R University

Exam 2015-07-29

Personal Data

Family Name:

Given Name:

Signature:

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Registration Number

0 1 2 3 4 5 6 7 8 9 (0 1 2 3 4 5 6 7 8 9)

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

Scrambling

0 0

Type: 010

Exam ID: 15072900002

Please mark the boxes carefully: ☒ Not marked: ☐ or ■

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Only clearly marked and positionally accurate crosses will be processed!

Answers 1 - 6

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

1. *(1 point)* 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 130 packages filled by the machine are collected. The sample mean $\bar{y}$ is equal to 132.3 and the sample variance s^2_{n-1} is equal to 31.04.

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

   (a) -14.637
   (b) 14.939
   (c) -10.761
   (d) 16.232
   (e) 18.773

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 = -2.4955, df = 93, p-value = 0.9928
alternative hypothesis: true difference in means between group Sparag and group Consumo is great
95 percent confidence interval:
 -3.332352       Inf
sample estimates:
 mean in group Sparag mean in group Consumo
             4.360010              6.360513
```

   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	17	15
Good	34	24
Bad	38	67
Very bad	11	44

   The following table of percentages was constructed:

	Location	
Evaluation	City	Suburbs
Very good	17.0	10.0
Good	34.0	16.0
Bad	38.0	44.7
Very bad	11.0	29.3

Which of the following statements are correct?

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

(b) The percentage table can be easily constructed from the original contingency table: Each value is in relation to the total sample size.

(c) The percentage table provides total percentages.

(d) The value in row 4 and column 1 in the percentage table indicates: 11 percent of the respondents live in the city and evaluated the public tranportation as very bad.

(e) The value in row 3 and column 1 in the percentage table indicates: 38 percent of the respondents lived in the city and evaluated the public transportation as bad.

4. *(2 points)* A survey with 48 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     47 27.623
2     44 20.363  3     7.260 5.229 0.0035629
```

Which of the following statements are correct?

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

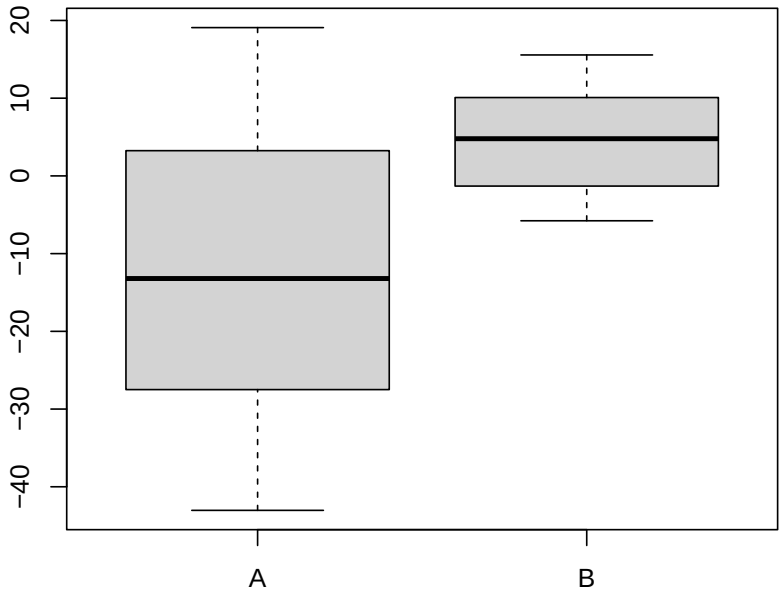
(b) The test statistic is smaller than 22.

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

(d) The fraction of explained variance is larger than 49%.

(e) The fraction of explained variance is smaller than 59%.

5. *(2 points)* 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.

6. *(3 points)* For the matrix

$$A = \begin{pmatrix} 4 & -6 & -8 & -2 \\ -6 & 13 & 12 & 9 \\ -8 & 12 & 17 & 9 \\ -2 & 9 & 9 & 39 \end{pmatrix}.$$

compute the matrix $L = (\ell_{ij})_{1 \le i,j \le 4}$ from the Cholesky decomposition $A = LL^\top$.
Which of the following statements are true?

(a) $\ell_{41} \le 0$
(b) $\ell_{33} = 6$
(c) $\ell_{32} > -10$
(d) $\ell_{31} \ge -4$
(e) $\ell_{44} > -6$