$\underline{\underline{K}}$

$$p(x=x_1) = \mu^{x_1}(1-\mu)^{n-x_1}\binom{n}{x_1}$$

Likelihood $\mu^{x_1}(1-\mu)^{1-x_1} \times \mu^{x_2}(1-\mu)^{1-x_2} \times \cdots \times \mu^{x_N}(1-\mu)^{1-x_n} \cdot 2^n$

$$L(\mu) = \mu^{x_1+x_2\cdots x_n}(1-\mu)^{(1-x_1)+(1-x_2)+\cdots(1-x_N)} 2^n$$

$\max\limits_{\mu} L(\mu)$ m heads n-m tails

$$= \mu^{m}(1-\mu)^{n-m} \Rightarrow \max_{\mu}\ m\log\mu + (n-m)\log(1-\mu)$$

$$\frac{m}{\mu} - \frac{(n-m)}{1-\mu} = 0 \Rightarrow m(1-\mu) = \mu(n-m)$$

$$\Rightarrow m - \cancel{m\mu} = \mu n - \cancel{\mu m}$$

$$\boxed{\mu = \frac{m}{N}}$$

μ makes the 'm' heads maximally happen

$\Rightarrow \mu =$ max likelihood estimator

μ : Probability of getting head

One expt 'm' 'N'

$m \quad 0 \quad 1 \quad 2 \quad \cdots \quad N$

$$P(m=k) = \mu^k(1-\mu)^{n-k}\binom{n}{k}$$

$$E(m) = \sum_{k=0}^{N} k\binom{N}{k}p^k(1-p)^{N-k} = N\mu$$

$$Var(m) = \sum_{k=0}^{N}(k-E(m))^2\binom{N}{k}\mu^k(1-\mu)^{n-k} = n\mu(1-\mu)$$

PD for a continuous random var:

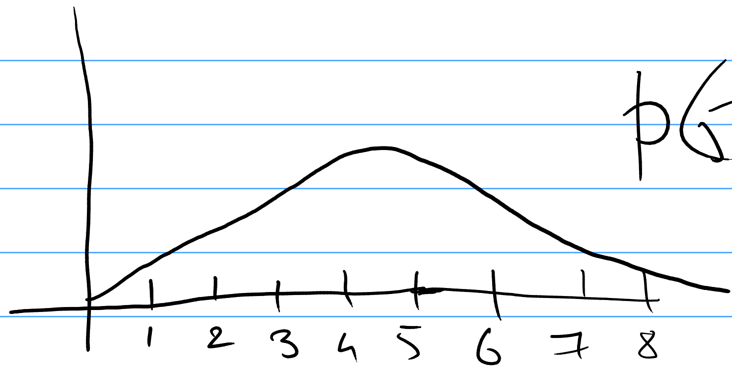
$P(x = 5.637219583235\ldots)$

doesn't make sense

Probability Density function (PDF)

$p: D \to \mathbb{R}$ } ∞ly many

① $p(x) \geq 0$ ② $\int_D p(x) = 1$



$p(5'2'' \leq x \leq 5'4'')$

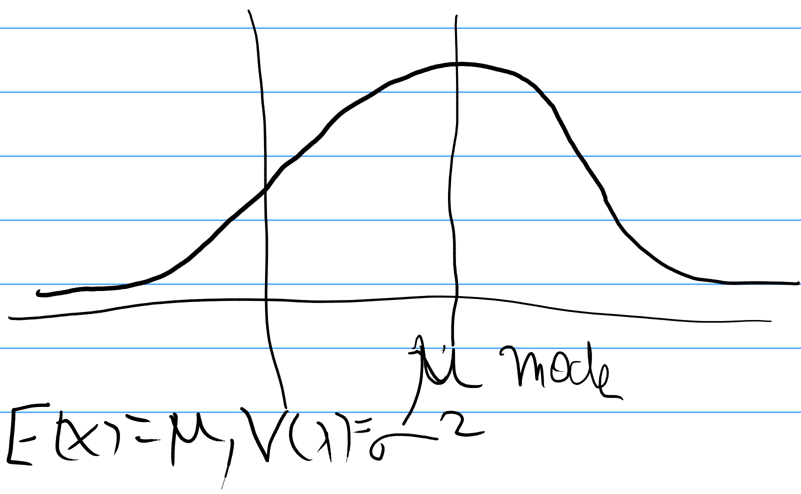
$= \int_{5'2''}^{5'4''} p(x)dx$

Pareto Normal Beta Gamma

$$p(x \mid \mu, \sigma^2) = \frac{1}{\sqrt{2\pi}\,\sigma} e^{-\frac{(x-\mu)^2}{2\sigma^2}}$$ } normal (gaussian)

$p(x) \geq 0$

$\int_{-\infty}^{\infty} p(x) = 1$



μ mode

$E(x) = \mu, V(x) = \sigma^2$