

Frage 1

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If we fail to reject a null hypothesis  $H_0$  at a significance level of .05 then



- ☐ a. We can conclude that  $H_0$  is true.
- ☐ b. There is a 5% probability that  $H_0$  is false.
- ☐ c. The data does not contain enough evidence to reject  $H_0$ .
- ☐ d. There is a 95% chance that  $H_0$  is true.

Frage **2**

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Sam rolls two fair six sided dice. Each one of the 36 possible outcomes is assumed to be equally likely. Given that the two dice land on different numbers, the conditional probability that at least one die roll is a six equals

- ☐ a.  $1/6$
- ☐ b.  $2/3$
- ☐ c.  $11/36$
- ☐ d.  $1/3$

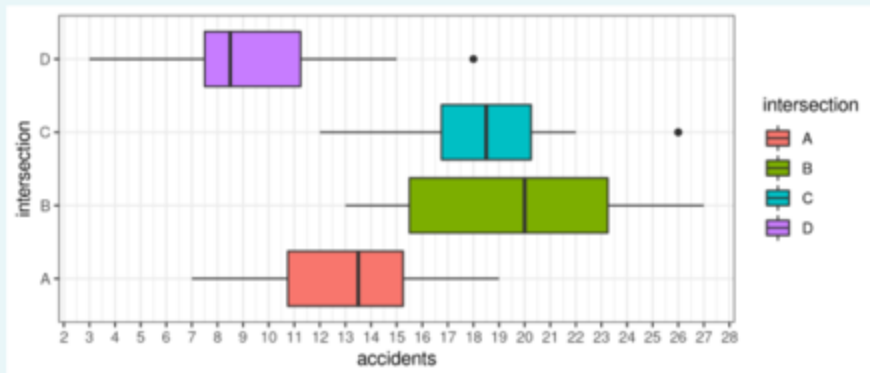
## Frage 3

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Data on the number of yearly accidents were collected from four intersections (A-D) over a 20 year period. Which of the following statements is **false**.



- ☐ a. The minimum accident total at intersection B was higher than the number of accidents observed at intersection D in 75% of years.
- ☐ b. All of the accidents totals at intersection A were lower than the median number of accidents at intersection B.
- ☐ c. During at least 75% of years, intersection B had more accidents than the lowest 25% of years at intersection C.
- ☐ d. During at least 10 years, fewer than 21 accidents occurred at intersection B.

Let  $X_1, \dots, X_{90}$  be a random sample from a continuous distribution with the expectation  $-\frac{1}{2}$  and variance 10.

Determine the approximate value  
of

$$P\left(\sum_{i=1}^{90} X_i > -60\right)$$

using the Central limit theorem. Use the values given in the table below.

$z$	0.00	0.01	0.02	0.03	0.04	0.05	0.06
0.0	0.5000	0.5040	0.5080	0.5120	0.5160	0.5199	0.5239
0.1	0.5398	0.5438	0.5478	0.5517	0.5557	0.5596	0.5636
0.2	0.5793	0.5832	0.5871	0.5910	0.5948	0.5987	0.6026
0.3	0.6179	0.6217	0.6255	0.6293	0.6331	0.6368	0.6406
0.4	0.6554	0.6591	0.6628	0.6664	0.6700	0.6736	0.6772
0.5	0.6915	0.6950	0.6985	0.7019	0.7054	0.7088	0.7123
0.6	0.7257	0.7291	0.7324	0.7357	0.7389	0.7422	0.7454
0.7	0.7580	0.7611	0.7642	0.7673	0.7704	0.7734	0.7764
0.8	0.7881	0.7910	0.7939	0.7967	0.7995	0.8023	0.8051

**Table 1:** Cumulative distribution function of the standard normal distribution

- ☐ a. 0.309
- ☐ b. 0.159
- ☐ c. 0.841
- ☐ d. 0.691

## Frage 5

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I have data on the daily high temperature (in Celsius) in Vienna and the daily total revenue from ice cream sales at Eis Greissler locations in Vienna (in thousands of Euros). The relationship is linear, and the correlation between the two variables is  $r = 0.4$ .

