

Exercises

Groups

- ▶ discuss the questions in groups of two or three
- ▶ we will discuss the answers afterwards together

Data storage, easy

▶ what can we store using one ...

- ▶ Bit
- ▶ Byte
- ▶ kB
- ▶ MB
- ▶ TB

?

Data sizes - storage on DNA, easy

- ▶ is DNA information stored redundantly?
- ▶ how much data is stored in human genome in bytes?

Data sizes - transmission, easy

- ▶ how long does it take to upload a human genome
 - ▶ using WLAN, e.g., eduroam ~ 100 Mbit/s
 - ▶ using 1 Gbit/s, e.g., Ethernet

Data encoding - Flag signaling, medium

- ▶ consider a sailor who wants to signal a number between 0 and 127 using flags
- ▶ how can he achieve his goal using least amount of flags?
- ▶ source: von Baeyer, 2004, page 31



Figure 1:

Official U.S. Navy Page from United States of America [Public domain]

Data encoding - Fax, medium

- ▶ what happens actually when we send a fax?
- ▶ how much data are sent over the phone lines when we send an A4 page?
- ▶ assumptions:
 - ▶ about 5000 characters per page
 - ▶ phone line can carry about 8 kbit/s
- ▶ how could we send the fax faster?

Data sizes - capacity estimation, easy

- ▶ how much storage does a picture taken with your smartphone consume? How big is the picture pixelwise?
- ▶ assume that one picture needs 5 MB. How many pictures can you store on a smartphone with 128 GB memory?

Data encoding - picture, medium

older Röntgen machines still generate pictures in analog format. We scan the DIN A2 Röntgen picture using a 1000x1414 Pixel Scanner.

1. how big are the smallest details of the picture which we can still recognize?

Data encoding - picture II

2. we store the picture in *portable graymap (PGM)* format which looks like this:

```
P2
8 8 (denotes width, height)
255 (denotes max gray value)
000 000 013 083 094 032 000 000
000 ...
007 ...
062 ...
066 ...
010 ...
000 ...
000
```

How much space does the Röntgen picture consume? Every character in PGM is encoded in ASCII. Spaces and newlines are also characters.

Data encoding - picture III

3. what are the advantages and disadvantages of PGM?

Redundancy - Error detection, medium

- ▶ ASCII code takes up 7 bits for a single character, but computers generally work with bytes
- ▶ if you transmit data over communication lines, sometimes bits can be corrupted, i.e., 0 flips to 1
- ▶ how can we use the eighth bit to detect or correct data?