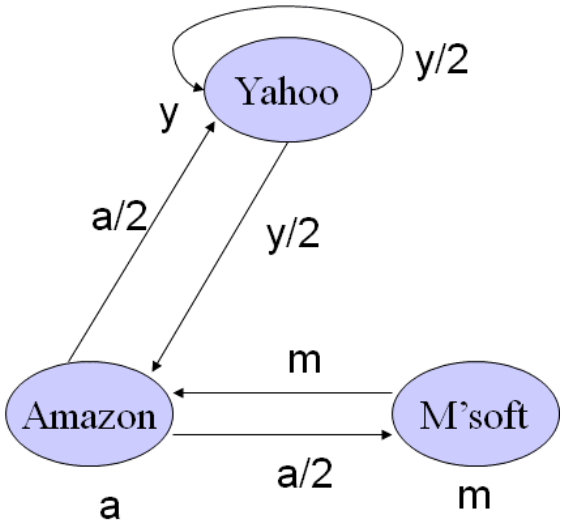
Midterm Study Topics & Questions

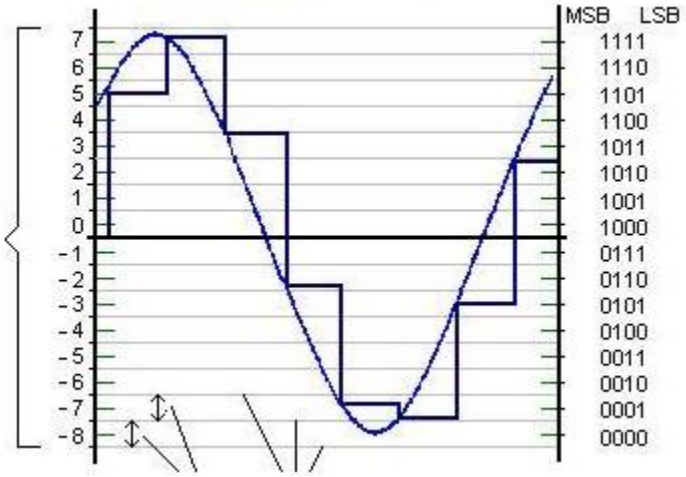
You are allowed 2 pages of notes for the test.

1. What is multimedia? [L01)
   a. Give examples of MM data in an application (combinations of text, sound, images, animation, graphics)
   b. Discuss a multimedia system you use on one of the following platforms: mobile phone, home PC, TV, Social media, streaming video, etc.
   c. Explain three state-of-the-art MM research topics
2. What are Multimedia Information Systems?
   Consider their advanced features: supports problem solving (in the information domain), contains large amounts of MM data, interactive or immersive, smart features, intelligent assistance, and user interface (and interaction) modalities. [L01,L13]
3. Name a multimedia application that focusses on (and explain why):
   a. Data
   b. Information
   c. Knowledge
   d. Wisdom
4. What characterizes an interactive multimedia information system?
5. Explain adaptive behavior in machine learning systems.
6. How does multimedia enable augmented, virtual, and extended reality?
7. Explain how we model the web as a directed graph [L02]
8. What is information retrieval?
   Explain searching, role of metadata, information content, etc.
9. Which of the following represents “the fraction of relevant instances that are retrieved”?
   a. Precision
   b. Recall
   c. Relevance
   d. Importance
10. In web search which one is more important, precision or recall?
11. What is the difference between web search and information retrieval?
12. What is a web crawler?
13. Define relevance and importance of web documents in a web query, how does that relate to the PageRank algorithm?
14. Given the web/link graph below, write the normalized connectivity matrix, the initial values of W0, and the formula for the PageRank calculation with damping.



