# Assignment 2

CN8811 Multimedia Processing and Digital Communications

(Chap3: Source coding)

1. Consider a DMS with symbols $s_1$, $s_2$, and $s_3$ with probabilities 0.7, 0.15, and 0.15 respectively.

   (a) Calculate the source entropy.

   (b) Calculate the entropy of the second order extension.

   (c) Design a variable-length code, and provide the codeword statistics such as average codeword length, variance of the code, coding efficiency.

   (d) In general, under what conditions the coding efficiency can be 100%.

2. On an average a pop vending machine sells 200 cans a day, and the average split-up per day is 80 cans of pepsi, 50 cans of coke, 40 cans of sprite, 20 cans of crush, 10 cans of dew. Each time a pop is sold, the information is transmitted digitally to a remote computer for accounting purposes. Design a Huffman coding scheme such that the sales information can be transmitted as fast as possible. Quote the efficiency of your coding scheme.

   Suppose if the received bit stream is 01100101001110100.. or 10011010110001011..., identify the brand names of the first four pop cans sold.

3. Find the Huffman codewords for DMS symbols with probabilities 0.36, 0.14, 0.13, 0.12, 0.10, 0.09, 0.04, and 0.02. What is the compression ratio achieved when compared to fixed-length codes?

4. A source sends out the following binary sequence

   $$11111111010011110001101111 0 \cdots$$

   Design Lempel-Ziv coding scheme for the above bit stream, and provide the coding efficiency.

5. Find the Lempel-Ziv source code for the binary source sequence

   $$000100100000011000010000000100000010100001000000110100000001100$$

   Recover the original sequence back from the Lempel-Ziv source code. [*Hint:* You require two passes of the binary sequence to decide on the size of the dictionary.]

6. Textbook: 13.12, 13.13, 13.14, 13.15