# Probability of correct estimation

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## Question

Consider a Normal random variable $\mathbf{z}$ with mean 1 and variance $\sigma^2 = 4$. Let $\hat{\boldsymbol{\mu}}$ denote the sample average estimator. How many i.i.d. samples should I observe to guarantee that the following relation holds?

$$\text{Prob}\{0.9 \leq \hat{\boldsymbol{\mu}} \leq 1.1\} \geq 0.85$$

## Solution

Since $\mathbf{z}$ is Normal, the distribution of $\hat{\boldsymbol{\mu}}$ is Normal as well, with mean 1 and variance $\sigma^2/N$.

```
varz=4
muhat=1

for (N in 1:200){
  varhat=varz/N
  P=pnorm(1.1,muhat,varhat)-pnorm(0.9,muhat,varhat)
  ##cat("N=",N,"P=",P,"\n")
  if (P>=0.85)
    break;
}
```

The required number of samples is **58**