Data Compression VTU Question Paper Set

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10CS/IS663

Sixth Semester B.E. Degree Examination, Dec.2016/Jan.2017
Data Compression

Time: 3 hrs. Max. Marks:100

Note: ***Answer FIVE full questions, selecting at least TWO questions from each part.***

PART – A

1 a. Define data compression. Explain the two broad classes of compression algorithms, with example. **(04 Marks)**

b. Write a short note on Markov model. With a help of a simple example, show that Markow model gives better performance than probability model with iid assumption. **(06 Marks)**

c. A source emitted a sequence 'zigzagzip'.
   i) Compute the entropy of source
   ii) Develop an Huffman code for the sequence using minimum variance procedure.
   iii) Draw the Huffman tree.
   iv) Find the average length of the code and its redundancy.
   v) Encode the source output using the developed code. **(10 Marks)**

2 a. A source generated a text sequence 'attached and detached'.
   i) Encode the text using LZW encoding algorithm
   ii) Decode the encoded sequence. **(10 Marks)**
   Construct the initial dictionary in alphabetical order with symbols preceding alphabets.

b. Explain detail, the coding schemes used in group – 3 facsimile apparatus. **(10 Marks)**

3 a. Define autocorrelation. Write short note on ARMA (N, M) model. **(06 Marks)**

b. Briefly explain the function of a quantizer. Show that for every bit being included in a uniform quantizer of uniformly distributed source, the signal – to – noise ratio increases by 6dB. **(10 Marks)**

c. Highlight various distortion criterias used in lossy compression schemes. **(04 Marks)**

4 a. Explain vector quantization in detail. **(08 Marks)**

b. With necessary diagram, explain Delta modulation. Also explain how the error developed can be avoided. **(12 Marks)**

PART – B

5 a. Find the inverse Z-tranform of $F(z) = \frac{6z^2 - 9z}{z^2 - 2.5z + 1}$. **(06 Marks)**

b. How are the elements of DCT and DST matrix represented? Derive the DWHT transform matrix. **(06 Marks)**

c. Briefly explain the fundamental concepts of the following in relation with linear systems.
i) Scaling ii) Time invariance iii) Transfer Function iv) Impulse Response. **(08 Marks)**

6 a. With a neat block diagram, explain in detail. **(10 Marks)**

b. With a block diagram, explain MPEG – 2 AAC encoder. **(10 Marks)**

7 a. Explain multi resolution analysis and sealing function, with an example. **(10 Marks)**

b. With a neat diagram, explain SPIHT. **(10 Marks)**

8 a. With a neat diagram, explain H.261 video coding algorithms. **(10 Marks)**

b. Explain H.264 advanced video coding. **(10 Marks)**

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10CS/IS663

Sixth Semester B.E. Degree Examination, June/July 2016
Data Compression

Time: 3 hrs. Max. Marks:100

Note: ***Answer FIVE full questions, selecting at least TWO questions from each part.***

PART – A

1 a. Define data compression. With an example, explain the process of modeling and coding. **(06 Marks)**

b. Develop a Huffman code for the character sequence 'zigzagzip' generated by a source. Draw the Huffman tree for the code. Compute the entropy of the source, average length of the Huffman code and its redundancy. **(10 Marks)**

c. Verify if the code {0, 10, 101, 001, 110, 1110} is uniquely decodable. **(04 Marks)**

2 a. A receiver received some encoded symbols from channel that were encoded using LZW algorithm. The received symbols and initial dictionary are as given below.

Encoded symbols: 3 4 1 2 1 3 2 5 11 13 9 11.

Initial Dictionary					
Index	1	2	3	4	5
Entry	I	N	O	P	-

i) Decode the symbol sequence

ii) Reverse the decoded sequence and encode it using the same initial dictionary. **(10 Marks)**

b. Explain in detail, the coding schemes used in group – 3 facsimile apparatus. **(10 Marks)**

3 a. Define autocorrelation. Write short note on ARMA (N,M) model. **(06 Marks)**

b. Briefly explain the function of a quantizer. Show that, for every bit being included in uniform quantizer of uniformly distributed source, the signal-to-noise ratio increases by 6dB. **(10 Marks)**

c. Highlight the various distortion criterions used in lossy compression schemes. **(04 Marks)**

4 a. Explain vector quantization in detail. **(08 Marks)**

b. With necessary diagrams, explain Delta modulation. Also explain how the error developed can be avoided. **(12 Marks)**

