Friedrich-Alexander-Universität
Rechts- und Wirtschafts-
wissenschaftliche Fakultät

Exam Statistics (87015), winter semester 2021/2022

Dear student,

Please mark your answers to the single-choice questions on the answer sheet on the last page in the following way: ○⊗○
If you want to correct an answer, please completely color the **wrong** answer like: ○●⊗

Please fill in your details below:

Surname : _____

Name : _____

Matriculation number : _____

Study program : _____

Room, Seat : _____

Examinor : Prof. Dovern

IMPORTANT: Also mark your matriculation number on the answer sheet !

_____

_____

The following information may be entered by the examinor only:

_____

Grade:

_____

Signature examinor:

Please read these instructions carefully:

- All pages **must** remain together!
- The exam consists of 30 **single-choice questions** in total, 5 of which are related to R.
- Use the answer sheet on the last page to fill in your final answers. **Entries in the question section are not graded.**
- Write your name and matriculation number clearly on the answer sheet and additionally mark your matriculation number with crosses.
- Please use a **dark ball pen** on the answer sheet!
- The exam duration is 90 minutes.
- **Additional material allowed:**
  - Non-programmable calculator
  - A handwritten cheat sheet (two-sided) in A4 format

Good luck!

Exam Statistics, winter semester 2021/2022

Exercise 1: Single-choice questions

Do not forget to mark your answers on the answer sheet and also fill in your name and matriculation number on the answer sheet.

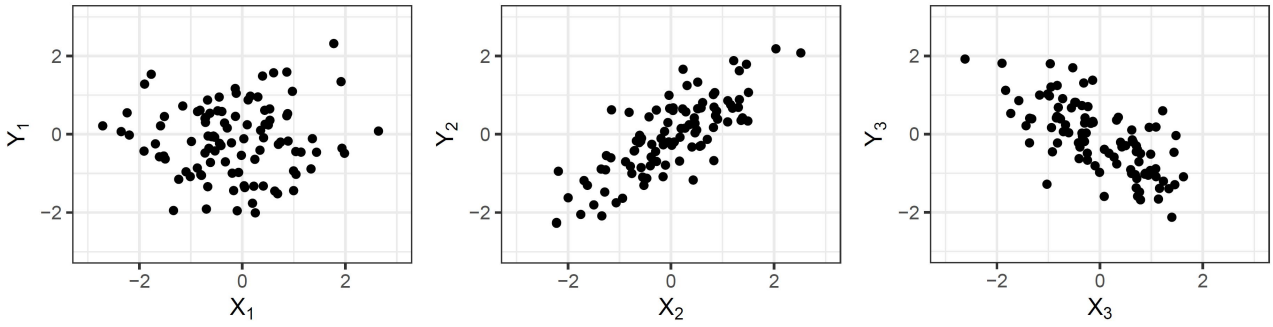
Note: Exercise 1 consists of 25 questions. You can reach 1 point per question. Each question has **only one correct answer**. Mark the correct answer with a cross **on the answer sheet**. There is **no deduction of points for wrong answers**.

1.1 Feature X is the price (in Pound Sterling) for one cafe latte in London. Feature Y is the price (in Yen) of one cafe latte in Tokio. The following values are known: $\bar{x} = 4.4$, $\bar{y} = 550.0$, $s_X = 1.4$ and $s_Y = 143.0$.

Calculate the values of an appropriate measure that allows to compare the dispersion of both features, X and Y, in a meaningful way. Decide for which feature the value is higher.

A It is higher for Y, since 3.85 (for Y) > 3.14 (for X)
B It is higher for X, since 0.32 (for X) > 0.26 (for Y)
C It is higher for Y, since 1.80 (for Y) > 0.70 (for X)
D It is higher for X, da 1.96 (for X) > 0.81 (for Y)
E The standard deviation relative to the mean is equal for X and Y.

The following graphs show scatterplots for three different correlations between the variables X_i and Y_i. $r_i = r_{X_i Y_i}$ is the Bravais-Pearson correlation coefficient for each case $i = 1, 2, 3$.



1.2 Which of the following statements is correct?

A $r_2 > r_1$
B $r_1 = r_3$
C $r_1 > r_2$
D $r_3 > r_1$
E $r_3 > r_2$

1.3 A bakery collects the following features:

1. Daily flour usage in kg
2. Daily number of customers
3. Types of pastry for sale ("bread", "rolls", "croissants", etc.)
4. Daily revenue in Euro

Assign the correct measurement to the four features.

