2) a) $H(X|X) = -\sum_{x \in \Omega_x} \sum_{y \in \Omega_y} p(x)\, p(x|x)^{1} \underbrace{\log p(x|x)^{1}}_{=0} = 0$

$p(x|x)$: probability of x given x is 1

$H(X|X) = 0$ when the two random variable under comparison is the same, then there is no extra information required for communicating Y given X

b) $I(X;Y)$ = mutual information. = how much reduction in uncertainty given info about Y

$I(X;Y) = H(X) - H(X|Y)$

If X & Y are independent then $H(X|Y) = H(X)$

∵ having the additional info ~~about~~ given Y will not provide you with any additional info

$I(X;Y) = H(X) - H(X) = 0$ i.f.f X, Y independent

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3) a) $p(X_A = 0, X_B = 1) = \frac{N_B - N_{AB}}{N}$

$p(X_A = 0, X_B = 0) = \frac{N - (N_A + N_B - N_{AB})}{N} = \frac{N - N_A - N_B + N_{AB}}{N}$