

Exam: Algebra

Hamburg University of Applied Science
 Faculty of Engineering & Computer Science, Department of Information and Electrical Engineering
 Prof. Dr. Robert Heß, July 5th 2013, duration: 90 Min.

Result: of 100 points Mark: points.

Problem 1 (15 points)

The sequence of Fibonacci numbers is defined by $a_1 = a_2 = 1$, $a_{k+2} = a_k + a_{k+1}$ for $k \in \mathbb{N}$.

Prove by mathematical induction: $1 + \sum_{k=1}^n a_k = a_{n+2}$

Problem 2 (15 points)

Express the following terms by disjunction and negation only as short as possible:

a) $a \wedge b$ b) $c \rightarrow d$ c) $\bar{e} \wedge f \wedge g$ d) $h \leftrightarrow i$

Problem 3 (20 points)

Solve the following SLE by Gauss Jordan elimination:

$$x - y + 2z = -1 \quad 3x + 2y + z = 2 \quad x + 2y + 3z = -2 \quad -y - 2z = 2$$

Problem 4 (20 points)

An SLE is expressed by the following extended coefficient matrix:

$$(A|b) = \left(\begin{array}{cccc|c} 1 & 2 & 3 & 1 & -1 \\ 0 & 1 & 2 & 1 & -1 \\ 1 & 3 & 4 & 2 & -1 \\ 2 & 3 & 1 & 1 & 2 \end{array} \right)$$

- a) Evaluate the rank of A and $A|b$.
 b) What is the solution behaviour? Explain your answer.

Problem 5 (20 points)

For $A = \begin{pmatrix} 1 & 3 & 3 \\ 1 & 2 & 1 \\ 2 & 3 & 1 \end{pmatrix}$ evaluate A^{-1} and $\det(A)$

Problem 6 (10 points)

Solve the SLE $x + y = 2$, $x - y = 4$ by applying Cramer's rule.