A 1. Interval scale, 2. Nominal scale, 3. Ordinal scale, 4. Absolute scale
B 1. Interval scale, 2. Ordinal scale, 3. Ordinal scale, 4. Interval scale
C 1. Ratio scale, 2. Absolute scale, 3. Nominal scale, 4. Ratio scale
D 1. Absolut scale, 2. Ratio scale, 3. Ordinal scale, 4. Interval scale
E 1. Ratio scale, 2. Ordinal scale, 3. Nominal scale, 4. Interval scale

A fair coin with the two sides "heads" (H) and "tails" (T) is thrown three times in a row. The sample space S is thus:

$$S = \{(HHH), (HHT), \ldots, (TTT)\}$$

Consider the event E: "Tails faces up at least twice."

1.4 What is the probability of event E?

- **A** $\frac{1}{16}$
- **B** $\frac{1}{8}$
- **C** $\frac{1}{2}$
- **D** $\frac{3}{8}$
- **E** $\frac{2}{3}$

The normally distributed random variable Y describes monthly expenses for mobile internet services by students in Germany. The expected value μ_Y of Y is unknown. The variance is $\sigma_Y^2 = 4.84$. A mobile internet provider claims that the average monthly cell phone expenses of students equal 30 EUR.

You doubt this claim and test it with a hypothesis test. An *i.i.d.* sample of $n = 130$ students resulted in the sample average $\overline{y} = 27.38$.

1.5 What is the value of the test statistic for this hypothesis test?

- **A** $t = -6.1720$
- **B** $t = -13.5785$
- **C** $t = -154.8182$
- **D** $t = -1.1909$
- **E** $t = -0.1044$

1.6 You calculate the following 95% confidence interval for μ_Y based on the *i.i.d.* sample:

$$CI_{0.95} = [27.0018, 27.7582]$$

What is the correct conclusion from this realized confidence interval?

- **A** H_0 can be rejected at the significance level of 5% since $30 \notin CI_{0.95}$.
- **B** H_0 cannot be rejected at the significance level of 5% since $30 \notin CI_{0.95}$.
- **C** H_0 can be rejected at the significance level of 5% since $30 \in CI_{0.95}$.
- **D** H_1 is true with a probability of 95% since $30 \notin CI_{0.95}$.
- **E** H_0 cannot be rejected at the significance level of 5% since $30 \in CI_{0.95}$.

1.7 You want to create a new PIN code for accessing your phone. The PIN code must consist of exactly 6 numbers and you wish to use each number (from 0 to 9) only once. How many possibilities for such a PIN code exist?

A 30
B 210
C 1000000
D 151200
E 5005

A government agency, interalia, issues student visas to promising applicants. If a visa is issued or not (feature *A*) depends on the applicant's school performance in their home country (feature *P*: "exceptional", "above average" or "average").

The government agency uses data from 10000 applicants as training data for a decision tree. The entropy of feature *A* is 0.84. Additionally, the following absolute frequencies and conditional entropys are known:

	$n(\bullet)$	$E(A\|\bullet)$
P = "exceptional"	2000	0.87
P = "above average"	4000	0.69
P = "average"	4000	0.48

1.8 What is the value of the entropy gain (*EG*) of the partition based on feature *P*?

A 0.642
B -1.200
C 0.198
D 2.040
E 0.840

1.9 The covariance between two variables *X* and *Y* is $s_{XY} = -3.73$. The variance of *X* is $s_X^2 = 3.24$ and the variance of *Y* is $s_Y^2 = 4.41$. What is the value of the Bravais-Pearson correlation coefficient?

A -3.8307
B -0.4876
C -0.2611
D 0.1931
E -0.9868

Consider the following three situations:

1. Classification of incoming email into the categories "private", "work", "advertising" and "spam" according to specific factors (sender, subject line, salutation, ...).

2. Grouping members of a social media platform according to their characteristics (age, nationality, online activity, ...).

3. Smartphone face recognition: classification of a face into the categories "known"/"unknown" according to facial features (distance between eyebrows, eye size, mouth shape, ...)

1.10 Assign the correct type of machine learning algorithm to each of the above examples.

A	1. Supervised Learning	2. Supervised Learning	3. Unsupervised Learning
B	1. Supervised Learning	2. Unsupervised Learning	3. Unsupervised Learning
C	1. Unsupervised Learning	2. Unsupervised Learning	3. Unsupervised Learning
D	1. Supervised Learning	2. Unsupervised Learning	3. Supervised Learning
E	1. Unsupervised Learning	2. Supervised Learning	3. Supervised Learning

A car insurer wants to conduct 50 phone interviews to analyze risky driving behavior among its customers. The car insurer sends invitations to the interviews to all customers. The first 50 customers who respond to the invitation will be interviewed.

1.11 What type of sampling approach does this example refer to?

A Simple random sample
B Stratified sample
C Convenience sample
D Clustered sample
E Independently and identically distributed sample

1.12 Which of the following statements does **not** hold in general for the probability density function (pdf) $f(x)$ of a normally distributed random variable X?

