][1][1][0][3] . [0][4][0]

1. **Problem**
   What is the derivative of $f(x) = x^9 e^{3.4x}$, evaluated at $x = 0.61$?

   Solution
   Using the product rule for $f(x) = g(x) \cdot h(x)$, where $g(x) := x^9$ and $h(x) := e^{3.4x}$, we obtain

$$\begin{aligned} f'(x) &= [g(x) \cdot h(x)]' = g'(x) \cdot h(x) + g(x) \cdot h'(x) \\ &= 9x^{9-1} \cdot e^{3.4x} + x^9 \cdot e^{3.4x} \cdot 3.4 \\ &= e^{3.4x} \cdot (9x^8 + 3.4x^9) \\ &= e^{3.4x} \cdot x^8 \cdot (9 + 3.4x). \end{aligned}$$

   Evaluated at $x = 0.61$, the answer is

$$e^{3.4 \cdot 0.61} \cdot 0.61^8 \cdot (9 + 3.4 \cdot 0.61) = 1.689157.$$

   Thus, rounded to two digits we have $f'(0.61) = 1.69$.

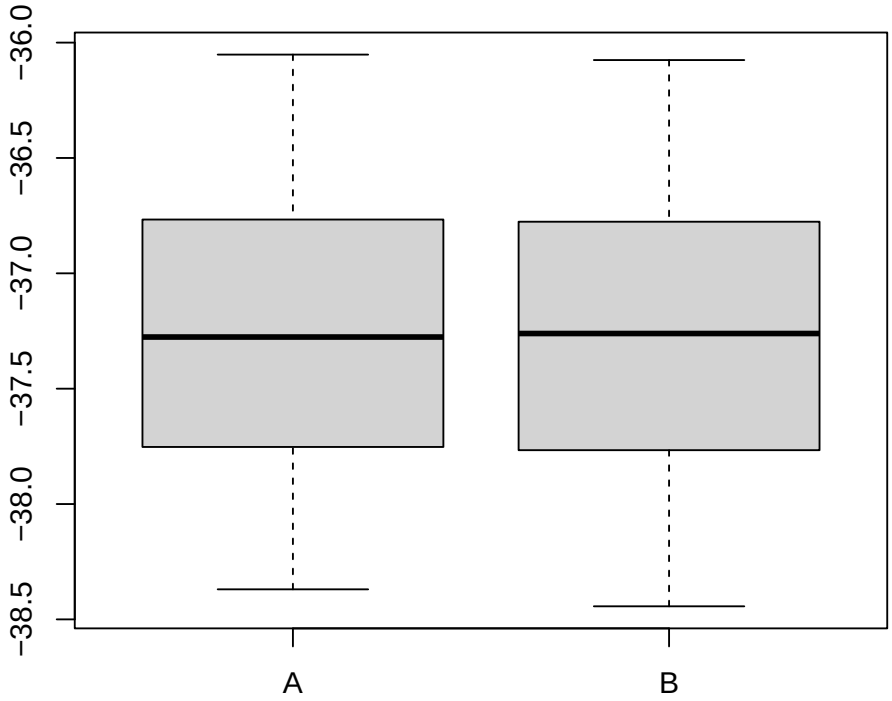
2. **Problem**
   What is the seat of the federal authorities in Switzerland (i.e., the de facto capital)?

   (a) St. Gallen
   (b) Geneva
   (c) Vaduz
   (d) Bern
   (e) Lausanne

   Solution
   There is no de jure capital but the de facto capital and seat of the federal authorities is Bern.

   (a) False
   (b) False
   (c) False
   (d) True
   (e) False

3. **Problem**
   In the following figure the distributions of a variable given by two samples (A and 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) 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) True. Distribution B is about symmetric.

4. **Problem**
What is the name of the R function for logistic regression?

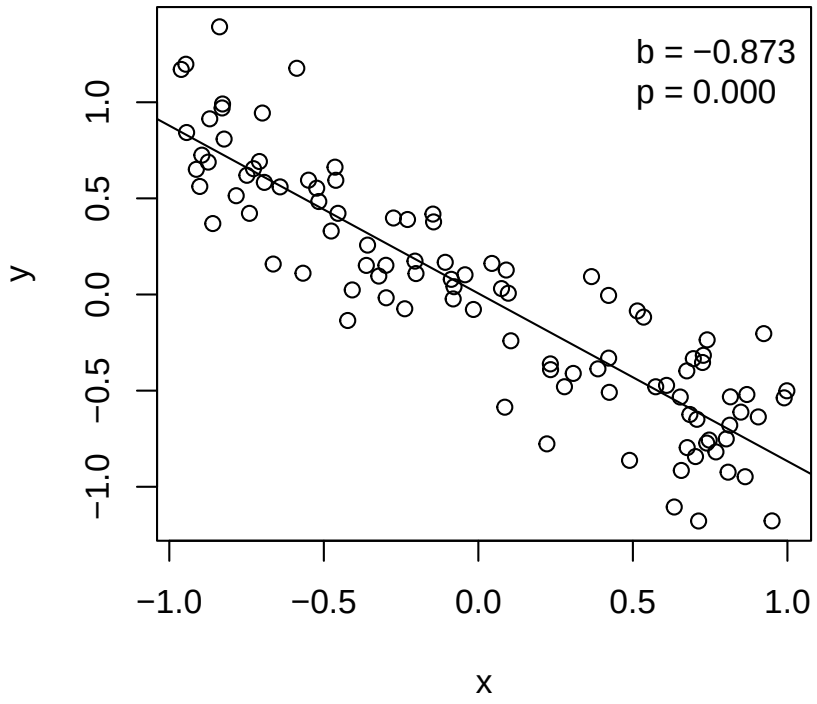
Solution
`glm` is the R function for logistic regression. See `?glm` for the corresponding manual page.

5. **Problem**
Using the data provided in `regression.csv` estimate a linear regression of `y` on `x` and answer the following questions.

(a) `x` and `y` are not significantly correlated / `y` increases significantly with `x` / `y` decreases significantly with `x`

(b) Estimated slope with respect to `x`:

Solution



To replicate the analysis in R:

```
## data
d <- read.csv("regression.csv")
## regression
m <- lm(y ~ x, data = d)
summary(m)
## visualization
plot(y ~ x, data = d)
abline(m)
```

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 13 shares, how much are they worth in €?

Solution
The worth in € is the number of shares $\times$ stock price $\times$ exchange rate, i.e., $13 \times 84.8492 \times 1 \approx 1103.04$.