

CS 559: Computer Graphics

Fall 2001

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Please answer the questions concisely on your own paper. Please staple together all of your pages and write your name and CS login on all pages. Concise answers are appreciated. Where a sketch is asked for, a simple one will suffice. If you don't think that your artwork is good enough to convey your point, use words to explain your pictures.

Some of these questions are designed to help you with project 1.

Question 1:

Suppose that you have to convert an RGB color image to black and white. (you'll be asked to do this soon enough).

There are 3 "common" ways to convert to black and white: quantize each pixel (just round to black or white), ordered dithering, and Error Diffusion. (call these Q, O and E).

You could convert to grayscale first (using perceptual weighting of RG and B) and then Quantize, or you could simply have your quantization pick Black or White. (call the former G and the latter P).

This means there are 6 possible ways to have implemented the BW command QG, OG, EG, QP, OP, and EP.

Describe an image that produces a different result for each one of these algorithms. (e.g. it will be obvious looking at the result of an algorithm on this image which of those 6 categories it falls into). Give a sketch and a description of the image. Describe (or sketch) the 6 different results.

Question 2:

Describe what each of the following convolution kernels would do to an image. Assume that the kernels are "centered," and that the resulting image is trimmed to be the size of the original. E.g. the kernel

0	0	0	0	0
0	0	0	0	0
0	0	1	0	0
0	0	0	0	0
0	0	0	0	0

would be the "identity transformation."

2A:

0	0	0	0	0
0	0	0	0	0
0	0	.25	0	0
0	0	0	0	0
0	0	0	0	0

2B:

0	0	0	0	0
0	0	0	0	0
0	0	0	0	0
0	0	0	0	0
0	0	0	0	1

2C:

0	0	0	0	0
0	0	0	0	0
0	-1	1	0	0
0	0	0	0	0
0	0	0	0	0

2D

0	0	1	-1	0
0	0	1	-1	0
0	0	1	-1	0
0	0	1	-1	0
0	0	1	-1	0

2E

0	0	0	0	0
0	0	0	0	0
0	0	1	0	0
0	0	0	0	0
0	0	0	0	.25

Question 3

Consider the problem of "blending" two colors by taking the average of the 3 numbers used to represent them. Consider doing this in the color spaces we have discussed in class (RGB, CMY, HSV, ...).

Suppose you had to describe what happens with this blending to an artist. Pick a space that you think this description would be easiest in and describe (in terms of color and terms an artist would use, not in terms of

math!) what the blending operation does. Give examples of where interpolation in your chosen space gives a more "intuitive" result than what some other spaces would do.

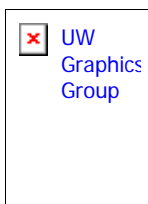
Question 4

Students in last years class were asked to write a program that decimated an image by a factor of two. Some students did this by point sampling, while others did this by averaging each 2x2 block of the image. Call the groups P (for point samplers) and A for the averagers. (there are other ways to do this, that are even more correct, but for this question consider only these two). Consider only monochrome images for this question.

Suppose we wanted to be able to encode a secret message by making an image such that everyone who wrote the "half" algorithm with one method saw the image, and everyone who wrote it the other way did not.

4A: Describe han image that the two different groups (P and A) would get very different results for. (One that we could use for testing programs quickly).

4B: Explain why it is difficult (maybe impossible?) to create an image such that everyone in group A gets one result, and everyone in group P gets a different result (but the same as everyone else in their group).



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