Assignment of Chapter 3

1. Consider a random variable X which takes on four values with probabilities
$$P = \left\{ \frac{1}{6}, \frac{1}{3}, \frac{1}{4}, \frac{1}{4} \right\}.$$

   (a) Construct a Shannon-Fano code for X.

   (b) Determine the expected length of code in (a). Is it optimal? If not, provide a counterexample.

2. Consider a random variable X which takes on seven values with probabilities
$$P = \left\{ \frac{1}{36}, \frac{1}{18}, \frac{1}{12}, \frac{1}{9}, \frac{1}{6}, \frac{2}{9}, \frac{1}{3} \right\}.$$

   (a) Construct a binary Huffman code for X.

   (b) Construct a ternary Huffman code for X.

   (c) Determine the expected length of code in (a) and (b) in terms of bits per symbol. Are they equal?

   (d) Discuss the optimality of the code constructed in (a).