PART – B

5 a. Find the inverse z-Transform of $F(z) = \frac{6z^2 - 9z}{z^2 - 2.5z + 1}$. **(06 Marks)**

b. How are the elements of DCT and DST matrix represented? Derive the DWHT transform matrix. **(06 Marks)**

c. Briefly explain the fundamental concept of the following in relation with Linear systems. Sealing, Time Invariance, Transfer Function, Impulse Response. **(08 Marks)**

6 a. With a neat block diagram, explain in detail the basic sub band coding algorithm. **(10 Marks)**

b. With a block diagram, explain MPEG – 2 AAC encoder. **(10 Marks)**

7 a. Explain multi-resolution analysis and scaling function with an example. **(10 Marks)**

b. With a neat diagram, explain SPIHT. **(10 Marks)**

8 a. With a neat diagram, explain H.261 video coding algorithm. **(10 Marks)**

b. Explain H.264 advanced video coding. **(10 Marks)**

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10CS/IS663

Sixth Semester B.E. Degree Examination, Dec.2015/Jan.2016

Data Compression

Time: 3 hrs. Max. Marks:100

Note: ***Answer FIVE full questions, selecting at least TWO questions from each part.***

PART – A

1 a. Explain Lossy and lossless compression Techniques with examples. **(04 Marks)**

b. For the sequence, 12323454567898910 find the entropy. Using the differences of neighboring sequences, find the entropy and give your comment. **(08 Marks)**

c. A source emits letters from an alphabet A = $\{a_1, a_2, a_3, a_4, a_5\}$ with $p(a_1) = p(a_3) = 0.2$, $p(a_2) = 0.4$, $p(a_4) = p(a_5) = 0.1$.

i) Calculate entropy of the source.

ii) Find a Huffman code for this source.

iii) Find average length of Huffman code and hence its redundancy. **(08 Marks)**

2 a. Encode the following sequence using LZW algorithm:

xyzzy␣xyzzy␣xyzzy␣xyzzy␣xll␣xll␣xll

The alphabet for the source is {␣, l, x, y, z}. The LZW dictionary initially looks as follows:

Index	1	2	3	4	5
Entry	␣	y	z	l	x

(10 Marks)

b. Write an algorithm used by CALIC to form the initial prediction and explain this algorithm. **(06 Marks)**

c. Briefly explain different groups in Facsimile encoding. **(04 Marks)**

3 a. What is distortion? Discuss different ways to measure distortion. **(06 Marks)**

b. Show that SNR of uniform quantizer of a uniformly distributed source is 6.02ndB. **(06 Marks)**

c. Write down the operation of a jayant Quantizer suppose the multiplier values are $M_0 = M_4 = 0.8$, $M_1 = M_5 = 0.9$, $M_2 = M_6 = 0.1$, $M_3 = M_7 = 1.2$. Initial value of the step size $\Delta_0 = 0.5$ and the sequence to be quantized is 0.1, - 0.2, 0.2, 0.1, -0.3, 0.1, 0.2, 0.5, 0.9, 1.5. **(08 Marks)**

4 a. What is vector quantization? Explain the vector quantization, with a block diagram. **(10 Marks)**

b. Explain the splitting technique for initializing the LBG algorithm. Training set vectors are given in Table Q 4b (i) and initial set of output points in Table Q 4b(ii). **(10 Marks)**

Height	75	65	59	64	65	57	72	44	62	60	56	70
Weight	180	120	119	150	162	88	175	41	114	110	91	172

Table 4b (i)

Height	45	75	45	80
Weight	50	117	117	180

Table 4b (ii)

PART – B

5 a. Describe the properties of a linear system. Also explain, time invariance and transfer function of the linear system. **(06 Marks)**

b. Find the inverse z – transform of the function

$$F(z) = \frac{2z^4 + 1}{2z^3 - 5z^2 + 4z - 1}$$ **(06 Marks)**

c. Explain the orthonormal transform and that orthonormal transforms are energy preserving. **(08 Marks)**

6 a. By considering the example of encoding the sequence of values $\{x_n\}$ given bellow, explain in detail how subband coding works.

