EENG 410 Homework #2

1. A discrete zero-memory source generates three independent symbols A, B and C with probabilities 0.9, 0.08 and 0.02, respectively. Design a binary Huffman code for this source. Determine the average length of the code.

2. Design a binary Huffman code for the second extension (two symbols at a time) of the zero-memory source of Problem 1 above. Determine the average code length per symbol for this code.

3. A discrete first-order Markov source generates two dependent symbols A and B with conditional probabilities:

   $$P(A|A)=0.8 \quad P(B|A)=0.2$$
   $$P(A|B)=0.6 \quad P(B|B)=0.4$$

   From Homework #1 we know the stationary distribution is:

   $$P(A)=0.75$$
   $$P(B)=0.25$$

   and the source entropy is $H(S)=0.7842$ bits/symbol.

   Design a binary Huffman code for the second extension of this source (two symbols at a time). Determine the efficiency of this code.

4. Design a binary Huffman code for the third extension (three symbols at a time) of the Markov source of Problem 3 above. Determine the efficiency of this code.

5. An input alphabet (a keyboard for a word processor) consists of 100 characters.
   a) If the keystrokes are encoded by a fixed-length code, determine the required number of binary symbols (binits) for the encoding.
   b) Assume that 10 of the keystrokes are equally likely and that each occurs with probability 0.05. Assume also that the remaining 90 keystrokes are equally likely. Determine the average number of binits required to encode this alphabet using a variable-length Huffman code.