Likelihood $\prod_{i=1}^{n} P(Y_i = y_i \mid X's \text{ \& } \beta's)$

$\in (0,1)$

$\in (0,1)$ (also probably closer to 0)

log(likelihood)

$$\log(1) = 0$$

$$-\infty < \log(<1) < 0$$

Take the example of flipping coin H TT

What is the maximum Likelihood estimate of p?

$$\text{Likelihood} = p(1-p)(1-p) = p^1(1-p)^2$$

$$\text{log-likelihood} = \ln\left(p^1(1-p)^2\right)$$

$$= \ln(p^1) + \ln((1-p)^2)$$

$$\ell = 1\ln p + 2\ln(1-p)$$

$$\ell' = \frac{1}{p} + \frac{2}{1-p}(-1)$$

$$\frac{1}{p} - \frac{2}{1-p} \quad \text{set} = 0 \quad \text{solve for } p$$

$$\frac{1}{p} = \frac{2}{1-p}$$

$$1-p = 2p$$

$$1 = 3p \qquad p = \frac{1}{3}$$