Multimedia Systems and Applications

Midterm Exam

(Question Bank)

1. Briefly explain, in your own words, the difference between "Hypermedia" and "Multimedia".

2. What extra information is multimedia good at conveying?

(a) What can spoken text convey that written text cannot?

(b) When might written text be better than spoken text?

3. What information is embedded in (a) Speech (b) Image and (b) Video, respectively?

4. Please answer the following questions.

(a) What is gamma correction for the display in the CRT system?

(b) If the color is out of gamut on a device, please provide one method to deal with this problem.

5. (a) What is Weber's Law?

(b)What is Nyquist Theorem?

(c) Please describe "aliasing."

6. (a) What is meant by the Multimedia and Hypermedia? Distinguish between these two concepts.

(b) Why is file or data compression necessary for Multimedia activities, specially when transmitted on the Internet?

(c) Please describe "aliasing."

7. My old SoundBlaster card is an 8-bit card

(a) What is the definition of Signal-to-Quantization-Noise (SQNR)

(b)What is the best SQNR it can achieve?

8. For a quantization accuracy of N bits per sample, what is the worst case of the SQNR?

9. Describe the process of the digitization of an analog sound. Define what a sample is, the frequency of occurrence and how these factors can affect the quality of sound.

10. (a) Dithering is often used when converting greyscale images to monochrome. What is the basic idea of dithering algorithm?

(b) For the given 2x2 dither matrix, briefly describe the ordered dithering algorithm.

$$\begin{pmatrix} 0 & 2 \\ 3 & 1 \end{pmatrix}$$

(c) Use the same dither matrix, what is the result for the following input? Assume that the input is greyscale intensities normalized to 0 to 1.

0.66	0.18	0.03	0.19
0.54	0.13	0.56	0.37
0.70	0.99	0.88	0.46
0.67	0.17	0.67	0.98

11. Instead of using 8 bits per pixel, you'd like to use 48 bits per pixel in RGB. How could you store the original grayscale images so that in the new format they would appear the same as they used to, visually?

12. Please describe the steps to devise a Color Lookup Table to make 8-bit lookup color out of 24-bit color. You can choose your own way or median-cut algorithm.

13. Please answer the following questions.

(c) What is gamma correction for the display in the CRT system?

(d) If the color is out of gamut on a device, please provide one method to deal with this problem.

14. Suppose we use a new set of color-matching functions $x^{new}(\lambda)$, $y^{new}(\lambda)$, $z^{new}(\lambda)$ with values

λ (nm)	$x^{new}(\lambda)$	$y^{new}(\lambda)$	$z^{new}(\lambda)$
450	0.2	0.1	0.5
500	0.1	0.4	0.3
600	0.1	0.4	0.2
700	0.6	0.1	0.0

In this system, what are the chromaticity values (*x*, *y*) of equi-energy white light $E(\lambda)$ where $E(\lambda)=1$ for all wavelengths λ ? Explain.

15. Digital video uses *chroma subsampling*. What is the purpose of this? Why is it feasible?

16. If a set of ear protectors reduces the noise level by 30 dB, how much do they reduce the intensity (the power)?

17. Suppose the sampling frequency is 1.5 times the true frequency. What is the alias frequency?

18. Suppose we use a predictor as follows:

$$\hat{f}_n = trunc[\frac{1}{2}(\tilde{f}_{n-1} + \tilde{f}_{n-2})$$

$$e_n = f_n - \hat{f}_n$$

Also, suppose we adopt the quantizer

$$\tilde{e}_n = Q[e_n] = 16 * trunc[(255 + e_n)/16] - 256 + 8$$

$$\tilde{f}_n = \hat{f}_n + \tilde{e}_n$$

If the input signal has values as follows:

20 38 56 74 92 110 128

What is the output from a DPCM coder (without entropy coding)?

19. Suppose we use a predictor and the uniform delta modulation (DM) as follows:

$$\hat{f}_n = \tilde{f}_{n-1}$$

$$e_n = f_n - \hat{f}_n$$

Also, suppose we adopt the quantizer as

$$\tilde{e}_n = \begin{cases} 10 & \text{if } e_n > 0 \\ -10 & \text{otherwise} \end{cases}$$

$$\tilde{f}_n = \hat{f}_n + \tilde{e}_n$$

If the input signal has values as follows:

25 34 39 54 62 70 88

What is the output from a DM coder?