

Question I

Suppose a user wants to access an image database to search for specific images. The spatial resolution is 720×480 with 8 bits / channel.

- What is the size of an image if the 4: 2: 0 subsampling scheme is used?
- Calculate the aspect ratio of the image?
- How many seconds does it take to send the image via a 512 Kbits/s channel?
- If the image is displayed on a 16: 9 screen, in which direction will the stretch be performed?
- Given an interlaced video with the same image resolution produced at 60 fields per second, how many seconds will it take to send a 10-minute video on a 1 Mbits/s channel?
- What is the compression factor that should be done to send the video in real time?

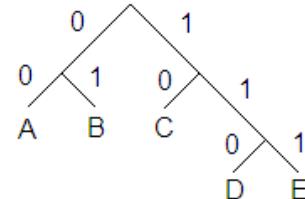
Question II

Consider a source generating messages on the alphabet a, b, c, d according to the probability distribution $p_a = 1/4$, $p_b = 1/2$, $p_c = 1/8$, $p_d = 1/8$.

- Calculate the source entropy $H(p)$.
- Find the associated Huffman codes.
- Find the Shanon-Fano codes.
- Calculate for both coding techniques the average code lengths I_{Huffman} and I_{Shano} , and then compare them to $H(p)$.

Now suppose having the following code tree containing 5 symbols A, B, C, D and E.

- Using this tree, decode the following message:
"0001001011011101".



- Given the following message that was coded using the LZW algorithm: "<65><66><256><67><258><68><260>". Decode the message. To remind you, the ASCII code of the letter A is 65, B is 66 and so on.

Question III

Given a colored RGB image of size $M \times N$, write an algorithm that takes the image and returns the indexed representation of the image. To remind you, an indexed image is composed of two matrices, one for the LUT or colormap and the second is the indexes of the colors in the image.