A $\int_{-\infty}^{\infty} f(x)\,dx = 1$
B $f(x) > 0$ for all $x \in X$
C The pdf is monotonically increasing in x.
D The expected value coincides with the value of x for which the maximum of the pdf is reached.
E The pdf is symmetric.

Airports use explosive trace detectors to detect explosives of small magnitude. Consider the following events:

A: "A person was in contact with explosives"
B: "The explosive trace detector returns a positive result"

Additionally the following probabilities are known:

P(A) = 0.0002
P(B) = 0.0005
P(B|A) = 0.98

1.13 What is the probability that a person was in contact with explosives when they receive a positive test result from the explosive trace detector test?

A 0.3920
B 0.4900
C 0.1960
D 0.0001
E 0.0245

Consider the 8 realizations x_i of a feature X where $i = 1, 2, \ldots, 8$.

i:	1	2	3	4	5	6	7	8
x_i:	10	13	20	21	22	30	30	35

1.14 What are the values of the mode and the 75% quantile, $x_{0.75}$?

A $Mode = 21.5$, $x_{0.75} = 15$
B $Mode = 22.6$, $x_{0.75} = 30$
C $Mode = 4.5$, $x_{0.75} = 22$
D $Mode = 21.5$, $x_{0.75} = 13$
E $Mode = 30.0$, $x_{0.75} = 30$

A survey among students asked each student how happy they are with the lunch menu at the university's cafeteria (feature X) and which diet they prefer (feature Y). The following contingency table displays the relative frequencies of the students' answers:

		Y			
		Omnivore	Vegetarian	Gluten-free	$\sum_{j=1}^{3} y_j$
X	Rather happy	0.50	0.11	?	0.61
	Rather unhappy	0.14	0.21	?	0.39
	$\sum_{i=1}^{2} x_i$	0.64	0.32	?	?

1.15 What are the correct values for the missing joint frequencies and the marginal frequency?

A It is not possible to calculate the missing values with the given information.
B $h_{13} = 0.00$, $h_{23} = 0.04$, $h_{\bullet 3} = 0.04$
C $h_{13} = 0.40$, $h_{23} = 0.00$, $h_{\bullet 3} = 0.96$
D $h_{13} = 0.61$, $h_{23} = 0.35$, $h_{3\bullet} = 1$
E $h_{13} = 0.04$, $h_{23} = 0.00$, $h_{3\bullet} = 0.04$

1.16 What is the relative frequency that a student is rather happy with the lunch menu given that she prefers a vegetarian diet?

A $h(\text{"Vegetarian"}, \text{"Rather happy"}) = 0.1100$
B $h(\text{"Rather happy"} \mid \text{"Vegetarian"}) = 0.3438$
C $h(\text{"Rather happy"}, \text{"Vegetarian"}) = 0.6100$
D $h(\text{"Rather happy"} \mid \text{"Vegetarian"}) = 0.1803.$
E $h(\text{"Vegetarian"} \mid \text{"Rather happy"}) = 0.1803$

1.17 The random variable X has a Poisson distribution with the parameter $\lambda = 2$ and describes the yearly number of failures of a hospital's X-ray apparatus. What is the probability that exact 4 failures happen during one year?

A 0.1465
B 4.9260
C 0.9098
D 0.0902
E 0.0001

The random variable X is normal distributed with unkown expected value μ and known variance $\sigma^2 = 38.44$. You collect an *i.i.d.* sample of size $n = 196$ and calculate the sample mean $\bar{x} = 11$.

1.18 Which of the following intervals corresponds to the 95% confidence interval for μ?

A $[10.6156, 11.3844]$
B $[9.8255, 12.1744]$
C $[5.6184, 16.3816]$
D $[9.9690, 12.0302]$
E $[10.1320, 11.8680]$

The following is an example for Simpson's Paradox:

In 1973, at the University of California, Berkeley, the overall acceptance rate in four departments for female applicants was 30%. The overall acceptance rate for male applicants was 47%. At the same time, in each of the departments, the acceptance rate for female applicants was higher than the acceptance rate for male applicants.

1.19 The effect of gender on the acceptance rate is overstated by these unconditional numbers because gender also affects the choice of department (D) of applicants. What is the role of D in this setting?

A D is a confounder.
B D is a mediator.
C None of the other answers is correct.
D D is a collider.
E D is an accelerator.

1.20 Which of the following statements about the Maximum Likelihood method is **not** correct?

A The idea behind the Maximum Likelihood method is to find out which parameter values are most likely to have generated the data sample at hand.
B The Maximum Likelihood method is only applicable to continuous distributions.
C The likelihood function is given by $L(\theta) = f(x_1;\theta) \cdot \ldots \cdot f(x_n;\theta)$.
D The Maximum Likelihood estimator aims to make the theoretical model as coherent as possible with the observed data.
E Taking the logarithm of the likelihood function does not change the position of the maximum.

