5/1/19 Section 5 Laura Section

pdf: probability density function

for a continuous rv → uncountably infinite

pmf: probability mass function

for a discrete rv → countably infinite

→ finite

<u>Discrete</u>

- Bernoulli
- Binomial → Generalization of Bernoulli
- Poisson distribution
- Hypergeometric
- Uniform (Discrete) → $\{x_1, \ldots, x_n\}$

$P(X = x_i) = \frac{1}{n}$ → pmf

<u>Continuous</u>

- Uniform (Cont.) ⟶ (a, b) $f_X(x) = \frac{1}{b-a}$ → pdf
- Exponential distribution → $x > 0$
- Triangular
- Normal

CDF: Cumulative probability

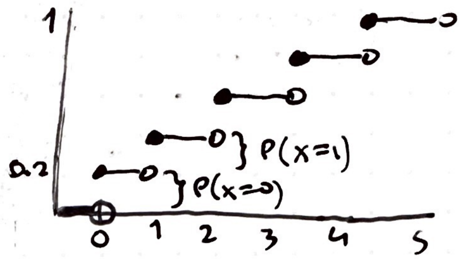
$Y: F_Y(y) = P(Y \leq y)$

Binomial distribution

$$P(X=x)=\begin{cases}\binom{n}{x}p^x(1-p)^{n-x} & x=0,1,2,\dots,n\\ 0 & \text{otherwise}\end{cases}$$

$n=5$

$p=\frac{1}{4}$



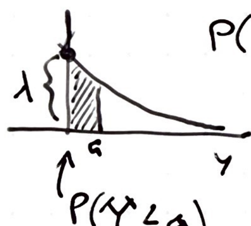
R code: help(rbinom)

dbinom → pmf

pbinom → cdf

$Y \sim \text{Exponential}(\lambda)$ λ: rate $\lambda > 0$

pdf: $f_Y(y)=\begin{cases}\lambda e^{-\lambda y} & \text{for } y>0\\ 0 & \text{otherwise}\end{cases}$



$P(Y=y)=0$

CDF (exponential)

$$F_Y(y)=\begin{cases}0 & y<0\\ \int_0^y \lambda e^{-\lambda t}\,dt = 1-e^{-\lambda y} & y>0\end{cases}$$

$\updownarrow$

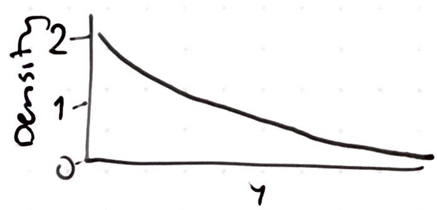
$P(Y \le y)$

$$\lim_{y\to\infty} F_Y(y)=1$$

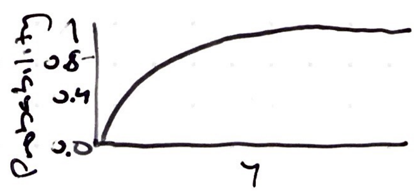
$$\lim_{y\to-\infty} F_Y(y)=0$$

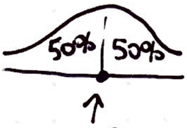
$$\lim_{y\to 0} F_Y(y)=0$$

Exponential PDF w/ lamda=2



Exponential CDF w/ lamda=2



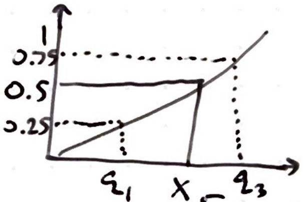


symmetric

point of symmetry = median = mean = mode

bimodal distribution

mean: point of equilibrium

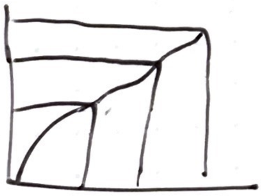


CDF

$q_1 : P(x \leq q_1) = 0.25$

$q_3 : P(x \leq q_3) = 0.75$

Cannot find the inverse when you hit more than 1 point on a horizontal line



CDF: $P = F_Y(y) = 1 - e^{-\lambda y}$

$p = 1 - e^{-\lambda y}$

$e^{-\lambda y} = 1 - p$

$-\lambda y = \log(1-p)$

$y = -\frac{1}{\lambda}\log(1-p) = F^{-1}(p) = y$

$p = 0.5$

Exponential Inverse CDF w/ lamda = 2