10 14 10 12 14 8 14 12 10 8 10 12 **(08 Marks)**

b. What is a filter? Discuss FIR and IIR filters. **(04 Marks)**

c. Discuss coding algorithm with a suitable diagram. Also explain the frame structure of layer – II coding. **(08 Marks)**

7 a. For seven – level decomposition shown below in Table Q7 (a) obtain the bitstream generated by the EZW coder ii) Decode the bitstream generated in the previous step. Verify that you the original co-efficient values. **(12 Marks)**

Table 7 (a)

26	6	13	10
-7	7	6	4
4	-4	4	-3
2	-2	-2	0

b. Explain multiresolution analysis and scaling function with an example. **(08 Marks)**

8 a. With a neat block diagram, Explain ITU – T recommendation H. 261. **(10 Marks)**

b. Explain with diagram MPEG – 1 video standard. **(06 Marks)**

c. Using H .262, derive an error factors for the set of co – efficient.

29.75 6.1 -6.03 1.93 -2.01 1.23 -0.95 2.11 **(04 Marks)**

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Sixth Semester B.E. Degree Examination, June/July 2015
Data Compression

Time: 3 hrs. Max. Marks:100

Note: ***Answer any FIVE full questions, selecting atleast TWO questions from each part.***

PART – A

1 a. What is data compression? Explain different compression algorithms and their performance measurement. **(06 Marks)**

b. What are uniquely decodable codes? Give the procedure and determine whether following codes are uniquely decodable codes: i) {0, 01, 11} ii) {0, 01, 10}. **(06 Marks)**

c. A source emits letters from an alphabet $t = \{a_1, a_2, a_3, a_4, a_5\}$ with probabilities $P(a_1) = 0.15$, $P(a_2) = 0.04$, $P(a_3) = 0.26$, $P(a_4) = 0.05$ and $P(a_5) = 0.50$. Entropy = 1.818 bits. Calculate: i) Huffman codes using minimum variance procedure; ii) Average length; iii) Redundancy. **(08 Marks)**

2 a. Given an initial dictionary consisting of letters entries (a, b, r, y, ␣) with indices (1, 2, 3, 4, 5). Encode the following message using the LZW algorithm.
a ␣ b a r ␣ a r r a y ␣ b y ␣ b a r r a y a r ␣ b a y. **(08 Marks)**

b. Explain diagram coding techniques. **(06 Marks)**

c. Write a note on JPEG-LS standard. **(06 Marks)**

3 a. What is distortion? Explain the probability modes of lossy compression scheme with their shapes. **(10 Marks)**

b. Show that SNR of a uniform quantizer for uniformly distributed source is 6.02n dB. **(06 Marks)**

c. Discuss different ways to measure distortion. **(04 Marks)**

4 a. With a neat block diagram, explain vector quantization procedure. **(08 Marks)**

b. Give the LBG algorithm where inputs are not scalars and distribution is known. **(06 Marks)**

c. Illustrate with a graph, how the Constant Factor adaptive Delta Modulation (CFDM) works. **(06 Marks)**

PART – B

5 a. State linear system properties. **(04 Marks)**

b. Find the inverse Z-transform of $F(z) = \dfrac{6z^2 - 9z}{z^2 - 2.5z + 1}$. **(06 Marks)**

c. Define sampling theorem. Obtain inverse Fourier transform f(t) in ideal sampling frequency domain view. **(10 Marks)**

6 a. Illustrate the basic subband coding algorithm with its block diagram. **(10 Marks)**

b. Explain application to speech coding G.722. **(06 Marks)**

c. Explain frame structure for layer-II coding in MPEG audio coding algorithm. **(04 Marks)**

7 a. Explain how wavelets are used in image compression, with a neat sketch. **(10 Marks)**

b. Discuss SPIHT scheme. **(10 Marks)**

8 a. What is motion compensation? Draw the block diagram of H.261 video coder and illustrate the roles of motion compensation and loop filter. **(10 Marks)**

b. Write a note on: i) Model-Based coding technique; ii) Video standard MPEG-2. **(10 Marks)**

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10CS/IS663

Sixth Semester B.E. Degree Examination, June/July 2014

Data Compression

Time: 3 hrs. Max. Marks:100

Note: ***Answer FIVE full questions, selecting at least TWO questions from each part.***

