

7 Information Theory (rkh23)

- (a) (i) Give two advantages and one disadvantage of Arithmetic coding over Huffman coding. [3 marks]
- (ii) Describe the possible outcomes of a single bit transmission error when decoding a stream of data using a Huffman code. Discuss whether the decoder can detect any errors that occur. How would your answer change for an Arithmetic coding scheme? [8 marks]
- (iii) Explain why Large Language Models can be used with Arithmetic coding to achieve better text compression. What are the disadvantages of this approach? [2 marks]
- (b) (i) Derive the relationship between k and p for a Hamming code where each block has k data bits and p parity bits. [3 marks]
- (ii) A B -interleaved coding scheme transmits B consecutive Hamming codewords by interleaving their bits. For example, a 2-interleaved system using a (7,4) Hamming code transmit adjacent codewords 0000000 and 1111111 as 010101010101. Where might this scheme have an advantage over a conventional transmission of each codeword? Discuss the choice of B . [4 marks]