B 2283

B.E./B.Tech. DEGREE EXAMINATION, MAY/JUNE 2007.

Fifth Semester

Information Technology

IF 356 — INFORMATION CODING TECHNIQUES

Time : Three hours Maximum : 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. What is prefix coding? Give one example.

2. State channel coding theorem.

3. Compare PCM and delta modulation.

4. Differentiate vocoder and waveform coder.

5. Define hamming distance.

6. Why cyclic codes are well-suited for error detection?

7. How dynamic Huffman coding is different than basic Huffman coding?

8. Why graphic interchange format is used extensively in the Internet?

9. How CELP provides better quality than LPC in speech coding?

10. Compare H.261 and MPEG-1.

PART B — (5 × 16 = 80 marks)

11. (a) Encode the following messages with their respective probability using basic Huffman algorithm :

Message	Probability
m_1	1/2
m_2	1/8

Message	Probability
m_3	1/8
m_4	1/16
m_5	1/16
m_6	1/16
m_7	1/32
m_8	1/32

Also calculate the average information (entropy) and hence efficiency of coding.

Or

(b) (i) State the channel capacity theorem. Explain Shannon's limit. (4)

(ii) Define information, entropy, and information rate of a discrete memory less source. (6)

(iii) An analog signal is band limited to B Hz, sampled at the Nyquist rate, and the samples are quantized into 4 levels. The quantization levels Q1, Q2, Q3, and Q4 (messages) are assumed independent and occur with a probabilities p1 = p4 = 1/8 and p2 = p3 = 3/8. Find the entropy and information rate of the source. (6)

12. (a) What is forward and backward estimation in adaptive prediction? Explain adaptive quantization and prediction using backward estimation in ADPCM systems. (16)

Or

(b) (i) Explain a PCM system to digitized a speech signal. What are A-law and μ-law? (8)

(ii) A PCM system uses a uniform quantizer followed by a 7-bit binary encoder. The bit rate of the system is equal to 50×10^6 b/s. (8)

(1) What is the maximum message bandwidth for which the system operates satisfactorily?

(2) Determine the output signal-to-quantization noise ratio when a full load sinusoidal modulating wave of frequency 1 MHz is applied to the input.

13. (a) (i) Using suitable equations explain coding and decoding procedure in linear block codes. (8)

(ii) Define syndrome and states its two properties. Explain syndrome decoding. (8)

Or

(b) Construct a convolutional encoder for the following specifications :

rate efficiency = 1/2, constraint length = 4. The connection from the shift registers to modulo-2 adders are described by the following equations :

$$g_1(x) = 1 + x$$

$$g_2(x) = x$$

Determine the output codeword for the input message 1110.

14. (a) (i) Explain the principles of Arithmetic coding. (6)

(ii) Consider the transmission of a message comprising a string of characters with probabilities of : (10)

$e = 0.3$, $n = 0.3$, $t = 0.2$, $w = 0.1$, $z = 0.1$.

Use Arithmetic coding techniques to encode this string.

Or

(b) Explain the schematic of JPEG encoding and decoding method. Why DC and AC coefficients are encoded separately?

15. (a) (i) With block schematic diagram explain linear predictive and decoding. How filter coefficient are estimated in LPC? Explain with suitable equations. (12)

(ii) Assuming the bandwidth of a speech signal is from 50 Hz through to 10 kHz and that of a music signal is from 15 Hz through to 20 kHz, derive the bit rate that is generated by the digitization procedure in each case assuming the Nyquist sampling rate is used with 12 bits per sample for the speech signal and 16 bits per sample for the music signal. Derive the memory required to store a 10 minutes passage of stereophonic music. (4)

Or

(b) (i) Explain the encoding procedure of I, P, and B frame in video compression using necessary diagram. (10)

(ii) Explain principles of video encoding based on H.261 standard. (6)

Time

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