

Quiz 5

$X \sim \text{Bin}(n, p)$, p is given and n is unknown. Find the ML estimate of n if X is observed.

$$p_x(X) = \binom{n}{X} p^X (1-p)^{n-X}$$

$$\frac{\binom{n}{X} p^X (1-p)^{n-X}}{\binom{n-1}{X} p^X (1-p)^{n-1-X}} = \frac{n}{n-X} (1-p) \geq 1 \Rightarrow n(1-p) \geq n-X \Rightarrow np \leq X \Rightarrow n \leq \frac{X}{p}$$

X/p is not an integer: Max n occurs at $n = \lfloor X/p \rfloor$

X/p is an integer: Max n occurs at $n = X/p$ or $n = X/p - 1$