15. Define NLP and give two examples of NLP applications [L03]
16. What is folksonomy, taxonomy, and what is their relevance to NLP?
17. What is a key task (the hardest problem) of any NLP system or algorithm which still remains unsolved? Give an example
18. Name three types of ambiguity
19. What is the difference between syntactic and semantic analysis?
20. What is the difference between question answering and summarization?
21. What is the difference between abstractive and extractive summarization?
22. What is the difference between text categorization and text clustering? [L04]
23. Explain the concept of bag of words and its application
24. What is a lexicon and how is it used in text categorization?
25. Is it possible to do clustering and classification without a similarity/distance metric?
26. Explain a metric to compute document similarity. [L04-05]
27. Explain text classification by k nearest-neighbors
28. Explain the basis of sentiment analysis and one application
29. Explain the following concepts in sound signals [L06, and L07]
    a. Frequency
    b. Amplitude
30. Explain the following concepts in sound perception
    a. Pitch
    b. Loudness
    c. Timbre
31. What does HRTF stand for?
32. Explain the three stages of sound reproduction
    a. ADC
    b. Processor
    c. DAC
33. Define
    a. Nyquist rate
    b. dB

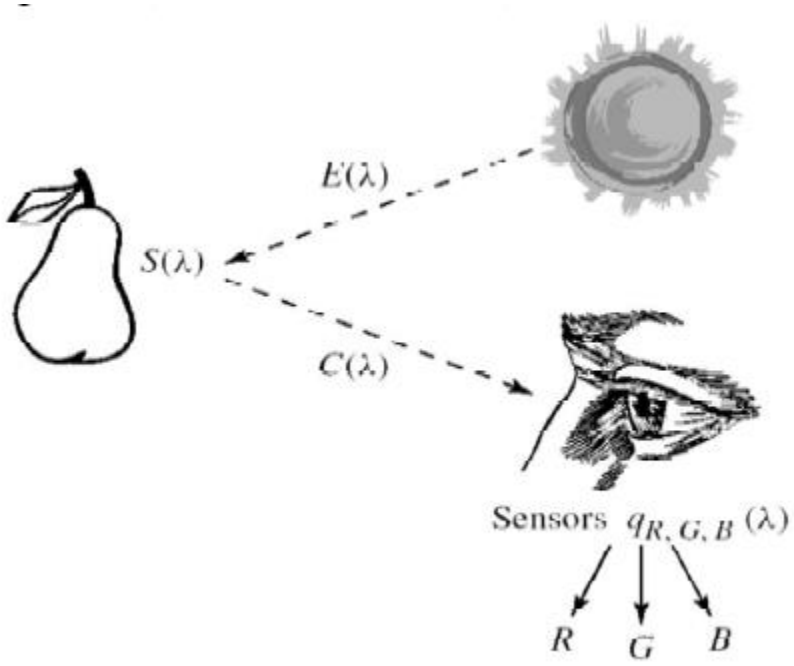
    c. SNR
    d. Quantization
34. Explain why we must sample above Nyquist rate
35. What is quantization noise, what is the difference between quantization noise and quantization error?
36. For a signal uniformly quantized using 7 bits/sample what is the signal to quantization noise ratio? [L06-P51]
37. Why does non-linear quantization improve SNR? [L06-P33]
38. Define and explain PCM
39. Write the PCM binary code received for the signal below:



40. Define
    a. AM
    b. FM
    c. MIDI
41. Define voiced vs. non-voiced sounds [L07, P33-34]
42. True or false:
    a. voiced sounds are characterized by vibration of the vocal cords
    b. unvoiced sounds involve no vibration, just random air pressure through the larynx
    c. Most vowels are voiced
    d. Consonants can be voiced or voiceless
43. What is CEPSTRUM analysis, and why is it related to deconvolution?
44. What are the four steps of Cepstral Analysis?
45. What is homomorphic filtering?
46. What is the role of metadata in music information retrieval systems? (L09-P09)
47. True/False – the following are examples of low level audio features
    a. Spectrogram
    b. Harmonicity
    c. Zero crossing rate
    d. Melody
    e. Lyrics
48. True/False
    a. High level music features are more robust than low level features

b. Silence ratio is a frequency domain feature
c. Music features are extracted on time segments
d. Similarity metrics enable visualization of music content
e. The bandwith of music is smaller than the bandwidth of speech

