

UNIVERSITY OF RUHUNA

BACHELOR OF COMPUTER SCIENCE (GENERAL) DEGREE

LEVEL II (SEMESTER II) EXAMINATION – NOVEMBER/DECEMBER 2016

CSC2263 – Multimedia and Video Production (Theory)

Duration: 2 hours

Answer all questions

1)

- a) Define the term Multimedia.
- b) What is the human perception frequency range of audio signals?
- c) Suppose an audio signal is digitized with the frequency of 20 Hz and quantization with 1 byte.
 - i. Compute the sampling period in *milliseconds*.
 - ii. Compute the bit rate in *bps*.
 - iii. Compute the capacity of one hour of digitized audio signal in *KBs*.
- d) Suppose the Huffman encoding technique has to be used to encode a source of $N = 8$ symbols: $X(n) = \{a, b, c, d, e, f, g, h\}$. The probabilities of these symbols are: $P(a) = 0.02$, $P(b) = 0.01$, $P(c) = 0.06$, $P(d) = 0.08$, $P(e) = 0.16$, $P(f) = 0.22$, $P(g) = 0.30$, $P(h) = 0.15$.
 - i. Find the average length of the code need to represent the above symbols without using any encoding technique.
 - ii. Compute the theoretical lowest average length of the code required to represent above symbols. The logarithmic values are shown in the table below.

x	$\text{Log}_2(x)$
0.02	-5.64
0.01	-6.64
0.06	-4.05
0.08	-3.64
0.16	-2.64
0.22	-2.18
0.30	-1.73
0.15	-2.73

- iii. Compute the Huffman code for each symbol by clearly showing the binary tree structure.
- iv. Compute the average length of the Huffman codes for the source.

2)

- a) Briefly describe monochrome, gray-scale, pseudo-color, and true-color image types.
- b) Consider a non-compressed video with resolution 1080×1920 and frame rate 30 fps. The depth of a pixel is 2 bytes.
- Compute the bit rate for 4:2:0 subsampling.
 - Compute the new bit rate if the video was compressed with the compression factor 100.
- c) What is it meant by the terms: spatial redundancy and temporal redundancy?
- d) Briefly explain the run length coding technique using an example.
- e) Consider the matrix given below obtained by applying discrete cosine transform to a 4×4 block of an image.

1250	-2	-11	-6
-24	-18	-5	-4
-10	-8	-3	2
-7	-1	1	2

- i. Compute the quantized matrix using the quantization matrix given below.

14	9	9	17
9	17	12	17
9	7	17	17
17	11	17	33

- ii. Write the zigzag ordering matrix of the quantized matrix computed above.
- f) Write two differences between JPEG and GIF image formats.
- g) What is the range of the visible light in the electromagnetic spectrum?
- h) Briefly explain the difference between luminance and brightness.

3)

- a) Briefly explain the three basic elements of MPEG-7 multimedia content description standard.
- b) Write down the advantages of using JPEG 2000 image compression standard.
- c) State the Nyquist sampling theorem.
- d) A given audio signal is a mixture of three frequencies: 100 Hz, 300 Hz, and 800 Hz. Explain a method to derive each of the above frequencies separately. Use appropriate charts as necessary.
- e) State the four sound compression techniques along with their corresponding models.
- f) Briefly explain the three layers of MPEG audio.
- g) Explain YIQ color model.

4)

- a) Write the high level document structure of SMIL.
- b) A video is stored in the path: *D:\Movies*. The name of the video is *my_Vid* and its extension is *.avi*. This video should be embedded to a webpage using HTML. Also the video should start automatically and play in a loop. The width and height of the video should be set to 300 and 400 pixels respectively.

Write the relevant HTML code segment to implement the above requirements.

- c) State five media protection principles.
- d) What are the two underlying technologies of digital rights management (DRM)? Briefly explain each of them.
- e) Briefly explain three techniques used for watermarking of formatted text.
- f) Briefly explain a technique that can be used to watermark a still image.
- g) State the Fourier's theorem.
- h) Briefly explain the phenomenon of frequency masking.
- i) State three differences between symmetric encryption and asymmetric encryption.