For a day in which the high temperature was 1 standard deviation above the mean, what would be our best estimate for the standardized value of ice cream sales at Eis Greissler?

- ☐ a. -0.4
- ☐ b. 0.4
- ☐ c. We cannot say without knowing the estimated slope,  $b_1$ .
- ☐ d. We cannot say without knowing the standard deviations of temperature and revenue.

Frage 6

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In the context of a statistical test at significance level  $\alpha$ , the p-value is below  $\alpha$ . Which of the following is **true**?

- ☐ a. The rejection region would be bigger if we would have used level  $\alpha/2$ .
- ☐ b. The value of the null hypothesis lies within the  $(1 - \alpha)100\%$  confidence interval computed from these data.
- ☐ c. The test statistic lies in the rejection region.
- ☐ d. We would also reject at level  $\alpha/2$ .



Frage 8

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Practically speaking, why can we use the normal distribution to look up the level-.05 critical value in a 2-sample t-test when the sample size is large?

- ☐ a. Asymptotically, the normal distribution converges to the t-distribution.
- ☐ b. The difference is negligible between critical values from the normal distribution and the t-distribution with high degrees of freedom.
- ☐ c. We can never use the normal distribution because our test statistic is t-distributed. The normal distribution would give significantly different values.
- ☐ d. The central limit theorem shows that for all sample sizes, the t and normal distributions are close.

Frage 9

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A 95% confidence interval for a population mean based on a sample of size 400 was (20, 28). Which of the following is **true**?

- ☐ a. There is a 95% probability that the true value of the population mean is in (20,28).
- ☐ b. The sample mean has a 95% chance of being in (20, 28).
- ☒ c. Across many samples, 95% of sample means should lie within an interval made by this method.
- ☐ d. If we were to collect a new sample, then the interval created using it would contain the true population mean with probability 95%.

Meine Auswahl widerrufen

Frage **10**

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A scientist tests 1000 hypotheses over his lifetime. Since he understands power well, he makes sure that each experiment is evaluated with a test that has exactly 60% power against a specific alternative hypothesis. He follows the usual tradition of doing tests at the 5% significance level. Suppose that, among all of the test that he performs in his lifetime, the null is actually true in 10% of the cases, while the specific alternative holds otherwise. In total, how many null hypotheses will he expect to reject?

- ☐ a. 545
- ☐ b. 650
- ☐ c. 550
- ☐ d. 600

Frage **11**

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Bieber Fever (i.e., being a huge Justin Bieber fan) is a growing health concern among America's youth. To investigate it, I gave a survey to middle school students in New York City which asked the following two questions: "What is your gender?" and "Do you have Bieber Fever?" In my data set, 30% of respondents have Bieber Fever, 65% of the respondents were girls, and among the boys, 10% have Bieber Fever.

Under the null hypothesis of independence, how many boys do we expect to not have Bieber Fever?

- ☐ a. 39
- ☐ b. 91
- ☐ c. 49
- ☐ d. 32

Frage **12**

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A 95% confidence interval from a poll performed to estimate the population proportion of eligible voters who would not vote in the next Presidential election is (42%, 48%). Which of the following statements is **true**?

- ☐ a. The sample size that was used in the poll was approximately 30.
- ☐ b. The sample size that was used in the poll was approximately 1,050.
- ☐ c. The probability that the population proportion lies in this interval is 0.95.
- ☐ d. If the poll were to be repeated in an identical fashion then there is a 95% chance that the new sample proportion will lie in the range 42% to 48%.

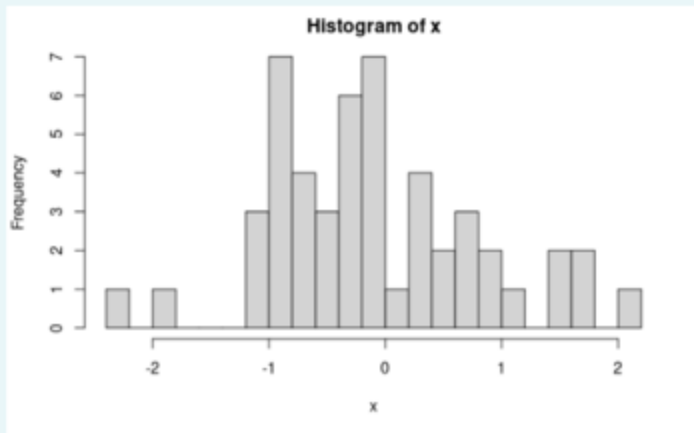
## Frage 13

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Consider the following histogram of a data set consisting of 50 observations. Which of the following statements is **true**.



