Chair of Distributed Systems and Security
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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.

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Signature or full name if no pen input available

Computer Networking and IT-Security

Exam:	INHN0012 / Quiz 2	**Date:**	Thursday 18th January, 2024
Examiner:	Prof. Dr.-Ing. Stephan Günther	**Time:**	14:30 – 14:45

Working instructions

- This exam consists of **4 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 15 credits.
- Detaching pages from the exam is prohibited.
- Allowed resources:
  - everything **except team work and any kind of AI**
  - the **cheatsheet** from `https://cns.net.in.tum.de`
- 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 Data over tin cans (10 credits)

Given the network shown below, consisting of tin cans 1 and 2, which are connected to each other by a taut cord.

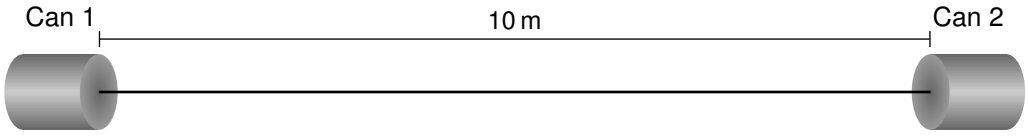


Figure 1.1: Direct connection of two tin cans with a tensioned cord

Information is encoded in the form of the duration of a tone of a certain frequency:

- a tone of 200 ms means a start bit
- a tone of 100 ms means a logical 1
- a tone of 75 ms means a logical 0
- individual tones are separated by a 75 ms idle period

The propagation delay of sound between both tin cans as assumed to be 2000 m/s.

0 1

a)* Name the analog to the start bit for Ethernet. (no reasoning)

0 1

b)* Determine the propagation delay between both tin cans.

0 1

c)* On which technical aspect does the maximum achievable data rate depend?

0 1 2

d)* Derive the average achievable data rate in bit/s assuming that a redundancy-free data stream is to be sent.

The ASCII string “DWT” (without quots) is being transmitted.

0 1 2

e)* Determine the binary representation of that string. Mark start and end of each codeword.

0 1

f) Derive the serialization time (including start bit) for the message.

g)* Reason whether or not under these circumstances a full-duplex communication would be possible.

0 1 2

Problem 2 **Short problems (5 credits)**

a)* For a path in the internet we have determined an MTU of 1240 B. Derive the most meaningful MSS for TCP connections over IPv4. Assume that neither TPC nor IP options / extensions are being used.

0 1

b)* Explain why it is important to choose a MSS for TCP in dependency of the MTU instead of using an arbitrary value.

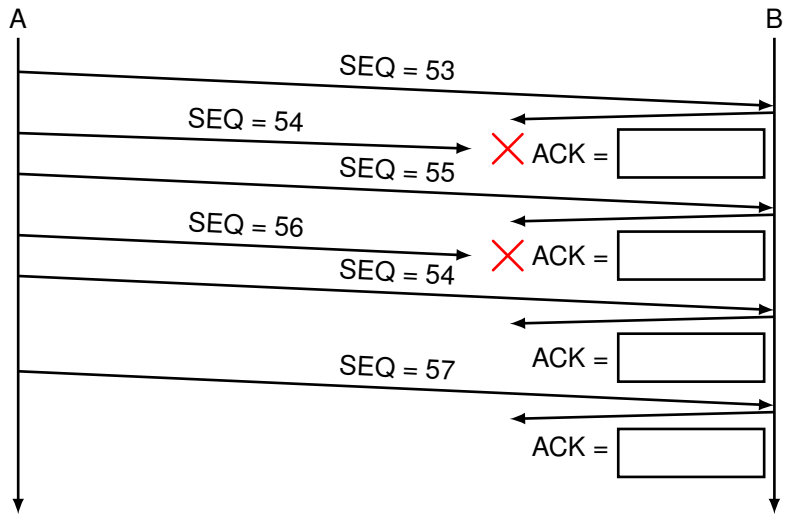
0 1

c)* Why do we need a connection establishment with TCP in contrast to UDP?

0 1

d)* The following diagram shoes multiple segments on Layer 4 being sent from *A* to *B*. Two of those segments get lost. Determine the correct acknowledgement numbers (assume forward acknowledgements) sent by *B* when receiving the segments. **Assume that Go-Back-N is being used.**

0 1 2



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