PART – A

1 a. Differentiate between lossless compression and lossy compression. **(04 Marks)**

b. What do you mean by self information? Explain it. Also derive the equation for entropy. **(10 Marks)**

c. Explain physical and probability models. **(06 Marks)**

2 a. List out the advantages of static dictionary technique. Also explain diagram coding. **(06 Marks)**

b. Explain LZ77 adaptive dictionary approach with an example. **(10 Marks)**

c. Explain run length coding. **(04 Marks)**

3 a. Explain probability models. **(04 Marks)**

b. Discuss quantization problem. **(06 Marks)**

c. Explain two types of adaptive quantization. **(10 Marks)**

4 a. Explain LBG algorithm. **(07 Marks)**

b. Explain delta modulation. **(08 Marks)**

c. Write a note on image coding. **(05 Marks)**

PART – B

5 a. Explain the properties of a linear system. **(06 Marks)**

b. Using partial fraction method, compute the inverse z-transform of

$$F(z) = \frac{6z^2 - 9z}{z^2 - 2.5z + 1}.$$ **(10 Marks)**

c. Explain properties of z-transform. **(04 Marks)**

6 a. With block diagram, explain sub band coding system. Also explain analysis, quantization, coding and synthesis process. **(10 Marks)**

b. Write a note on how sub band coding is used for audio coding. **(05 Marks)**

c. Explain how image compression is done using sub band coding. **(05 Marks)**

7 a. Explain multi resolution analysis. **(10 Marks)**

b. Explain image compression using wavelets. **(05 Marks)**

c. Write a note on JPEG 2000. **(05 Marks)**

8 a. Write a note on motion compensation. **(04 Marks)**

b. Explain H.261 video coding algorithm. **(10 Marks)**

c. Explain MPEG-2 video standards H.262. **(06 Marks)**

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Sixth Semester B.E. Degree Examination, Dec. 2013/Jan. 2014
Data Compression

Time: 3 hrs. Max. Marks:100

Note: ***Answer FIVE full questions, selecting atleast TWO questions from each part.***

PART – A

1 a. Explain lossy and lossless compression techniques, with examples. **(04 Marks)**

b. How the given code words are tested for unique decidability? Prove that the code {0, 01, 11} is uniquely decodable. **(04 Marks)**

c. What is prefix code? Explain with examples. **(04 Marks)**

d. A source emits a letter from an alphabet A = $\{a_1, a_2, a_3, a_4, a_5\}$ with probability $P(a_1) = 0.15$, $P(a_2) = 0.04$, $P(a_3) = 0.26$, $P(a_4) = 0.05$ and $P(a_5) = 0.50$. i) Calculate the entropy of the source ii) Find the Huffman code iii) Find the average length of the code in (ii) iv) Calculate its redundancy. **(08 Marks)**

2 a. Encode the following sequence, using the LZ78 approach
wabba ♭ wabba ♭ wabba ♭ wabba ♭ woo ♭ woo ♭ woo . **(06 Marks)**

b. Write an algorithm used by CALIC to form the initial prediction and explain this algorithm. **(06 Marks)**

c. How multi resolution approach helps in progressive image transmission? **(04 Marks)**

d. Briefly explain JPEG – Ls standard. **(04 Marks)**

3 a. Explain the various distortion criteria used in lossy compression schemes. **(04 Marks)**

b. What is uniform quantizer? Explain uniform quantization of a uniformly distributed source. **(10 Marks)**

c. Explain adaptive quantization, with examples. **(06 Marks)**

4 a. What is vector quantization? Explain the vector quantization, with a block diagram. **(08 Marks)**

b. Explain LBG algorithm, in detail. **(08 Marks)**

c. Explain the prediction in DPCM. **(04 Marks)**

PART – B

5 a. What are transforms? Explain DCT with suitable diagram. Mention its advantages. **(10 Marks)**

b. Find the inverse Z – transform of $f(z) = \dfrac{2z^4 + 1}{2z^3 - 5z^2 + 4z - 1}$. **(04 Marks)**

c. Explain discrete Fourier transformation (DFT). **(06 Marks)**

6 a. What is filter? Discuss the FIR and IIR filters. **(04 Marks)**

b. Explain the basic subband coding algorithm. **(08 Marks)**

c. Explain the MPEG audio coding algorithm with a suitable diagram. Also explain the frame structure of Layer II coding. **(08 Marks)**

7 a. With a neat diagram, explain the SPIHT algorithm. **(07 Marks)**

b. Explain embedded zero tree coder, with examples. **(08 Marks)**

c. Explain the use of wavelets in image compression, with a neat sketch. **(05 Marks)**

8 a. Explain the various representation of video signals. **(06 Marks)**

b. Consider the following 4 × 4 image

$$\begin{bmatrix} 110 & 218 & 116 & 112 \\ 108 & 210 & 110 & 114 \\ 110 & 218 & 210 & 112 \\ 112 & 108 & 110 & 116 \end{bmatrix}$$