1.21 A transport company monitors the temperatures in their refrigerated trucks. The temperatures $x_1, \ldots, x_n$ are measured in degrees celsius. The company finds that the average temperature is $\overline{x} = 3.8$ and the standard deviation is $s_x = 0.9$.

Y denotes the temperature in Fahrenheit, where $y_i = -\frac{160}{9} + \frac{5}{9} x_i$.

What is the value of the standard deviation of the temperature in the refrigerated trucks in Fahrenheit, s_y?

A 4.46
B -17.28
C 0.50
D 2.11
E 0.25

The daily temperature in March in Svalbard, Norway, is normal distributed with expected value $\mu = -13.5$ and variance $\sigma^2 = 10.24$.

1.22 What is the maximum temperature that you can expect on a random day in March with a probability of 75%?

A -10.1250
B 0.6745
C -11.3416
D -15.6584
E -6.5931

1.23 What is the probability that the temperature on a random day in March equals exactly -13?

A 84.38%
B 100%
C 50%
D 0%
E 56.36%

1.24 Consider an independently and identically distributed random sample of size n. Which of the following statements is generally **not** correct?

A The central limit theorem only holds when the sample consists of normally distributed random variables.
B The central limit theorem states that the sum of the sample variables follow a normal distribution as $n \to \infty$
C The weak law of large numbers states that the variance of the sample mean converges to zero as $n \to \infty$
D The central limit theorem states that the sample mean is approximatively normally distributed for very large n.
E The distribution of the sample mean is symmetric for very large n.

1.25 A supermarket sells frozen peas.The random variable X describes the content in grams of one box of frozen peas. X is normal distributed with expected value $\mu = 500$ and variance $\sigma^2 = 81$. The supermarket's quality control unit collects a random sample of $n = 100$ boxes of frozen peas for an internal analysis. What is the distribution of the sample mean $\overline{X}$?

A $\overline{X} \sim N(500, 81)$
B $\overline{X} \sim N(50, 8.1)$
C $\overline{X} \sim N(500, 0.09)$
D $\overline{X} \sim N(500, 0.81)$
E $\overline{X} \sim N(5, 9)$

Do not forget to mark your answers on the answer sheet and also fill in your name and matriculation number on the answer sheet.

Exercise 2: Single-choice questions about R

Do not forget to mark your answers on the answer sheet and also fill in your name and matriculation number on the answer sheet.

Note: Exercise 2 consists of 5 questions. You can reach 1 point per question. Each question has **only one correct answer**. Mark the correct answer with a cross **on the answer sheet**. There is **no deduction of points for wrong answers**.

2.1 The daily amount of oil produced (in cubic meters, m^3) at an oil drilling derrick is normally distributed with a mean of 7. The standard deviation is 2. Which of the following codes returns the probability that more than 8.5 m^3 are produced on a random day?

A pnorm(8.5, mean = 7, sd = 2)
B dnorm(8.5, mean = 7, sd = 2)
C 1 - pnorm(8.5, mean = 7, sd = 2)
D 1 - dnorm(8.5, mean = 7, sd = 2)
E qnorm(8.5, mean = 7, sd = 2)

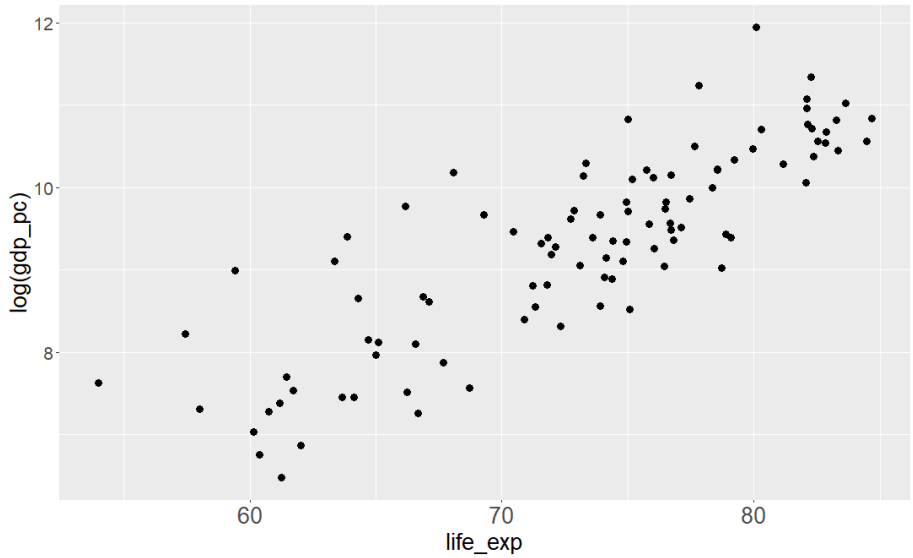
Assume a work space in R Studio for the following questions. You have one dataframe called df in your environment. df contains a sample of $n = 100$ countries and consists of the following variables:

