Bsc. Applied Artificial Intelligence

Module: Analysis 1 Exam number: Mock exam	Examination candidate (Please in block letters.) Surname:
Examiner: PD Dr. Kimmerle Date of exam: Duration of exam: 75 minutes Authorised auxiliary means: 1 hand written A4 page (written on both sides), no calculator	First name: Degree programme: Matriculation no.: Room and seating:

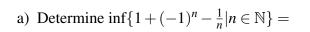
Question	1	2	3	4	5	Σ	grade
Points achieved							
Possible points	12	5	5	12	11	45	

Information:

- This exam has 5 questions.
- This exam may not be separated and has to be submitted completely.
- Please answer on the task sheets (also use the back page). If additional sheets are handed in, please note their number on the cover sheet.
- Unless otherwise stated, all results must be justified and proven by the corresponding calculation steps.
- Please write with a non-erasable pen (e.g. ballpoint pen, fountain pen). Do <u>not</u> use the color red.

Legal notice: Please note this a mock exam. No conclusions for the (final) exam can be guaranteed.

In this question please give your answer (a number, t(rue)/f(alse) or a cross/checkmark in each of the given boxes. Justify your answers shortly. [a) - f) 1 pt. each, g) 4 pts., h) 2 pts.]





b) Compute $\log_2(2^{10}) + \ln(e^{-1}) =$



c) Let w = 3 + 2i and $z = 2 + i \in \mathbb{C}$. Compute $w \cdot z =$



d) We consider the inverse multiplicative element of $z = 2 + i \in \mathbb{C}$.

The real part of z^{-1} reads:



e) Consider the sets $A = \{1, 2\}$ and $B = \{0, 3\}$. What is the cardinality of the cartesian product of both sets, i.e. $|A \times B|$?

f) How many permutations has a set with 5 distinct elements?

g) Fill the gaps in the following table:

space for, e.g., auxiliary columns:

A	В	C	$(A \lor B) \lor C$	$A \Leftrightarrow B$	$\overline{A \wedge C}$
W	W	f			
W	f	f			
f		f	f	W	

h) Which of the following terms is equivalent to $\exp(\ln(2x))$? (multiple choice, please encircle!)

- a) $\ln\left(e^{2x}\right)$,
- b) 2x,

c) x^2 ,

- d) $ln(exp(x^2))$, e) None of the answers a) d).

Show with complete induction over n that we have for any $a \in \mathbb{N}$:

$$\forall n \in \mathbb{N}: (2a-1)^n$$
 is odd

[5 pt.]

a) [2 pts.] Proof by the root test that the series

$$\sum_{k=0}^{\infty} \frac{1}{100^k}$$

converges absolutely.

b) [3 pts.] By using the geometric series rewrite

$$0, \overline{12} = 0, 12121212...$$

as a rational number, i.e. as a fraction $\frac{p}{q}$, $p \in \mathbb{Z}$, and $q \in \mathbb{N}$.

a) [3 pts.] Determine the following limit

$$\lim_{x\downarrow 0}\frac{\sqrt{x}}{\sin(x)}.$$

b) [4 pts.] Let Arcosh be the inverse function of cosh : $\mathbb{R} \to \mathbb{R}^+$. Compute the derivative

and determine its domain of definition.

c) [5 pts.] Determine all stationary points of the function

$$f(x) = x(\ln(x) - 1)$$

and classify w.r.t. minima or maxima.

a) [3 pts.] Determine all primitives for

$$\int \cos(x)\sin(x)\,dx.$$

b) [3 pts.] Compute the integral

$$\int_0^{\pi} \cot(x) \, dx.$$

c) [5 pts.] Plot the set H enclosed between $f: [-1,1] \to \mathbb{R}, x \mapsto \sqrt{1-x^2}$ and the x-axis. Compute the area of H by integration.

Free page, e.g. for secondary calculations