## Summary

Given: an event *E* (usually *n* i.i.d. samples from a distribution with unknown parameter  $\theta$ ).

1. Find likelihood  $\mathcal{L}(E; \theta)$ Usually  $\prod \mathbb{P}(x_i; \theta)$  for discrete and  $\prod f(x_i; \theta)$  for continuous

2. Maximize the likelihood. Usually:

A. Take the log (if it will make the math easier)

B. Set the derivative to 0 and solve

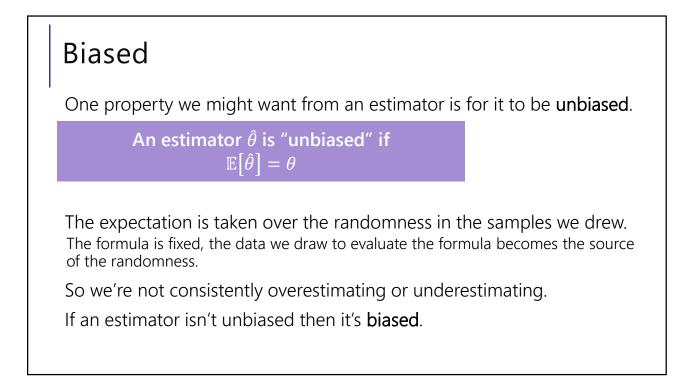
C. Use the second derivative test to confirm you have a maximizer

## Expectation

$$\ln\left(\mathcal{L}(x_i;\theta_{\mu},\theta_{\sigma^2})\right) = \sum_{i=1}^n \ln\left(\frac{1}{\sqrt{\theta_{\sigma^2}2\pi}}\right) - \frac{1}{2} \cdot \frac{(x_i - \theta_{\mu})^2}{\theta_{\sigma^2}}$$

$$\frac{\partial}{\partial \theta_{\mu}} \ln(\mathcal{L}) =$$

Setting equal to  $\boldsymbol{0}$  and solving



## Are our MLEs biased?

Our estimate for the coin-flips (if we generalized a bit) would be num heads total flips

pollev.com/robbie