R University

Exam 2015-07-29

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0 1 2 3 4 5 6 7 8 9

In this section **no** changes or modifications must be made!

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Answers 1 - 6

	a	b	c	d	e
1	☐	☐	☐	☐	☐
2	☐	☐	☐	☐	☐
3	☐	☐	☐	☐	☐
4	☐	☐	☐	☐	☐
5	☐	☐	☐	☐	☐
6	☐	☐	☐	☐	☐

1. *(1 point)* 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 521.3 and the sample variance s^2_{n-1} is equal to 527.08.

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

   (a) 1.275
   (b) -13.070
   (c) -53.309
   (d) 9.888
   (e) 14.581

2. *(1 point)* The waiting time (in minutes) at the cashier of two supermarket chains with different cashier systems is compared. The following statistical test was performed:

```
        Two Sample t-test

data:  Waiting by Supermarket
t = -2.2038, df = 114, p-value = 0.01478
alternative hypothesis: true difference in means between group Sparag and group Consumo is less
95 percent confidence interval:
       -Inf -0.3192428
sample estimates:
 mean in group Sparag mean in group Consumo
             4.199330              5.489176
```

   Which of the following statements are correct? (Significance level 5%)

   (a) The absolute value of the test statistic is larger than 1.96.
   (b) A one-sided alternative was tested.
   (c) The *p* value is larger than 0.05.
   (d) The test shows that the waiting time is longer at Sparag than at Consumo.
   (e) The test shows that the waiting time is shorter at Sparag than at Consumo.

3. *(1 point)* In a small city the satisfaction with the local public transportation is evaluated. One question of interest is whether inhabitants of the city are more satisfied with public transportation compared to those living in the suburbs.

   A survey with 250 respondents gave the following contingency table:

	Location	
Evaluation	City	Suburbs
Very good	23	13
Good	37	34
Bad	30	52
Very bad	10	51

   The following table of percentages was constructed:

	Location	
Evaluation	City	Suburbs
Very good	9.2	5.2
Good	14.8	13.6
Bad	12.0	20.8
Very bad	4.0	20.4

Which of the following statements are correct?

(a) The value in row 2 and column 2 in the percentage table indicates: 13.6 percentage of those, who evaluated the public transportation as good live in the suburbs.

(b) The value in row 1 and column 2 in the percentage table indicates: 5.2 percent of those living in the suburbs evaluated the public transportation as very good.

(c) The percentage table can be easily constructed from the original contingency table: percentages are calculated for each row.

(d) The percentage table provides total percentages.

(e) The percentage table provides the satisfaction distribution for each location type.

4. *(2 points)* A survey with 51 persons was conducted to analyze the design of an advertising campaign. Each respondent was asked to evaluate the overall impression of the advertisement on an eleven-point scale from 0 (bad) to 10 (good). The evaluations are summarized separately with respect to type of occupation of the respondents in the following figure.

To analyze the influence of occupation on the evaluation of the advertisement an analysis of variance was performed:

```
  Res.Df    RSS Df Sum of Sq     F     Pr(>F)
1     50 36.455
2     47 25.856  3    10.599 6.422 0.00097914
```

Which of the following statements are correct?

(a) A one-sided alternative was tested for the mean values.

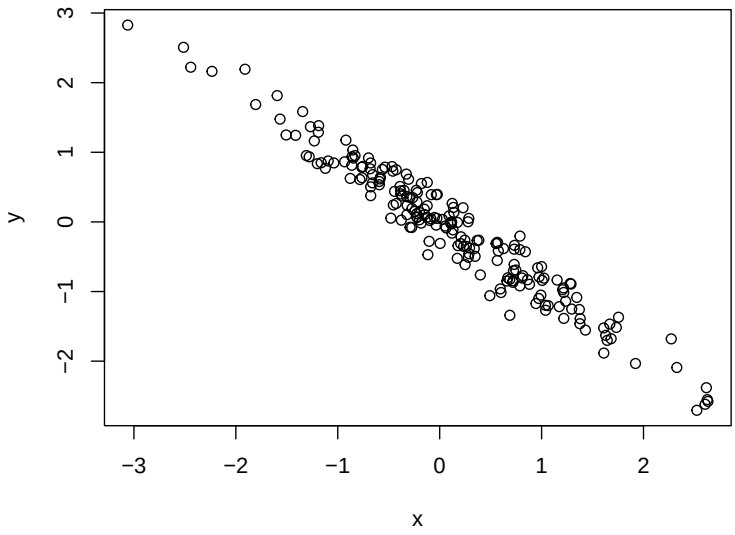
(b) The fraction of explained variance is smaller than 18%.

(c) The fraction of explained variance is larger than 51%.

(d) It can be shown that the evaluation of the respondents depends on their occupation. (Significance level 5%)

(e) The test statistic is larger than 14.6.

5. *(2 points)* The following figure shows a scatterplot. Which of the following statements are correct?



(a) For $X = -0.7$, Y can be expected to be about -1.3 .
(b) The standard deviation of Y is at least 6.
(c) The mean of X is at most 5.
(d) The absolute value of the correlation coefficient is at least 0.8.
(e) The scatterplot is standardized.

6. *(3 points)* For the matrix

$$A = \begin{pmatrix} 9 & 0 & 12 \\ 0 & 25 & 5 \\ 12 & 5 & 42 \end{pmatrix}.$$

compute the matrix $L = (\ell_{ij})_{1 \le i,j \le 3}$ from the Cholesky decomposition $A = LL^\top$.
Which of the following statements are true?

(a) $\ell_{11} = 3$
(b) $\ell_{21} > 0$
(c) $\ell_{33} \le 5$
(d) $\ell_{31} < 4$
(e) $\ell_{22} > 2$