



## Personal Data

Family Name:
Given Name:
Signature:
checked

## Registration Number

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0	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	0
1	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	1
2	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	2
3	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	3
4	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	4
5	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	5
6	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	6
7	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	7
8	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	8
9	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	9

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

### Scrambling

0 0

Type

010

Exam ID

15072900001

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

This document is scanned automatically. Please keep clean and do not bend or fold. For filling in the document please use a **blue or black pen**.

**Only clearly marked and positionally accurate crosses will be processed!**

### Answers 1 - 6

	a	b	c	d	e
1	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
2	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
3	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
4	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
5	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
6	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	a	b	c	d	e





1. (1 point) 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 178 packages filled by the machine are collected. The sample mean  $\bar{y}$  is equal to 188.5 and the sample variance  $s_{n-1}^2$  is equal to 44.03.

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

- (a) 18.014
  - (b) -28.059
  - (c) -23.122
  - (d) -20.603
  - (e) -34.944
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 = 4.6127, df = 132, p-value = 1
alternative hypothesis: true difference in means is less than 0
95 percent confidence interval:
    -Inf 3.101398
sample estimates:
mean in group Sparag mean in group Consumo
      8.381688             6.099765
```

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 centre are more satisfied with public transportation compared to those living in the suburbs.

A survey with 250 respondents gave the following contingency table:

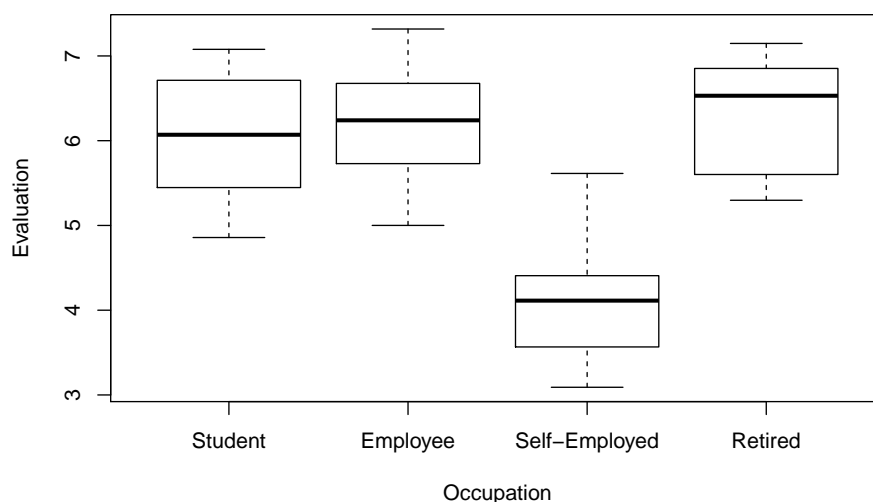
	Location	
Evaluation	city centre	suburbs
very good	16	18
good	43	28
bad	28	62
very bad	13	42

The following table of percentages was constructed:

	Location	
Evaluation	city centre	suburbs
very good	47.1	52.9
good	60.6	39.4
bad	31.1	68.9
very bad	23.6	76.4

Which of the following statements are correct?

- (a) The percentage table gives the satisfaction distribution for each location type.
  - (b) The percentage table contains column percentages.
  - (c) The value in row 1 and column 2 in the percentage table indicates: 52.9 percent of those living in the suburbs evaluated the public transportation as very good.
  - (d) The value in row 3 and column 1 in the percentage table indicates: 31.1 percent of the respondents lived in the city centre and evaluated the public transportation as bad.
  - (e) The percentage table can be easily constructed from the original contingency table: percentages are calculated for each column.
4. (2 points) A survey with 52 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.

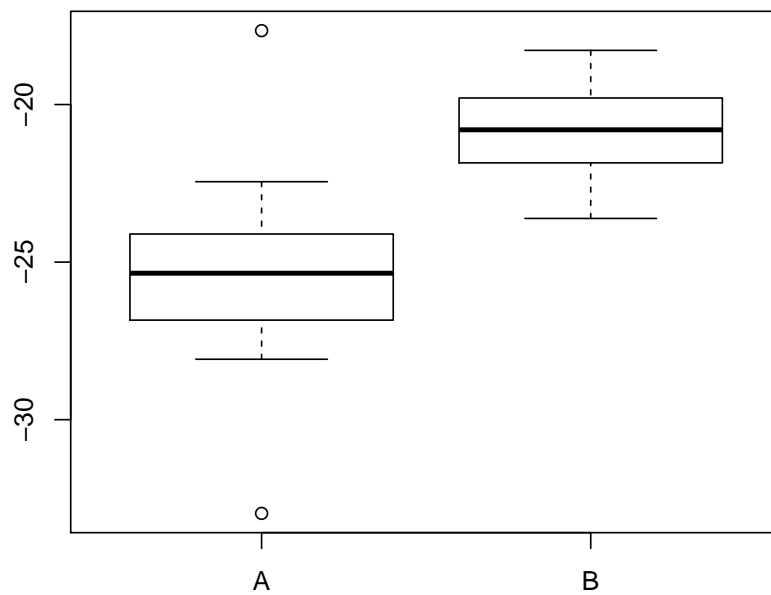


To analyze the influence of occupation on the evaluation of the advertisement an analysis of variance was performed:

	Res.Df	RSS	Df	Sum of Sq	F
1	51	68.986			
2	48	24.762	3	44.224	28.575
		Pr(>F)			
1					
2		9.5074e-11			

Which of the following statements are correct?

- (a) The test statistic is smaller than 15.9.
  - (b) The fraction of explained variance is smaller than 24%.
  - (c) The fraction of explained variance is larger than 24%.
  - (d) It can be shown that the evaluation of the respondents depends on their occupation. (Significance level 5%)
  - (e) A one-sided alternative was tested for the mean values.
5. (2 points) 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 left-skewed.

6. (3 points) For the matrix

$$A = \begin{pmatrix} 25 & -10 & -20 & -20 \\ -10 & 20 & 16 & 20 \\ -20 & 16 & 36 & 34 \\ -20 & 20 & 34 & 43 \end{pmatrix}.$$

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

- (a)  $\ell_{44} < -4$
- (b)  $\ell_{31} \leq -4$
- (c)  $\ell_{22} \geq 4$
- (d)  $\ell_{42} \geq 3$
- (e)  $\ell_{11} \leq 5$





