

6.441 Transmission of Information

Problem Set 1

Spring 2010

Due date: February 11

Problem 1

Prove or disprove the following:

- a) $I(X + Y; Y|X) = 0$.
- b) $H(X|Z) - H(X|Y, Z) = H(Y|Z) - H(Y|X, Z)$.
- c) $I((X_1, \dots, X_n); (Y_1, \dots, Y_n)) = \sum_{i=1}^n H(Y_i|Y_1 \dots Y_{i-1}) - H(Y_i, X_i \dots X_n|Y_1 \dots Y_{i-1}, X_1 \dots X_{i-1}) + H(X_i \dots X_n|Y_1 \dots Y_{i-1}, X_1 \dots X_{i-1})$.
- d) $I((X_1, \dots, X_n); (Y_1, \dots, Y_n)) \geq \sum_{i=1}^n H(Y_i|Y_1 \dots Y_{i-1}) - H(Y_i|Y_1 \dots Y_{i-2}, X_1 \dots X_n)$.

Let $Z = X + Y$ in the following:

- e) $H(Z) = H(X) + H(Y)$.
- f) $H(Z, X) = H(X) + H(Y)$.

Problem 2

Problem 2.7 in Cover and Thomas.

Problem 3

Problem 2.9 in Cover and Thomas.

Problem 4

Problem 2.11 in Cover and Thomas.

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