Row 1: Name of the country (country)

Row 2: Life expectancy in years (life_exp)

Row 3: GDP per capita (gdp_pc)

Apart from the dataframe df, the environment contains no other objects. The dataframe contains no missing values (NAs). The *tidyverse* package is activated. Your analyses resulted in the following output:



2.2 Look at the scatter plot of the logarithm of the per capita income and the life expectancy. Complete the command to create this plot.

ggplot(data = df, **T**(x = **U**, y = **V**)) + geom_**W**()

A	**T**: axis	**U**: life_exp	**V**: ln_gdp	**W**: scatter
B	**T**: df	**U**: gdp_pc	**V**: life_exp	**W**: point
C	**T**: aes	**U**: life_exp	**V**: gdp_pc	**W**: scatter
D	**T**: aes	**U**: life_exp	**V**: log(gdp_pc)	**W**: point
E	**T**: aes	**U**: log(gdp_pc)	**V**: life_exp	**W**: point

2.3 Which of the following R commands returns the names of countries with a life expectancy below 60 years?

A df %>% select(country) %>% filter(life_exp < 60)
B df %>% filter(life_exp < 60) %>% select(country)
C df$life_exp > 60
D df %>% filter(life_exp > 60) %>% select(- country)
E df %>% select(life_exp) %>% filter(life_exp < 60)

2.4 Consider the following sequence of commands:

```
a <- length(df$life_exp)
b <- sum(df$life_exp)
c <- (1/a)*b
```

Which command produces the same value as the value saved in c?

A cor(df$life_exp, df$gdp_exp)
B mean(length(df$country))
C var(df$life_exp)
D mean(df$life_exp)
E mean(df$life_exp) / length(df$life_exp)

2.5 A researcher hypothesizes that the average life expectancy across countries is less than 70 years. You doubt this claim and use the available sample to conduct a hypothesis test with a significance level of $\alpha = 0.05$. Assume that the sample is independent and normally distributed. The null hypothesis is $H_0: \mu \leq 70$.

You use the following command for the hypothesis test

```
t.test(x = df$life_exp, mu = 70, alternative = "greater", conf.level = 0.95)
```

The output includes the test statistic $t = 3.05$, the p-value $p = 0.002$ and the 95% confidence interval $[71.1019, 72.4185]$.

Based on this information, which of the statments is **not** correct?

A The value of the test statistic would change if you had chosen $\alpha = 0.01$ instead.
B H_0 can be rejected since $p = 0.002 < \alpha = 0.05$.
C H_0 can be rejected since $70 \notin [71.1019, 72.4185]$.
D H_0 can be rejected since $3.05 > t_{99,0.95} = 1.66$.
E H_0 cannot be rejected for all $\alpha < 0.002$.

Do not forget to mark your answers on the answer sheet and also fill in your name and matriculation number on the answer sheet.