49. In information theory, what is the definition of entropy? [L09-P41]
50. Which compression algorithm has higher SNR for the same input signal?
    a. Lossless compression
    b. Lossy compression
51. Explain the principle of differential coding for audio
52. Draw the diagram and explain lossless predictive coding
53. What is DPCM (L09-P48,P56)?
54. What is the range of visible light in nm (of wavelength) [L10]
55. In the image formation model



Explain E(λ), S(λ), C(λ), $q_{R,G,B}(\lambda)$

56. Which of the two images below has been gamma corrected?

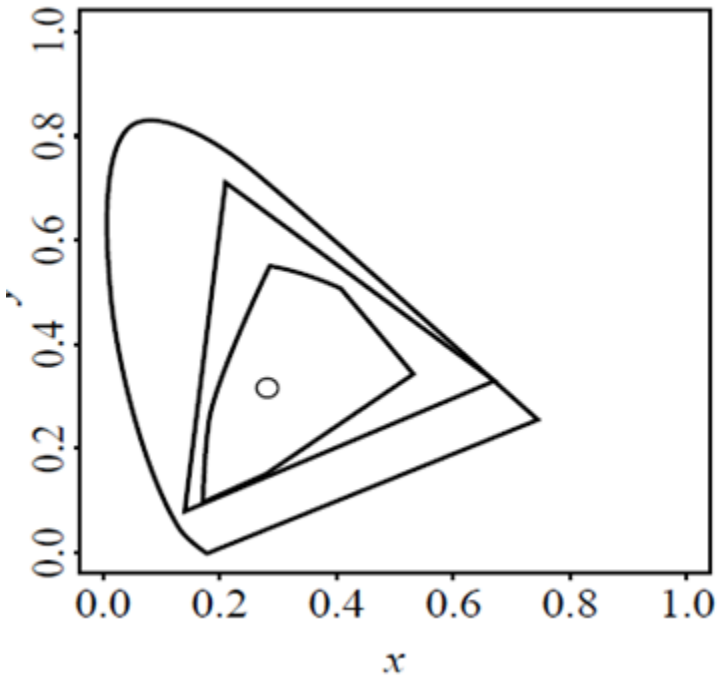
57. Explain contrast in luminance (black-white) and color (opposites: Y-B, R-G).
58. Given the equations to convert from RGB to XYZ, convert the color Magenta in 8-bit RGB (255,0,255) to XYZ (hint: convert RGB to 0-1 scale before converting color spaces)

$$X = 0.3935 \cdot R + 0.3653 \cdot G + 0.1916 \cdot B$$

$$Y = 0.2124 \cdot R + 0.7011 \cdot G + 0.0866 \cdot B$$

$$Z = 0.0187 \cdot R + 0.1119 \cdot G + 0.9582 \cdot B$$

59. The outside shape is the chromaticity diagram, the small circle is the reference white, of the remaining figures which is the gamut of the display and which the gamut of the printer:



60. Define image resolution, aspect ratio, and size [L11]
61. What is the dynamic range of an image, and how does it affect quality?
62. What is pixelation?
63. What is dithering and what is it used for? Does it work for color images?
64. What is the difference between visual quality (measured in subjective score) and quality of experience? [L12]
65. Name 3 desirable image features and 3 undesirable image features
66. Name 3 network parameters that are adjusted during quality of service (QoS) management
67. What are the three steps of a basic edge detector? (L12-P55)
68. Name four types of image regions and how can we identify them? (L12-P59)
69. In MMIS video data falls in two categories, produced and observed, explain the difference. [L13, p.10-11]
70. In video-based MMIS, explain the role of ontologies. [L13, p. 13,25]
71. What is the semantic perspective in a produced video document? [L13, p. 14]
72. What the content perspective in produced video? [L13 p.16]

73. Explain what the semantic gap in MMIS is. [L13, P19-20]—related to the difference between perceptual and semantic similarity [L13, p.23]
74. What is Word2Vec used for? {L13-P26)
75. Explain the process of video content segmentation. [L13, P29-31]
76. What is video summarization? [L13-P36]
77. The perspective used in semantic video indexing comes from (select one answer): a. the author, b. the location, c. the camera. [L13, p. 4]