Training Exam for
Multimedia Communications

1. Huffman-Coding

Given is the following alphabet $\Sigma$

$$\Sigma = \{X, Y, Z\}$$

and a message $\mu$ in this alphabet

$$\mu = [XZZZYY]$$

(a) How many bits are at least needed to code every letter of the alphabet with constant code size? How many bits are needed for the message $\mu$ using this code?

(b) Calculate the probability of occurrence $p_i$ for every character $\sigma_i$ of the alphabet $\Sigma$ from its occurrences in the message $\mu$.

(c) Use these probabilities to create a Huffman-Tree and give the Huffman-Code for every $\sigma_i \in \Sigma$.

(d) How many bits are needed to encode the message $\mu$ with your Huffman-Code? Calculate the compression rate.

2. MPEG-coding

Given are the following image cutouts for two consecutive frames of an image sequence. Image 1 is coded as I-frame, image 2 as P-frame.

(a) The image cutouts given above are divided in $4 \times 4$-blocks. Specify the motion vectors of the single blocks for the P-frame encoding of image 2. The error measure for the block-matching is $MAD(I_1, I_2) := \|I_1 - I_2\|_1$, the search region is $\pm 2$ pixel. Give the signal that is encoded for the P-frame.

(b) Java-Programming

This exercise asks some Questions about the programming language Java.
i. Enumerate the visible modifiers for class variables in java.

ii. Give the values of the following Java-expressions, explain your results:
   A. 100 % 8 * 4
   B. 100/6
   C. 100/6.0