Distribution Tables

Standard Normal Distribution - p-Quantiles

p	.0	.1	.2	.3	.4	.5	.6	.7	.8	.9
50	0.0000	.0025	.0050	.0075	.0100	.0125	.0150	.0175	.0201	.0226
51	.0251	.0276	.0301	.0326	.0351	.0376	.0401	.0426	.0451	.0476
52	.0502	.0527	.0552	.0577	.0602	.0627	.0652	.0677	.0702	.0728
53	.0753	.0778	.0803	.0828	.0853	.0878	.0904	.0929	.0954	.0979
54	.1004	.1030	.1055	.1080	.1105	.1130	.1156	.1181	.1206	.1231
55	.1257	.1282	.1307	.1332	.1358	.1383	.1408	.1434	.1459	.1484
56	.1510	.1535	.1560	.1586	.1611	.1637	.1662	.1687	.1713	.1738
57	.1764	.1789	.1815	.1840	.1866	.1891	.1917	.1942	.1968	.1993
58	.2019	.2045	.2070	.2096	.2121	.2147	.2173	.2198	.2224	.2250
59	.2275	.2301	.2327	.2353	.2378	.2404	.2430	.2456	.2482	.2508
60	.2533	.2559	.2585	.2611	.2637	.2663	.2689	.2715	.2741	.2767
61	.2793	.2819	.2845	.2871	.2898	.2924	.2950	.2976	.3002	.3029
62	.3055	.3081	.3107	.3134	.3160	.3186	.3213	.3239	.3266	.3292
63	.3319	.3345	.3372	.3398	.3425	.3451	.3478	.3505	.3531	.3558
64	.3585	.3611	.3638	.3665	.3692	.3719	.3745	.3772	.3799	.3826
65	.3853	.3880	.3907	.3934	.3961	.3989	.4016	.4043	.4070	.4097
66	.4125	.4152	.4179	.4207	.4234	.4261	.4289	.4316	.4344	.4372
67	.4399	.4427	.4454	.4482	.4510	.4538	.4565	.4593	.4621	.4649
68	.4677	.4705	.4733	.4761	.4789	.4817	.4845	.4874	.4902	.4930
69	.4958	.4987	.5015	.5044	.5072	.5101	.5129	.5158	.5187	.5215
70	.5244	.5273	.5302	.5330	.5359	.5388	.5417	.5446	.5476	.5505
71	.5534	.5563	.5592	.5622	.5651	.5681	.5710	.5740	.5769	.5799
72	.5828	.5858	.5888	.5918	.5948	.5978	.6008	.6038	.6068	.6098
73	.6128	.6158	.6189	.6219	.6250	.6280	.6311	.6341	.6372	.6403
74	.6433	.6464	.6495	.6526	.6557	.6588	.6620	.6651	.6682	.6713
75	.6745	.6776	.6808	.6840	.6871	.6903	.6935	.6967	.6999	.7031
76	.7063	.7095	.7127	.7160	.7192	.7225	.7257	.7290	.7323	.7356
77	.7388	.7421	.7454	.7488	.7521	.7554	.7588	.7621	.7655	.7688
78	.7722	.7756	.7790	.7824	.7858	.7892	.7926	.7961	.7995	.8030
79	.8064	.8099	.8134	.8169	.8204	.8239	.8274	.8310	.8345	.8381
80	.8416	.8452	.8488	.8524	.8560	.8596	.8632	.8669	.8705	.8742
81	.8779	.8816	.8853	.8890	.8927	.8965	.9002	.9040	.9078	.9116
82	.9154	.9192	.9230	.9269	.9307	.9346	.9385	.9424	.9463	.9502
83	.9542	.9581	.9621	.9661	.9701	.9741	.9781	.9822	.9863	.9904
84	.9945	.9986	1.0027	1.0069	1.0110	1.0152	1.0194	1.0237	1.0279	1.0322
85	1.0364	1.0407	1.0450	1.0494	1.0537	1.0581	1.0625	1.0669	1.0714	1.0758
86	1.0803	1.0848	1.0893	1.0939	1.0985	1.1031	1.1077	1.1123	1.1170	1.1217
87	1.1264	1.1311	1.1359	1.1407	1.1455	1.1503	1.1552	1.1601	1.1650	1.1700
88	1.1750	1.1800	1.1850	1.1901	1.1952	1.2004	1.2055	1.2107	1.2160	1.2212
89	1.2265	1.2319	1.2372	1.2426	1.2481	1.2536	1.2591	1.2646	1.2702	1.2759
90	1.2815	1.2873	1.2930	1.2988	1.3047	1.3106	1.3165	1.3225	1.3285	1.3346
91	1.3408	1.3469	1.3532	1.3595	1.3658	1.3722	1.3787	1.3852	1.3917	1.3984
92	1.4051	1.4118	1.4187	1.4255	1.4325	1.4395	1.4466	1.4538	1.4611	1.4684
93	1.4758	1.4833	1.4908	1.4985	1.5063	1.5141	1.5220	1.5301	1.5382	1.5464
94	1.5548	1.5632	1.5718	1.5805	1.5893	1.5982	1.6072	1.6164	1.6258	1.6352
95	1.6448	1.6546	1.6646	1.6747	1.6849	1.6954	1.7060	1.7169	1.7279	1.7392
96	1.7507	1.7624	1.7744	1.7866	1.7991	1.8119	1.8250	1.8384	1.8522	1.8663
97	1.8808	1.8957	1.9110	1.9268	1.9431	1.9600	1.9774	1.9954	2.0141	2.0335
98	2.0537	2.0748	2.0969	2.1201	2.1444	2.1701	2.1973	2.2262	2.2571	2.2904
99	2.3263	2.3656	2.4089	2.4572	2.5121	2.5758	2.6520	2.7477	2.8781	3.0901

