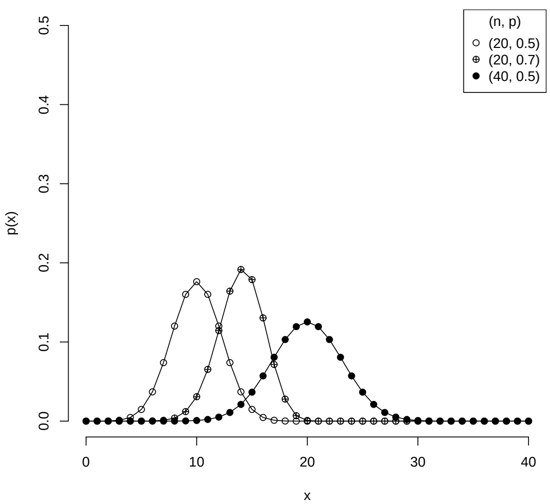
Probability Distributions

Binomial Distribution

Figure 1: Binomial Distribution



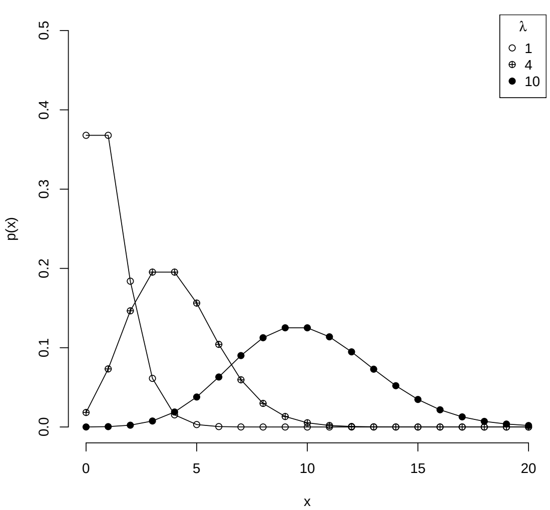
$X \sim \text{Binomial}(n, p)$
$p \in (0, 1)$
$x = 0, 1, 2, \ldots, n$

$f(x) = \binom{n}{x} p^x (1-p)^{x-1}$
$\mu = E[X] = np$
$\sigma^2 = E[(x-\mu)^2] = np(1-p)$

$M(t) = [pe^t + (1-p)]^n \qquad t \in \mathbb{R}$

Poisson Distribution

Figure 2: Poisson Distribution



$X \sim \text{Poisson}(\lambda)$
$\lambda \in \mathbb{R}^+$
$x = 0, 1, 2, \ldots$

$f(x) = \frac{e^{-\lambda}\lambda^x}{x!}$
$\mu = E[X] = \lambda$
$\sigma^2 = E[(x-\mu)^2] = \lambda$

$M(t) = e^{\lambda(t-1)} \qquad t \in \mathbb{R}$

Normal Distribution

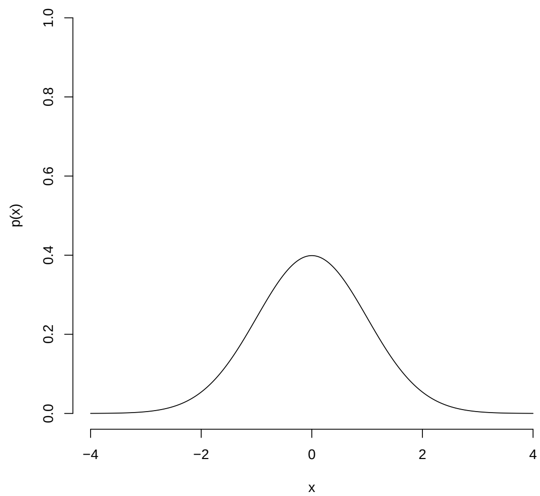


Figure 3: Normal$(0, 1)$ Distribution

$X \sim \text{Normal}(\mu, \sigma^2)$
$\mu \in \mathbb{R}$
$\sigma^2 \in \mathbb{R}^+$
$x \in \mathbb{R}$

$f(x) = \dfrac{1}{\sqrt{2\pi\sigma^2}} \exp\left[-\dfrac{(x-\mu)^2}{2\sigma^2}\right]$
$\mu = E[X] = \mu$
$\sigma^2 = E[(x-\mu)^2] = \sigma^2$

$M(t) = e^{\mu t + \frac{1}{2}\sigma^2 t^2}$ $\qquad t \in \mathbb{R}$