Computer Science Fundamentals WS 2021/22

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Please solve all exercises at home prior to the tutorial

Exercise 1

Determine the Hamming distances for the following binary codes. Can you detect or even correct an error? If yes, how many bit-errors can be compensated for?

a) {110101, 101011, 010011, 101100}
b) {2B, 4A, 78, A9} (in hexadecimal notation)

Exercise 2

Determine the Hamming distance for the code {1101011, 1010110, 0000011, 0001100}, and modify this code by changing only a single bit, so that the new Hamming distance is increased by one.

Exercise 3

How many different code words can be used with a 2-out-of-6-code or a 1-out-of-15-code? Give the Hamming distance for each one as well as the redundancy. Assume equal occurrence probabilities for all code words.

Exercise 4

For a serial data transfer, consider 7 Bit encoded ASCII-characters with an additional parity bit (arranged column-wise, MSB/LSB = Most/Least Significant Bit) and block parities (all even parity) sent for every 8 characters. The check bit in the lower right corner pads the number of ones in the entire block to an even number. We receive the following message:

MSB	1	0	1	1	1	1	1	0	
	0	1	1	1	1	1	1	1	
	0	1	0	0	0	0	0	1	
Data bits	0	0	0	1	0	1	0	0	0	block parities
	1	0	1	0	0	0	1	0	1	
	1	1	0	0	1	0	0	1	0	
LSB	0	0	1	1	0	1	1	0	0	
Parity-Bits	1	0	0	0	1	0	0	0	0	

a) What is the **received** message?
b) Was the message compromised during transmission? If yes, what is the **corrected** message?
c) Determine the redundancy added by the parity bits.