Standard Normal Distribution - Cumulative Distribution Function

z	0	1	2	3	4	5	6	7	8	9
0.0	.5000	.5040	.5080	.5120	.5160	.5199	.5239	.5279	.5319	.5359
0.1	.5398	.5438	.5478	.5517	.5557	.5596	.5636	.5675	.5714	.5753
0.2	.5793	.5832	.5871	.5910	.5948	.5987	.6026	.6064	.6103	.6141
0.3	.6179	.6217	.6255	.6293	.6331	.6368	.6406	.6443	.6480	.6517
0.4	.6554	.6591	.6628	.6664	.6700	.6736	.6772	.6808	.6844	.6879
0.5	.6915	.6950	.6985	.7019	.7054	.7088	.7123	.7157	.7190	.7224
0.6	.7257	.7291	.7324	.7357	.7389	.7422	.7454	.7486	.7517	.7549
0.7	.7580	.7611	.7642	.7673	.7704	.7734	.7764	.7794	.7823	.7852
0.8	.7881	.7910	.7939	.7967	.7995	.8023	.8051	.8078	.8106	.8133
0.9	.8159	.8186	.8212	.8238	.8264	.8289	.8315	.8340	.8365	.8389
1.0	.8413	.8438	.8461	.8485	.8508	.8531	.8554	.8577	.8599	.8621
1.1	.8643	.8665	.8686	.8708	.8729	.8749	.8770	.8790	.8810	.8830
1.2	.8849	.8869	.8888	.8907	.8925	.8944	.8962	.8980	.8997	.9015
1.3	.9032	.9049	.9066	.9082	.9099	.9115	.9131	.9147	.9162	.9177
1.4	.9192	.9207	.9222	.9236	.9251	.9265	.9279	.9292	.9306	.9319
1.5	.9332	.9345	.9357	.9370	.9382	.9394	.9406	.9418	.9429	.9441
1.6	.9452	.9463	.9474	.9484	.9495	.9505	.9515	.9525	.9535	.9545
1.7	.9554	.9564	.9573	.9582	.9591	.9599	.9608	.9616	.9625	.9633
1.8	.9641	.9649	.9656	.9664	.9671	.9678	.9686	.9693	.9699	.9706
1.9	.9713	.9719	.9726	.9732	.9738	.9744	.9750	.9756	.9761	.9767
2.0	.9772	.9778	.9783	.9788	.9793	.9798	.9803	.9808	.9812	.9817
2.1	.9821	.9826	.9830	.9834	.9838	.9842	.9846	.9850	.9854	.9857
2.2	.9861	.9864	.9868	.9871	.9875	.9878	.9881	.9884	.9887	.9890
2.3	.9893	.9896	.9898	.9901	.9904	.9906	.9909	.9911	.9913	.9916
2.4	.9918	.9920	.9922	.9925	.9927	.9929	.9931	.9932	.9934	.9936
2.5	.9938	.9940	.9941	.9943	.9945	.9946	.9948	.9949	.9951	.9952
2.6	.9953	.9955	.9956	.9957	.9959	.9960	.9961	.9962	.9963	.9964
2.7	.9965	.9966	.9967	.9968	.9969	.9970	.9971	.9972	.9973	.9974
2.8	.9974	.9975	.9976	.9977	.9977	.9978	.9979	.9979	.9980	.9981
2.9	.9981	.9982	.9982	.9983	.9984	.9984	.9985	.9985	.9986	.9986
3.0	.9987	.9987	.9987	.9988	.9988	.9989	.9989	.9989	.9990	.9990
3.1	.9990	.9991	.9991	.9991	.9992	.9992	.9992	.9992	.9993	.9993
3.2	.9993	.9993	.9994	.9994	.9994	.9994	.9994	.9995	.9995	.9995
3.3	.9995	.9995	.9995	.9996	.9996	.9996	.9996	.9996	.9996	.9997
3.4	.9997	.9997	.9997	.9997	.9997	.9997	.9997	.9997	.9997	.9998
3.5	.9998	.9998	.9998	.9998	.9998	.9998	.9998	.9998	.9998	.9998
3.6	.9998	.9998	.9999	.9999	.9999	.9999	.9999	.9999	.9999	.9999
3.7	.9999	.9999	.9999	.9999	.9999	.9999	.9999	.9999	.9999	.9999
3.8	.9999	.9999	.9999	.9999	.9999	.9999	.9999	.9999	.9999	.9999
3.9	1.	1.	1.	1.	1.	1.	1.	1.	1.	1.

Poisson Distribution - Probability Mass Function

x	λ									
	.005	.010	.020	.030	.040	.050	.060	.070	.080	.090
0	.9950	.9900	.9802	.9704	.9608	.9512	.9418	.9324	.9231	.9139
1	.0050	.0099	.0196	.0291	.0384	.0476	.0565	.0653	.0738	.0823
2	0.	0.	.0002	.0004	.0008	.0012	.0017	.0023	.0030	.0037
3	0.	0.	0.	0.	0.	0.	0.	.0001	.0001	.0001

x	λ									
	.100	.200	.300	.400	.500	.600	.700	.800	.900	1.00
0	.9048	.8187	.7408	.6703	.6065	.5488	.4966	.4493	.4066	.3679
1	.0905	.1637	.2222	.2681	.3033	.3293	.3476	.3595	.3659	.3679
2	.0045	.0164	.0333	.0536	.0758	.0988	.1217	.1438	.1647	.1839
3	.0002	.0011	.0033	.0072	.0126	.0198	.0284	.0383	.0494	.0613
4	0.	.0001	.0003	.0007	.0016	.0030	.0050	.0077	.0111	.0153
5	0.	0.	0.	.0001	.0002	.0004	.0007	.0012	.0020	.0031
6	0.	0.	0.	0.	0.	0.	.0001	.0002	.0003	.0005
7	0.	0.	0.	0.	0.	0.	0.	0.	0.	.0001

