CS510 Intro to Multimedia Networking: Homework #3

Due on October 12, 2015 at 8:00am

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Problem 1

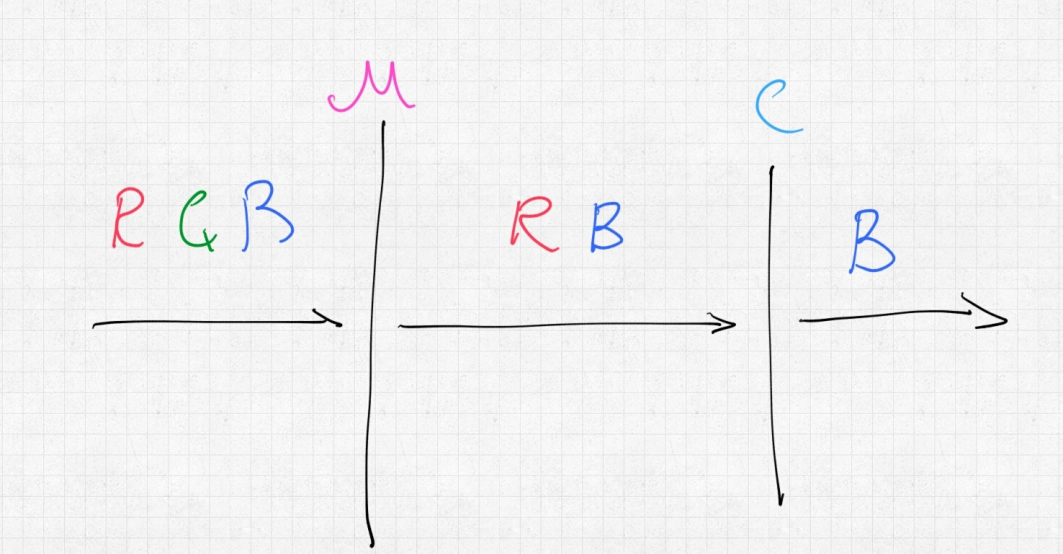
Suppose we have the ideal stereo audio signal of 16-bit samples and a sampling rate of 44,100 Hz. Further, suppose we have a process that converts this data into the ulaw format. What is the effective compression ratio of this process?
Bit-rate of given audio is $44100 \times 16 \times 2 = 1411200$ Bits/second.
Ulaw bit-rate is $8 \times 1000 \times 8 = 64000$ Bits/second.
Compression ratio is $\frac{1411200}{64000} = 22.05$

Answer: 22.05 : 1

Problem 2

How does one generate blue using CMY filters?

To generate blue we need to apply C and M filters to remove Green and Red.



Problem 3

Suppose we have a 24 MP image (6000x4000). We would like to compare the storage requirement for tuples (e.g., straight RGB storage) versus a single number that is an index to a color tuple (e.g., how GIF represents images).

(a) Assuming 24-bit RGB values, how much memory would be required to represent the image using straight tuples?

To represent 24MP image, using 24 bit RGB values we need $6000 \times 4000 \times 3 \times 24 = 576000000$ Bits

(b) Suppose we have a color table representation, where the index points to the color value (remember, the color table needs to store the actual RGB values). What is the total memory needed to represent the color table and represent the image, if the index is 8-bits? 12-bits? 16-bits? and 20 bits? There is one answer for each.

Problem 3 continued on next page...

Total memory for 8 bits = $256 * 8 * 24 = 49152 + 6000 * 4000 * 8 = 49152 + 192000000 = 192049152$ Bits
Total memory for 12 bits = $4096 * 12 * 24 = 1179648 + 6000 * 4000 * 12 = 1179648 + 288000000 = 289179648$ Bits
Total memory for 16 bits = $65536 * 16 * 24 = 25165824 + 6000 * 4000 * 16 = 25165824 + 384000000 = 409165824$ Bits
Total memory for 20 bits = $1048576 * 20 * 24 = 503316480 + 6000 * 4000 * 20 = 503316480 + 480000000 = 983316480$ Bits

(c) For the 8, 12, 16, and 20-bit indexes above, what is the maximum number of colors that can be represented.

For 8 bits = $2^8 = 256$ Colors
For 12 bits = $2^{12} = 4096$ Colors
For 16 bits = $2^{16} = 65536$ Colors
For 20 bits = $2^{20} = 1048576$ Colors