

Quiz 1

Name: KEY

Given two information sources with $|A|=2, |B|=2$. The joint probabilities of symbols from these sources are given in the following table.

1. Find $H(A)$, $H(B)$, $H(A,B)$, $H(B|A)$, $H(A|B)$. (6 p)
2. Sketch a Venn diagram to illustrate the calculated quantities. (2 p)
3. What is the value of $H(A) \cap H(B)$ and what does it represent. (2p)

	b0	b1	
a0	0.4	0.2	0.6
a1	0.1	0.3	0.4
	0.5	0.5	

$$\begin{aligned}
 H(A) &= H(0.6, 0.4) \\
 &= 0.6 \log_2 \left(\frac{1}{0.6} \right) + 0.4 \log_2 \left(\frac{1}{0.4} \right) \\
 &= 0.9710 \text{ bits}
 \end{aligned}$$

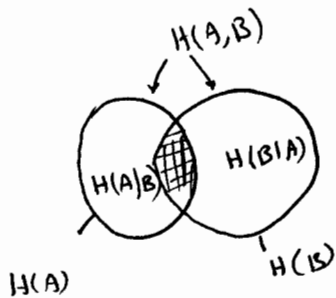
$$H(B) = H(0.5, 0.5) = 1 \text{ bit}$$

$$H(A, B) = H(0.4, 0.2, 0.1, 0.3) = 1.8464 \text{ bits}$$

$$H(B|A) = H(A, B) - H(A) = 1.8464 - 0.9710 = 0.8754 \text{ bits}$$

$$H(A|B) = H(A, B) - H(B) = 1.8464 - 1 = 0.8464 \text{ bits}$$

2)



$$\begin{aligned}
 3) \quad H(A) \cap H(B) &= I(A; B) = H(A) - H(A|B) \\
 &= 0.9710 - 0.8464 \\
 &= 0.1246 \\
 &= H(B) - H(B|A) \\
 &= 1 - 0.8754 \\
 &= 0.1246 \quad \checkmark
 \end{aligned}$$

It is the mutual information common to the two sources.