Chair of Distributed Systems and Security
School of Computation, Information, and Technology
Technical University of Munich

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Compliance to the code of conduct
I hereby assure that I solve and submit this exam myself under my own name by only using the allowed tools listed below.

_____
Signature or full name if no pen input available

Computer Networking and IT-Security

Exam:	INHN0012 / Quiz 1	**Date:**	Thursday 30th November, 2023
Examiner:	Prof. Dr.-Ing. Stephan Günther	**Time:**	12:30 – 12:45

Working instructions

- **Do not forget to sign the rules of conduct at the top of this page (or to enter yout name in the field in case you do not use a tablet device).**
- This exam consists of **6 pages** with a total of **2 problems**.
  Please make sure now that you received a complete copy of the exam.
- The total amount of achievable credits in this exam is 18 credits.
- Detaching pages from the exam is prohibited.
- Allowed resources:
  - everything **except group work, plagiarism and any kind of AI (e. g. ChatGPT**)
- Subproblems marked by * can be solved without results of previous subproblems.
- **Answers are only accepted if the solution approach is documented.** Give a reason for each answer unless explicitly stated otherwise in the respective subproblem.
- Do not write with red or green colors nor use pencils.
- Physically turn off all electronic devices, put them into your bag and close the bag.

Problem 1 Multiple Choice (8 credits)

The following subproblems are multiple choice / multiple answer, i. e. at least one answer per subproblem is correct. Subproblems with a single correct answer are graded with 1 credit if correct. Those with more than one correct answers are graded with 1 credit per correct answer and -1 credit per wrong answer. Missing crosses have no influence. The minimal amount of credits per subproblem is 0 credits.

Mark correct answers with a cross ☒
To undo a cross, completely fill out the answer option ■
To re-mark an option, use a human-readable marking ✕■

a)* Given a Signal with Power 16 mW and Noise Power 8 mW. What is the signal-to-noise ratio in this case?

☐ 3.01 dB ☐ 10.00 dB ☐ 0.30 dB ☐ 6.93 dB ☐ 2.00 dB ☐ 2.00

b)* Which statements about the Fourier transform are correct?

☐ Used to analyze non-periodic signals.
☐ The spectrum is discrete.
☐ The spectrum is continuous.
☐ The spectrum is always bounded.
☐ The spectrum is always complex.

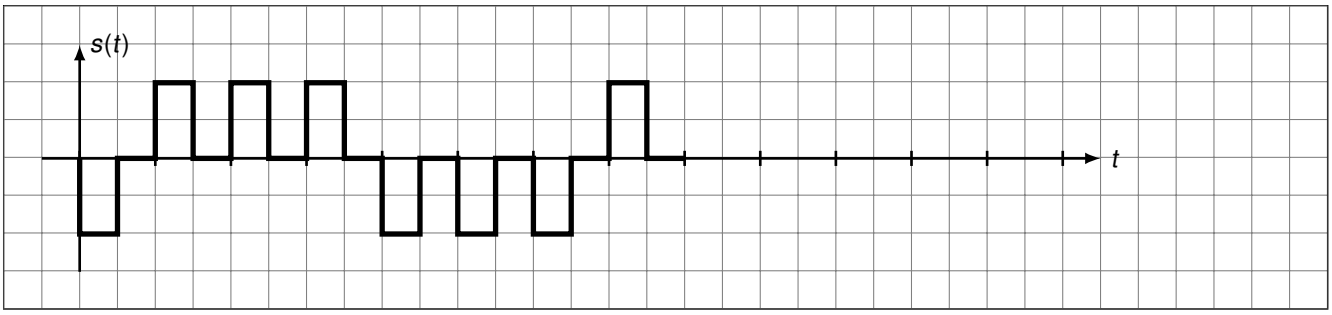
c)* You are given a packet of length 1000 B which is to be transmitted in a cabled network over the distance 2000 km using a data rate of 1000 Mbit/s. Determine the time until the parcel is fully received at its destination.