Apply loop filters of H·261 coding algorithm. **(06 Marks)**

c. With a neat block diagram, explain ITU – T recommendation H·263 video compression. **(08 Marks)**

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Sixth Semester B.E. Degree Examination, June/July 2013
Data Compression

Time: 3 hrs. Max. Marks:100

Note: ***Answer FIVE full questions, selecting at least TWO questions from each part.***

PART – A

1 a. Write a note on compression techniques and how compression algorithm can be evaluated. **(04 Marks)**

b. Calculate the entropy for a binary image.
$P(S_w) = 15/31$, $P(S_b) = 16/31$, P(W/W) = 0.8, P(b/b) = 0.7. **(06 Marks)**

c. Determine whether the following codes are uniquely decodable:
i) {0, 01, 110, 111}; ii) {0, 01, 11, 111}. Give the procedure. **(04 Marks)**

d. A source emits letters from an alphabet A = $\{a_1, a_2, a_3, a_4\}$ with probabilities $P(a_1) = 0.13$, $P(a_2) = 0.07$, $P(a_3) = 0.5$ and $P(a_4) = 0.3$.
i) Calculate entropy of the source.
ii) Find the minimum variance Huffman code.
iii) Find the average length of Huffman code and its redundancy. **(06 Marks)**

2 a. A sequence is encoded using the LZ77 algorithm. Given that c(a) = 1, c(b) = 2, c(r) = 3 and c(t) = 4. Decode the following sequence of triples.
⟨0, 0, 3⟩ ⟨0, 0, 1⟩ ⟨0, 0, 4⟩ ⟨2, 8, 2⟩ ⟨3, 1, 2⟩ ⟨0, 0, 3⟩ ⟨6, 4, 4⟩ ⟨9, 5, 4⟩. Assume that the size of the window is 21 and the size of the look-ahead buffer is 10. **(08 Marks)**

b. Given the following primed dictionary and the received sequence below, build on LZW dictionary and decode the transmitted sequence. **(06 Marks)**

Received sequence : 1 2 3 4 2 5 6 2 1 7 9 11 7 10 12 14
Initial dictionary : Index – 1 2 3 4 5 6
Entry – T O B E R N

c. Give the algorithm used by CALIC to form the initial prediction and explain this algorithm. **(06 Marks)**

3 a. Explain the term distortion in Lossy coding. Discuss the different ways to measure distortion. **(08 Marks)**

b. What is quantization? Explain the quantization problem with an example. **(06 Marks)**

c. Explain the uniform quantization with fixed length code words and show that SNR of a uniform quantizer of a uniform distributed source is 6.02 ndB. **(06 Marks)**

4 a. With a neat block diagram, explain vector quantization procedure. **(06 Marks)**

b. Give Lloyd algorithm to generate the pdf – optimized scalar quantizer assuming that the distribution is known. Show how this algorithm can be generalized to the case where a training set is available. **(10 Marks)**

c. Explain the drawbacks of delta modulation with a sketch. **(04 Marks)**

PART – B

5 a. Explain the two properties of the linear system. **(04 Marks)**

b. Find the inverse Z-transform of $F(z) = \frac{2z^4 + 1}{2z^3 - 5z^2 + 4z - 1}$. **(08 Marks)**

c. Explain quantization and coding of transform coefficients. **(08 Marks)**

6 a. Explain basic subband coding algorithm with block diagram. **(10 Marks)**

b. Explain MPEG-2 AAC encoder with a neat block diagram. **(10 Marks)**

7 a. Explain multi resolution analysis and the scaling functions. **(10 Marks)**

b. For the seven-level decomposition shown below:

26	6	13	10
-7	7	6	4
4	-4	4	-3
2	-2	-2	0

Find the bit stream generated by the EZW coder. **(10 Marks)**

8 a. Briefly explain ITU-T recommendation H.261 encoder with a block diagram. **(06 Marks)**

b. Briefly explain video signal representation. **(06 Marks)**

c. Briefly explain motion compensation. Consider the following 4 × 4 image

$$\begin{bmatrix} 110 & 218 & 116 & 112 \\ 108 & 210 & 110 & 114 \\ 110 & 218 & 210 & 112 \\ 112 & 108 & 110 & 116 \end{bmatrix}$$

Apply loop filter of H.261 coding algorithm. **(08 Marks)**

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