EENG 410 Homework #1

1. A discrete zero-memory source generates three independent symbols A, B and C with probabilities 0.9, 0.08 and 0.02, respectively. Determine the entropy of the source.

2. A pair of fair dice are rolled successively to generate sequences of whole numbers between 2 "snake eyes" and 12 "box cars" inclusive. Determine the entropy of this discrete zero-memory source.

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

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

   a) Determine the probabilities of the symbols A and B.
   b) Determine the entropy of the source.
   c) Determine the entropy of the adjoint source.

4. A "tricky" coin behaves just like a normal coin with each toss resulting in a "head" or a "tail" with equal probability unless three tosses in a row result in all "tails". In that case the next toss of the coin is always a "head" and never a "tail". Determine the entropy of this "tricky" coin.

5. A simple language has three letters D, E, and R and the *blank* as symbols. The spelling rules for this language are:

$$P(E|D)=0.5\quad P(R|D)=0.1\quad P(blank \vee D)=0.4$$
$$P(D|E)=0.3\quad P(E|E)=0.5\quad P(R \vee E)=0.2$$
$$P(D|R)=0.1\quad P(E|R)=0.5\quad P(blank \vee R)=0.4$$
$$P(D|blank)=0.5\quad P(R \vee blank)=0.5$$

   a) Draw a finite state machine to represent this first-order Markov source.
   b) Determine the entropy of this source.
   c) Determine the individual symbol probabilities.