Simple Moment Matching

Def'n. For a r.v. X, its k^{th} (raw) moment is

$$\mathbb{E}[X^k] \quad \text{for } k \text{ where the expectation exists.}$$

For a r.v. X, its k^{th} central moment is

$$\mathbb{E}\left[(X - \mathbb{E}[X])^k\right] \quad \text{when the expectation exists.}$$

e.g., the first moment: mean $\mu_X = \mathbb{E}[X]$;
the second central moment: variance $\sigma_X^2 = \mathrm{Var}[X]$.

Theoretical		Empirical	"R"
X		$x_1, x_2, \ldots, x_n$	data = c($x_1, \ldots, x_n$)
$\mu_X := \mathbb{E}[X]$	$\longleftrightarrow$	$\bar{x} := \frac{1}{n}(x_1 + \cdots + x_n)$	mu.hat = mean(data)
$\sigma_X^2 := \mathbb{E}[(X-\mu_X)^2]$		$s^2 := \frac{1}{n-1}\sum_{i=1}^{n}(x_i - \bar{x})^2$	var(data)
$\sigma_X = \sqrt{\sigma_X^2}$	$\longleftrightarrow$	$s = \sqrt{s^2}$	sigma.hat = sd(data)