



CS 414 – Multimedia Systems Design
Lecture 19 –
Midterm Review Session

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Spring 2008



Administrative

■ Homework 1

- deadline – February 29
- solutions will be posted on March 1

■ Midterm special office hours

- Sunday, March 2
 - William Conner: Office hours: 2-3pm in TA office
 - Klara Nahrstedt, Office hours: 3-4pm in 3104 SC



Midterm

- March 3 (Monday), 11-11:50am, 1103 SC
- Closed Book, Closed Notes
- You can bring calculator



Covered Material

- Class Notes (Lectures 1-18)
- Book Chapters to read/study:
 - Media Coding and Content processing book
 - Chapter 2, chapter 3.1-3.2, 3.8, chapter 4.1-4.2.2, 4.3, 4.5, chapter 5, chapter 7.1-7.5, 7.7
 - Multimedia Systems book
 - Chapter 2, chapter 5.1



Material

■ Media Characteristics

- Synchronous, Isochronous, Asynchronous
- Regular, irregular
- Weakly and strongly periodic streams

■ Audio Characteristics

- Samples, frequency,
- Perception, psychoacoustic effects, loudness, pitch, decibel, intensity
- Sampling rate, quantization



Material

- Audio Characteristics
 - PCM, DPCM, ADPCM, signal-to-noise ratio
- Image Characteristics
 - Sampling, quantization, pixels
 - Image properties: color, texture, edges
 - Simple edge detection process



Material

■ Video technology

- Color perception: hue, brightness, saturation,
- Visual representation: horizontal and vertical resolution , aspect ratio; depth perception, luminance, temporal resolution and motion
- Flicker effect
- Color coding: YUV, YIQ, RGB
- NTSC vs HDTV formats



Material

- Basic Coding schemes

- Run-length coding

- Statistical coding

- Huffman coding

- Arithmetic coding

- Hybrid codes

- JPEG: image preparation, DCT transformation, Quantization, entropy coding, JPEG-2000 characteristics



Material

■ Hybrid Coding

- Video MPEG: image preparation, I, P, B frames characteristics, quantization, display vs processing/transmission order of frames
- Audio MPEG: role of psychoacoustic effect, masking, steps of audio compression
- MPEG-4: differences to MPEG-2/MPEG-1
 - Audio-visual objects, layering



Material

- Quality of Service concepts
 - Service classes, QoS specification – deterministic, predictive, best effort, QoS classification – application, system, network QoS, relation between QoS and resources
 - QoS operations: translation, negotiation, routing



Material

- Resource Management concepts
 - QoS and resources, establishment phase and transmission/enforcement phase
 - Admission of resources, reservation and allocation of resources
 - LBAP arrival model
 - Enforcement of guarantees : rate control, error control, resource monitoring and adaptation



Material

■ Multimedia Transport

- Requirements and constraints
- Examples of translation and negotiation protocols
- Admission control for bandwidth and delay
- Reservation protocols, types of reservations
- Traffic Shaping, how is a traffic shape expressed
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Material

■ Multimedia Transport

- Traffic Shaping – Leaky Bucket, (r, T) shaping, Token Bucket, difference between them
- Rate control – fair queuing, delay earliest deadline first, stop-and-go scheme, jitter-earliest deadline first scheme
- Error control – go-back-N retransmission, selective retransmission, difference to FEC (forward error correction) ,



Sample Problems

- Consider the following alphabet $\{C, S, 4, 1\}$, with probabilities: $P(C) = 0.3$, $P(S) = 0.2$, $P(4) = 0.25$, $P(1) = 0.25$.
- Encode the word CS414 using
 - Huffman coding and arithmetic coding
 - Compare which encoding requires less bits



Sample Problems

- Describe briefly each step in MPEG-1 audio encoding. Specify the functionality, which is performed in each step. You don't have to provide equations, only a clear explanation of the functionality that is performed inside each step.



Sample Problems

- What is flicker effect and how to remove it?
- Explain difference between synchronous and isochronous transmission stream modes
- Provide five differences between MPEG-4 video encoding standard and the previous MPEG video encoding standards



Sample Problems

- Consider voice application (like Skype). If you could redesign the underlying protocol stack under the voice application, what multimedia-sensitive protocols, services, and algorithms would you deploy? Specify clear design of the new protocol stack, i.e., what order would you use what services, algorithms, protocols.