☐ 6.67 ms ☐ 10.00 ms ☐ 10.01 ms ☐ anderer Wert ☐ 6.67 ms

d)* Which statements about 4B5B coding are correct?

☐ It provides control characters.
☐ It is a code for error correction.
☐ Long inputs are mapped to 4 bit long code words.
☐ It is a code for error detection.

e)* Given the baseband signal shown below, which encodes the bit sequence `0111 0001`. Which of the line codes presented in the lecture was used?

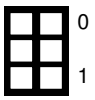


☐ RZ ☐ Manchester ☐ NRZ ☐ MLT-3 ☐ PAM-4

Problem 2 CRC (10 credits)

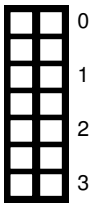
In the following, we consider CRC as introduced in the lecture with the reduction polynomial $r(x) = x^3 + x + 1$.

a)* Explain what a reduction polynomial is being used for.

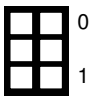


b)* Under which condition is $r(x)$ irreducible?

c) Show whether or not $r(x)$ is irreducible.



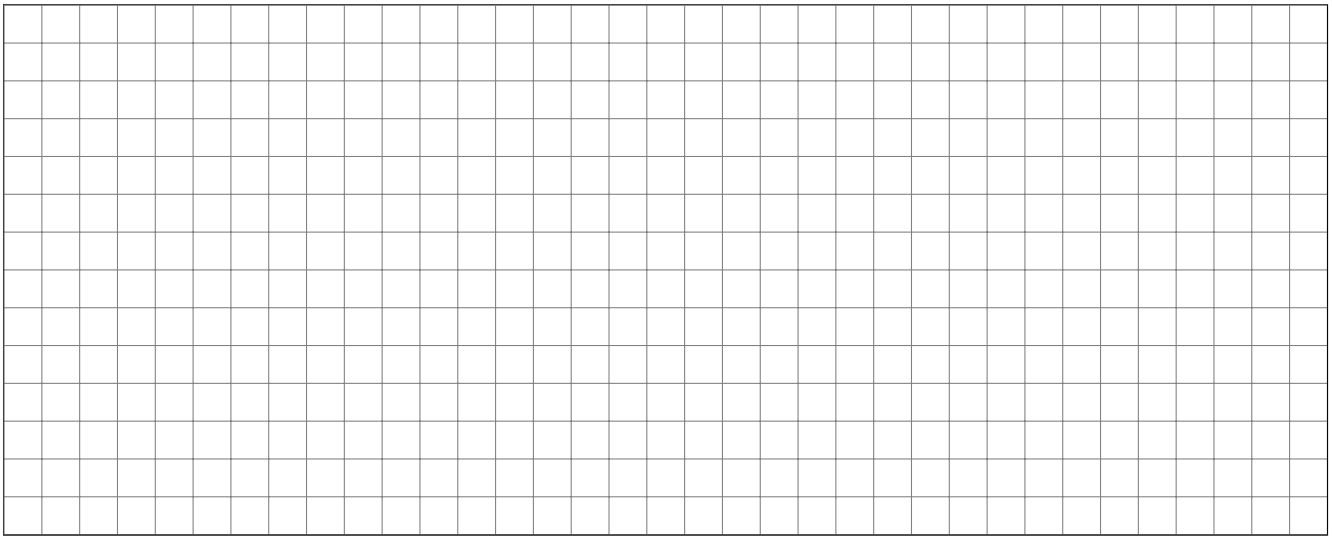
d)* Explain briefly why one often chooses a polynomial that is **not** irreducible as reduction polynomial for CRC.



Let be given the binary message `00100101` and the reduction polynomial $r(x) = x^3 + x + 1$.

0 1 2

e)* Derive the CRC checksum.



0 1

f)* Explicitly state the message that is transmitted.

0 1

g)* Give an error pattern that cannot be detected.

Additional space for solutions–clearly mark the (sub)problem your answers are related to and strike out invalid solutions.