

ECE 563: Homework 2 - Due September 29th, 2022

Problem 1: Properties of mutual information. Let X, Y_1, Y_2 be three RVs.

(a) Given $I(X; Y_1) = I(X; Y_2) = 0$, does it follow that $I(X; Y_1, Y_2) = 0$?

(b) Given $I(X; Y_1) = I(X; Y_2) = 0$, does it follow that $I(Y_1; Y_2) = 0$?

Problem 2: Data Processing Inequality. Let the RVs X, U, Z form a Markov chain, $X \rightarrow Y \rightarrow Z$.

(a) Show that $H(X|Y) = H(X|Y, Z)$.

(b) Show that $H(X|Y) \leq H(X|Z)$.

(c) Show that $I(X; Y) \geq I(X; Z)$.

(d) Show that $I(X; Z|Y) = 0$.

Problem 3: Cover, Thomas, AEP section problem: "An AEP-like limit."

Problem 4: Cover, Thomas, AEP section problem: "Random box size."

Problem 5: Cover, Thomas, Data compression section problem: "How many fingers does a Martian have?"

Problem 6: Cover, Thomas, Data compression section problem: "Slackness in Kraft's inequality."