# Chapter 2
# Location

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Data: $n$ Real-valued measurements $y_1, \ldots, y_n$

Let $\mu = \mathbb{E}\{Y_i\}$ be the (unknown) mean from the population.

Suppose we had a value ($\mu_0$) that we were wondering about for $\mu$ ($\mu = \mu_0$?). How could we decide?

Same 3 ingredents

1) Model $\quad Y_i \overset{iid}{\sim} N(\mu, \sigma^2)$ $\quad$ assume $\sigma^2$ know

density $f(y) = \frac{1}{\sqrt{2\pi\sigma^2}} \exp\left\{\frac{-1}{2\sigma^2}(y-\mu)^2\right\}$

so... $f(y_1, \dots, y_n) = \prod_{i=1}^{n} f(y_i)$

$$= (2\pi\sigma^2)^{-n/2} \exp\left\{\frac{-1}{2\sigma^2}\sum_{i=1}^{n}(y_i - \mu)^2\right\}$$

2) <u>Hypotheses</u>

$H_0: \mu = \mu_0$ (64.5)

$H_1: \mu \neq \mu_0$

3) <u>Statistic</u> using 1) & 2)

$$f(y_1, \dots, y_n) = (2\pi\sigma^2)^{-n/2} \exp\left\{\frac{-1}{2\sigma^2}\sum_{i=1}^{n}(y_i - \mu)^2\right\}$$

$$= c \exp\left\{\frac{-1}{2\sigma^2}\left[\sum y_i^2 - 2\mu \sum y_i + \mu^2\right]\right\}$$

Apparently $\boxed{s(y_1, \dots, y_n) = \sum_{i=1}^{n} y_i}$ is good.

or $= \frac{1}{n}\sum_{i=1}^{n} y_i = \bar{y}_n$

# How to conduct the test?

repeat

- Assume $H_0$
- Generate "data"
- Calc stat
- Compare to observed stat