- ☐ a. The sample mean is a bad summary of these data.
- ☐ b. The standard deviation of these data is at least 1.5.
- ☐ c. The data are asymmetric.
- ☐ d. The data are approximately normal.

Nina and Adam both need to buy a bicycle. The bike store has a stock of four green, three yellow and two red bikes. Nina randomly picks one of the bikes and buys it. Immediately after, Adam does the same. The sale price of the green, yellow and red bikes are 300, 200 and 100 euro, respectively. Let  $N$  be the event that Nina bought a green bike, and  $A$  be the event that Adam bought a green bike. Which of the following statements is **true**?

- ☐ a. The probability that at least one of them bought a green bike is bigger than  $8/9$ .
- ☐ b. The probability that Nina and Adam bought bicycles of different colors is the same as the probability that they bought bicycles of the same color.
- ☐ c. The probability that Nina and Adam bought bicycles of different colors is smaller than  $5/9$ .
- ☒ d. The probability that Nina and Adam bought bicycles of different colors is bigger than  $5/9$ .



Meine Auswahl widerrufen

## Frage 15

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Let  $X$  and  $Y$  be two independent standard normal random variables. Let  $S = \min\{X, Y\}$ . Find the probability that  $S \geq 1$  in terms of the cumulative distribution function  $\Phi$  of the standard normal random variable

$$\Phi(x) = \frac{1}{\sqrt{2\pi}} \int_{-\infty}^x e^{-\frac{t^2}{2}} dt, \quad x \in \mathbb{R}.$$

- ☐ a.  $(1 - \Phi(1)) \cdot \Phi(1)$
- ☐ b.  $1 - \Phi(1)^2$
- ☐ c.  $(1 - \Phi(1))^2$
- ☐ d.  $\Phi(1)^2$

Frage **16**

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Which of the following holds **true** for two independent random variables  $X$  and  $Y$ ?

- ☐ a.  $\text{Var}(X + Y) \leq \text{Var}(Y)$
- ☐ b.  $\text{Var}(2X - Y) = 2\text{Var}(X) - \text{Var}(Y)$
- ☐ c.  $\text{Var}(2X - Y) \leq 4\text{Var}(X)$
- ☐ d.  $\text{Var}(X + Y) \geq \text{Var}(X)$

Frage **17**

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Tom enters a chess tournament where his probability of winning a game is **0.3** against half of the players (category I), **0.4** against a quarter of the players (category II), and **0.5** against the remaining quarter of the players (category III). He plays a game against a randomly chosen opponent. What is the probability that he wins the game?

- ☐ a. 0.625
- ☐ b. 0.150
- ☐ c. 0.850
- ☐ d. 0.375

Frage **18**Bisher nicht  
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Let  $X \sim \mathcal{N}(1, 2)$  and  $Y \sim \mathcal{N}(2, 3)$  be two uncorrelated random variables. Compute the covariance  $\text{Cov}(3X + 2Y, 5X - 4Y + 7)$ .

- ☐ a. 0
- ☐ b. 54
- ☒ c. 6
- ☐ d. -12

[Meine Auswahl widerrufen](#)

Frage **20**

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I have collected data from international students from 5 different European countries. I asked their height and what country they are from. I am interested in testing whether or not average heights differ between countries but am concerned about the number of hypothesis tests this entails. Which of the following is **false**?

- ☐ a. I could do a two sample test for equality of heights for all  $\binom{5}{2}$  comparisons and correct the results via Bonferroni.
- ☐ b. I can use an ANOVA test to compare all countries.
- ☐ c. A chi-squared test is not applicable here.
- ☐ d. It doesn't matter whether I use an ANOVA or correct the individual tests via the Bonferroni correction as they both have the same assumptions.