Homework 4, 12/13/2024

❖ Due 12/20/2024 5:00PM, to E3

1. (100%) Find the shortest encoded bit string of the following source sequence:

   Source sequence: AABABCABCDABCDEABCDE

   (a) (10%) Calculate the entropy of the source sequence.

   (b) (10%) Use Shannon-Fano algorithm to encode the string. You first calculate probability distribution, develop a binary tree for it, and perform the encoding.

   (c) (10%) Use Huffman coding to encode the string. You first calculate probability distribution, develop a binary tree for it, and perform the encoding.

   (d) (15%) Use extended Huffman coding to encode the string where k=2. You first calculate probability distribution, develop a binary tree for it, and perform the encoding.

   (e) (20%) Using arithmetic coding. For this case, you can ignore the termination issue in a decoder, and output the shortest bit string of the first 2 symbols only, while the probability distribution is based on the whole sequence.

   (f) (20%) Use adaptive Huffman coding to encode the first 6 symbols of the string. The initial code assignment is given below:

   NEW:0 A: 001 B: 010 C: 011 D: 100 E: 101

   (g) (15%) Use LZW algorithm to generate the output code string for the source. The initial dictionary (string:code) is as follows.

   A: 1 B: 2 C: 3 D: 4 E: 5