COMP 2610/6261: Information Theory

Week 12 Tutorial Questions

Question 1: Suppose X and Y are random variables with the following joint distribution *p (x, y):*

X \ Y	0	1	2
0	$\frac{1}{6}$	$\frac{1}{12}$	$\frac{1}{6}$
1	$\frac{1}{4}$	$\frac{1}{3}$	0

Answer the following questions.

(i) Are X and Y independent? Explain your answer.

(ii) Compute the expected value of X and Y, i.e., $\mathbb{E}[X]$ and $\mathbb{E}[Y]$.

(iii) Compute the expected value of XY, i.e., $\mathbb{E}[XY]$.

Question 2: Three random variables X, Y, Z are given,

(i) Comparing the term H (Y) + H (X, Y, Z) with the term H (X, Y) + H (Y, Z) in general and determine which terms is greater than or equal to the other.

(ii) What is the condition for random variables X, Y, Z that these two terms are equal to each other, i.e., H(Y) + H(X,Y,Z) = H(X,Y) + H(Y,Z)

Question 3: Consider the Random Variable X and answer the following questions.

X	x_1	x_2	x_3	x_4	x_5
$p(x_i)$	0.4	0.25	0.15	0.1	0.1

(a) What is the entropy H(X)?

(b) Find the binary Huffman code for X.

(c) Find the Shannon-Fano-Elias code for X.