Entropy

Bernoulli: $P(x) = \begin{cases} p, & x=1 \\ 1-p, & x=0 \end{cases}$

$$H(x) = \mathbb{E}[I(x)] = -\mathbb{E}[\log_2 P(x)]$$

$$= -\sum_{x=0}^{1} P(x_i)\log_2 P(x_i) = -[(1-p)\log_2(1-p) + p\log_2 p]$$

Coin flip: $p = 1-p = 0.5$

$$H(x) = -(0.5\log_2(0.5) + 0.5\log_2(0.5))$$

$$= -(0.5(-1) + 0.5(-1)) = 1$$

Enjoys Cilantro: $p = 0.8, \ 1-p = 0.2$

$$H(x) = -(0.2\log_2(0.2) + 0.8\log_2(0.8))$$

$$= -(0.2(-2.3219) + 0.8(-0.3219)) = 0.72$$

KL Divergence: let $P(x)$ = cilantro, estimating using $Q(x)$ = coin flip

$$D_{KL}(P\|Q) = E_{x\sim P}\left[\log\frac{P}{Q}\right]$$

if $P=Q$, $\log(1)=0$

$$= p\log\left(\frac{p}{q}\right) + (1-p)\log\left(\frac{1-p}{1-q}\right)$$

$$= 0.8\log\left(\frac{0.8}{0.5}\right) + 0.2\log\left(\frac{0.2}{0.5}\right) = 0.278$$