

University of California at Berkeley
College of Engineering
Department of Electrical Engineering and Computer Sciences

EECS150
Fall 2002

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Homework #7

This homework is due on **Friday October 25th by 2pm**. Homework will be accepted in the EECS150 box outside of 125 Cory. Late homework will be penalized by 50%. No late homework will be accepted after the solution is posted. Please write your lab section number on your homework.

1. From Mano: problems 7-1, 7-2, 7-5, 7-6, 7-7, 7-8, 7-9, 7-15, 7-16, 7-17, 7-18, 7-19, 7-20 and 7-24.
2. Calculate the frame-buffer size in bits for digital video in the CIF format.
3. In our discussions about eTV, we used a frame buffer that holds the viewable pixels of the digital video data frame. Discuss the relative advantage and disadvantage of storing the not just the visible pixels, but the entire video frame.
4. What is the relative bandwidth savings (in percentage) of using 4:2:0 versus 4:2:2 chroma sub-sampling?
5. Given the context of eTV where each scan line of the image is received as a single network packet and written into a frame buffer, sketch a circuit (at the block diagram level) that can be used to convert from 4:2:0 to 4:2:2 chroma sub-sampling. The digital video information received from the network is 4:2:0 and we wish to store it in the frame buffer as 4:2:2. Assume no interpolation is necessary for generating chroma values; it is sufficient to simply replicate values.
6. One function of the frame buffer in eTV is to absorb the slight differences in video frame rate of the sender (video server) and the receiver. In detail, explain what happens over time when the server is sending frames at a slightly higher rate than the receiver is processing them. In particular, explain the case of 30 frames/sec at the server and 29.97 frames/sec video display at the receiver. What is the effect on the video image? Assuming the effect on the video image is unacceptable, what could be done in the receiver to try to help the problem, assuming that you do not have control over the sending rate and the video display rate.