Point Estimation

Exercise Example

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Estimating the binomial proportion

Exercise

Suppose you are testing a system with error probability of 0.01. *How many trials do you need to make your estimator* $\hat{p}_e$ *fall between* 0.011 *and* 0.009 99.75% *of the time?*

1. $P(0.009 \leq \hat{p} \leq 0.011) = 0.9975$
2. $P(0.009n \leq X \leq 0.011n) = 0.9975$
   - where $X \sim B(n, 0.01)$
3. Function $g(n) = P(0.009n \leq X \leq 0.011n)$
   - solve $g(n) = 0.9975$
4. $g(n) = F(0.011n) - F(0.009n)$ where F is CDF of $X \sim (n, 0.01)$

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Closure

- Larger $n \Rightarrow$ better estimate
  - higher probability close to the true value
- This is a toy exercise
  - get used to the estimator as a stochastic variable
  - example of how to play with numbers to get an impression
- In practice, estimating p
  - p is unknown

$n = 90\,000$ gives 99.74% probability of $0.009 \leq \hat{p} \leq 0.011$. Answer is approximately $90\,000$

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