INFORMATION THEORY

HOMEWORK # 3:

Please work out the **six** (6) problems stated below – CT refers to the text: Thomas M. Cover and Joy A. Thomsa, *Elements of Information Theory*, Second Edition, John Wiley & Sons, 2006. With this in mind, Problem **2-2** (CT) refers to Exercise 2 for Chapter 2 of CT.

   Show work and **explain** reasoning. Two (2) problems, selected at random amongst these six problems, will be marked.

1.
Solve Problem **3-5** (CT).

2.
Solve Problem **3-6** (CT) – In the rather shoddy notation of the book, we need to interpret

$$p(x_1, \ldots, x_n) = p(x_1) \ldots p(x_n), \quad (x_1, \ldots, x_n) \in \mathcal{X}^n$$

since the rvs $X_1, \ldots, X_n$ are i.i.d. rvs, each distributed according to the pmf $\boldsymbol{p} = (p(x), \ x \in \mathcal{X})$ on $\mathcal{X}$. Also compute both limits

$$\lim_{n \to \infty} \mathbb{E}\left[p(X_1, \ldots, X_n)^{\frac{1}{n}}\right]$$

and

$$\lim_{n \to \infty} \mathbb{E}\left[p(X_1, \ldots, X_n)\right]^{\frac{1}{n}}.$$

Are all these limits the same?

   Problem **3-6** (CT) has obvious points of contact with Problems **3-8** (CT) and **3-10** (CT).

3.
Solve Problem **3-12** (CT).

4.
Solve Problem **3-13** (CT). You may want to write little computer programs to do this!

5.
Solve Problem **4-2** (CT).

6.
Solve Problem **4-6** (CT).