x	λ									
	1.50	2.00	2.50	3.00	3.50	4.00	5.00	6.00	8.00	10.0
0	.2231	.1353	.0821	.0498	.0302	.0183	.0067	.0025	.0003	0.
1	.3347	.2707	.2052	.1494	.1057	.0733	.0337	.0149	.0027	.0005
2	.2510	.2707	.2565	.2240	.1850	.1465	.0842	.0446	.0107	.0023
3	.1255	.1804	.2138	.2240	.2158	.1954	.1404	.0892	.0286	.0076
4	.0471	.0902	.1336	.1680	.1888	.1954	.1755	.1339	.0573	.0189
5	.0141	.0361	.0668	.1008	.1322	.1563	.1755	.1606	.0916	.0378
6	.0035	.0120	.0278	.0504	.0771	.1042	.1462	.1606	.1221	.0631
7	.0008	.0034	.0099	.0216	.0385	.0595	.1044	.1377	.1396	.0901
8	.0001	.0009	.0031	.0081	.0169	.0298	.0653	.1033	.1396	.1126
9	0.	.0002	.0009	.0027	.0066	.0132	.0363	.0688	.1241	.1251
10	0.	0.	.0002	.0008	.0023	.0053	.0181	.0413	.0993	.1251
11	0.	0.	0.	.0002	.0007	.0019	.0082	.0225	.0722	.1137
12	0.	0.	0.	.0001	.0002	.0006	.0034	.0113	.0481	.0948
13	0.	0.	0.	0.	.0001	.0002	.0013	.0052	.0296	.0729
14	0.	0.	0.	0.	0.	.0001	.0005	.0022	.0169	.0521
15	0.	0.	0.	0.	0.	0.	.0002	.0009	.0090	.0347
16	0.	0.	0.	0.	0.	0.	0.	.0003	.0045	.0217
17	0.	0.	0.	0.	0.	0.	0.	.0001	.0021	.0128
18	0.	0.	0.	0.	0.	0.	0.	0.	.0009	.0071
19	0.	0.	0.	0.	0.	0.	0.	0.	.0004	.0037
20	0.	0.	0.	0.	0.	0.	0.	0.	.0002	.0019
21	0.	0.	0.	0.	0.	0.	0.	0.	.0001	.0009
22	0.	0.	0.	0.	0.	0.	0.	0.	0.	.0004
23	0.	0.	0.	0.	0.	0.	0.	0.	0.	.0002
24	0.	0.	0.	0.	0.	0.	0.	0.	0.	.0001

Musterlösung

Exam Statistics, winter semester 2021/2022

1.1	☐ A ■ B ☐ C ☐ D ☐ E
1.2	■ A ☐ B ☐ C ☐ D ☐ E
1.3	☐ A ☐ B ■ C ☐ D ☐ E
1.4	☐ A ☐ B ■ C ☐ D ☐ E
1.5	☐ A ■ B ☐ C ☐ D ☐ E
1.6	■ A ☐ B ☐ C ☐ D ☐ E
1.7	☐ A ☐ B ☐ C ■ D ☐ E
1.8	☐ A ☐ B ■ C ☐ D ☐ E
1.9	☐ A ☐ B ☐ C ☐ D ■ E
1.10	☐ A ☐ B ☐ C ■ D ☐ E
1.11	☐ A ☐ B ■ C ☐ D ☐ E
1.12	☐ A ☐ B ■ C ☐ D ☐ E
1.13	■ A ☐ B ☐ C ☐ D ☐ E
1.14	☐ A ☐ B ☐ C ☐ D ■ E
1.15	☐ A ■ B ☐ C ☐ D ☐ E
1.16	☐ A ■ B ☐ C ☐ D ☐ E
1.17	☐ A ☐ B ☐ C ■ D ☐ E
1.18	☐ A ☐ B ☐ C ☐ D ■ E
1.19	☐ A ■ B ☐ C ☐ D ☐ E
1.20	☐ A ■ B ☐ C ☐ D ☐ E
1.21	☐ A ☐ B ■ C ☐ D ☐ E
1.22	☐ A ☐ B ■ C ☐ D ☐ E
1.23	☐ A ☐ B ☐ C ■ D ☐ E
1.24	■ A ☐ B ☐ C ☐ D ☐ E
1.25	☐ A ☐ B ☐ C ■ D ☐ E
2.1	☐ A ☐ B ■ C ☐ D ☐ E
2.2	☐ A ☐ B ☐ C ■ D ☐ E
2.3	☐ A ■ B ☐ C ☐ D ☐ E
2.4	☐ A ☐ B ☐ C ■ D ☐ E
2.5	■ A ☐ B ☐ C ☐ D ☐ E