Computer Science and Mathematics
Summer term 2023

Exercises 6

1. How much digital storage capacity would be necessary for the content of a library with 100,000 books, if we assume that each book has 200 pages, each page has 50 lines and each line has 80 characters, and if a 1-byte ASCII code is used for the characters?

2. Find the 8-bit two's complement representation of the negative integer –84 .

3. ASCII coding:

Below you find a part of an 8-bit ASCII code table from a web page. What character string is encoded by the bit string given in binary representation as

0100'0011'0100'1000'0100'1001'0100'0101'0100'0110 ?

(The apostrophs are only used for better overview.)

Part of 8-bit ASCII code table:

decimal	hexadecimal	character
65	41	A
66	42	B
67	43	C
68	44	D
69	45	E
70	46	F
71	47	G
72	48	H
73	49	I
74	4A	J
75	4B	K
...	...	...

4. For a binary representation of genetic information, the four bases from DNA, adenine (A), thymine (T), guanine (G) and cytosine (C), are simply encoded by the 8-bit ASCII codes of their first letters (A = 01000001, etc.).

(a) What is the redundancy of this code, if we assume that the four bases occur with equal frequencies? (In the calculation of H_0, consider all possible 8-bit blocks as symbols of the alphabet.)

(b) Give a non-redundant binary code for A, T, G, C.