

B.E. Information Technology
Third Year Second Semester Examination 2024
Subject: Multimedia Coding & Communications

Time: 3 hours

Full Marks: 100

Different parts under the same CO should be answered together.

<p>CO1 [30]</p>	<p>1.</p> <p>a. What are the key components of Multimedia? Name two examples of Multimedia applications.</p> <p>b. Explain the purpose of Hypermedia. How does Hypermedia differ from traditional linear media?</p> <p>c. What is a "Sprite" in the context of Sprite Animation? Explain the concept of "Sprite Animation."</p> <p>d. Name two popular software tools used for Digital Audio editing.</p> <p>e. Name two Multimedia authoring tools. Compare and contrast two types of Multimedia authoring metaphors.</p> <p>f. Explain the steps involved in creating a Multimedia presentation from start to finish.</p> <p>g. What are the different video transition schemes? Explain any 4 of them in detail.</p> <p align="center">OR</p> <p>2.</p> <p>a. Explain GIF 87 file format in detail with suitable diagrams.</p> <p>b. Describe 8-bit Gray Level Images.</p> <p>c. Write short note on MIDI Messages.</p>	<p>3 + 3 + 5 + 2 + 4 + 3 + 10 = 30</p> <p>10 + 10 + 10 = 30</p>
<p>CO2 & CO3 [48]</p>	<p>3.</p> <p>(a) Execute LZW compression and decompression algorithm on the string "MISSISSIPPI" where the value of the string table is [M-1, S-2, I-3, P-4].</p> <p>(b) A 4-symbol alphabet has the following probabilities $P(a_1) = 0.1$, $P(a_2) = 0.5$, $P(a_3) = 0.25$, $P(a_4) = 0.15$ and following codes are assigned to the symbols $a_1 = 110$, $a_2 = 0$, $a_3 = 10$, $a_4 = 111$. What is the average code word length for this source?</p> <p>4. Construct a Shannon-fano tree and Hauffman tree for the word "APPLE". The code in real decimal numbers for the word "APPLE" formed out of a 4-symbol alphabet – "A", "P", "L" and "E" having probabilities 0.2, 0.4, 0.2, and 0.2 respectively. Compare the</p>	

codeword length, its entropy, and coding efficiency expressed for the same word by both schemes.

5. A long sequence of symbols generated from a source is seen to have the following occurrences.

Symbol	Occurrences
a1	3003
a2	996
a3	2017
a4	1487
a5	2497

(a) Assign Huffman codes to the above symbols, following a convention that the group/symbol with higher probability is assigned a "0" and that with lower probability is assigned a "1".

(b) Calculate the entropy of the source.

(c) Calculate the average code word length obtained from Huffman coding.

(d) Calculate the coding efficiency.

6.

Show the step-by-step execution of encoding and decoding of the Arithmetic coding algorithm on the string "EAOU" where the probability distribution of the symbols are given the following table:

Symbol	Probability
A	0.12
E	0.42
I	0.09
O	0.3
U	0.07

7. Below is a grey scale image X where grey levels are ordered from 0 to 6. X is represented using the following matrix:

$$X = \begin{bmatrix} 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 1 & 1 & 2 & 3 & 3 & 3 \\ 0 & 1 & 1 & 3 & 3 & 3 & 4 & 4 \\ 0 & 1 & 3 & 3 & 5 & 5 & 4 & 4 \\ 0 & 2 & 3 & 3 & 5 & 5 & 5 & 4 \\ 0 & 0 & 2 & 3 & 3 & 4 & 6 & 6 \\ 0 & 0 & 0 & 2 & 2 & 3 & 4 & 4 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \end{bmatrix}$$

Show the step by step execution of the Huffman coding to compress the image. Also, calculate the compression achieved using the Huffman coding.

8. Consider messages made up entirely of vowels (A, E, I, O, U). Here's a table of probabilities for each of the vowels:

<i>l</i>	p_l	$\log_2(1/p_l)$	$p_l \log_2(1/p_l)$
A	0.22	2.18	0.48
E	0.34	1.55	0.53
I	0.17	2.57	0.43
O	0.19	2.40	0.46
U	0.08	3.64	0.29
Totals	1.00	12.34	2.19

- Give an expression for the number of bits of information you receive when learning that a particular vowel is either *I* or *U*.
- Using Huffman's algorithm, construct a variable-length code assuming that each vowel is encoded individually. Please draw a diagram of the Huffman tree and give the encoding for each of the vowels.

Encoding for *A*:

Encoding for *E*:

Encoding for *I*:

Encoding for *O*:

Encoding for *U*:

	<p>9.</p> <p>Execute encoding and decoding of the arithmetic coding on the symbol "DEAF\$" using the following probability distribution:</p> <table border="1"> <thead> <tr> <th>Symbol</th> <th>Probability</th> <th>Range</th> </tr> </thead> <tbody> <tr> <td>A</td> <td>0.2</td> <td>[0, 0.2)</td> </tr> <tr> <td>B</td> <td>0.1</td> <td>[0.2, 0.3)</td> </tr> <tr> <td>C</td> <td>0.2</td> <td>[0.3, 0.5)</td> </tr> <tr> <td>D</td> <td>0.05</td> <td>[0.5, 0.55)</td> </tr> <tr> <td>E</td> <td>0.3</td> <td>[0.55, 0.85)</td> </tr> <tr> <td>F</td> <td>0.05</td> <td>[0.85, 0.9)</td> </tr> <tr> <td>\$</td> <td>0.1</td> <td>[0.9, 1.0)</td> </tr> </tbody> </table>	Symbol	Probability	Range	A	0.2	[0, 0.2)	B	0.1	[0.2, 0.3)	C	0.2	[0.3, 0.5)	D	0.05	[0.5, 0.55)	E	0.3	[0.55, 0.85)	F	0.05	[0.85, 0.9)	\$	0.1	[0.9, 1.0)	
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CO4 [12]	<p>10. Answer any FOUR of the following:</p> <ol style="list-style-type: none"> Mention some observations on JPEG Image compression. Write the main steps of JPEG Image Compression. Write a short note on JPEG - 2000 Standard. What is JBIG and JBIG 2? Differentiate between JPEG - LS Standard vs JPEG - 2000 Standard. What are 4 commonly used JPEG modes? 	3 x 4 = 12																								
CO5 [10]	<p>11. Write short notes on any FOUR of the following.</p> <ol style="list-style-type: none"> Multimedia Data Multimedia over IP Multimedia over ATM network Transport of MPEG 4 Media on Demand Multiplexing Technologies 	2.5 x 4 = 10																								