Confidence Intervals.

Let $X_1, \ldots, X_n$ be a normal random sample, i.e.,

$\{X_i : i = 1, \ldots, n\}$ are all independent,

and $X_i \sim \text{Normal}(\text{mean} = \mu, \text{sd} = \sigma)$

(μ: ?, σ: known)

We know exactly the sampling dist'n of the sample mean:

$$\bar{X}_n \sim \text{Normal}\left(\text{mean} = \mu, \text{sd} = \frac{\sigma}{\sqrt{n}}\right)$$

We know that $\bar{X}_n$ is a "good" estimator for the population mean μ.

C... confidence level

$$\mathbb{P}\left[\bar{X}_n - z^* \frac{\sigma}{\sqrt{n}} < \mu < \bar{X}_n + z^* \frac{\sigma}{\sqrt{n}}\right] = C$$

w/ $z^* = \Phi^{-1}\left(\frac{1+C}{2}\right)$ = qnorm((1+C)/2)