M339D: January 28th, 2026.

Simple Moment Matching.

Def'n. For a r.v. X, its k^{th} (raw) moment is defined as $\mathbb{E}[X^k]$, for k where the expectation exists.

For a r.v. X, its k^{th} central moment is defined as $\mathbb{E}[(X-\mathbb{E}[X])^k]$, 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($x_1, \ldots, x_n$)
$\mu_X := \mathbb{E}[X]$	$\bar{x} := \frac{1}{n}(x_1 + \cdots + x_n)$	mean(data)
$\mathrm{Var}[X] = \mathbb{E}[(X-\mu_X)^2]$	$s^2 := \frac{1}{n-1}\sum_{i=1}^{n}(x_i - \bar{x})^2$	var(data)
$\mathrm{SD}[X] = \sqrt{\mathrm{Var}[X]}$	$s := \sqrt{s^2}$	sd(data)