Statistical Hypotheses Test

Step to test a hypothesis

Step 1: Identify the types of hypothesis

Step 2: Set up the Null and Alternative Hypothesis

Step 3: Collect Data

Step 4: Test the hypothesis using computers

Types of Hypothesis

There are many types of hypothesis. For example:

- Compare "something" to a number:
  - One average current Bryant students study longer than 8 hours a week.
- Compare two things (No number appears on the hypothesis)
  - One average current Bryant students study longer hours than Harvard students
- Relationship between "two things"
  - People who are bigger perfectionists also tend to have more anxiety."
  - People who has more working experience earns higher income.

And many more...

"One - Sample" Hypotheses

- Compare "something" to a number

Hypothesis: Current Bryant students sleep longer than 8 hours a day.

on average

is the same as:

$\mu > 8$ (hours)

where μ is the mean of the numbers of hours ALL Bryant student sleep a day

average

"One - Sample" Hypotheses

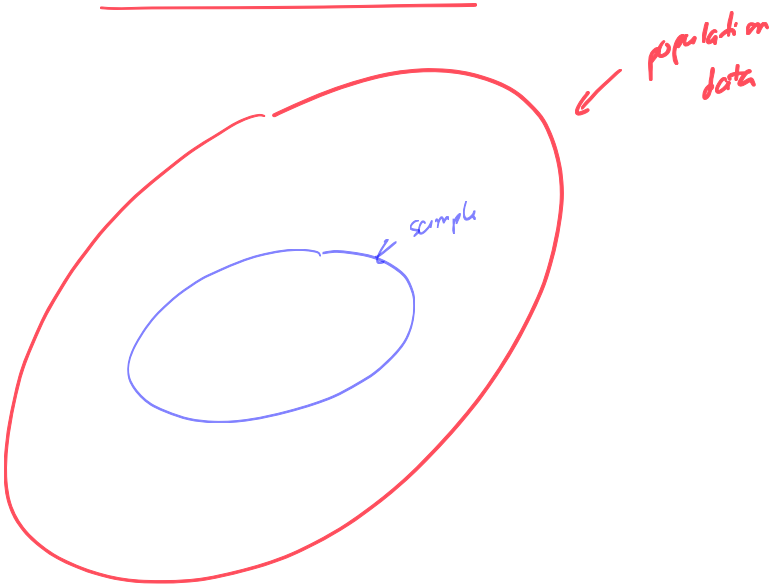
Hypothesis: People living in Smithfield drive less than 1.5 hour a day.

On average

"One - Sample" Hypotheses

Hypothesis: Current Bryant Students prefer watching football than basketball

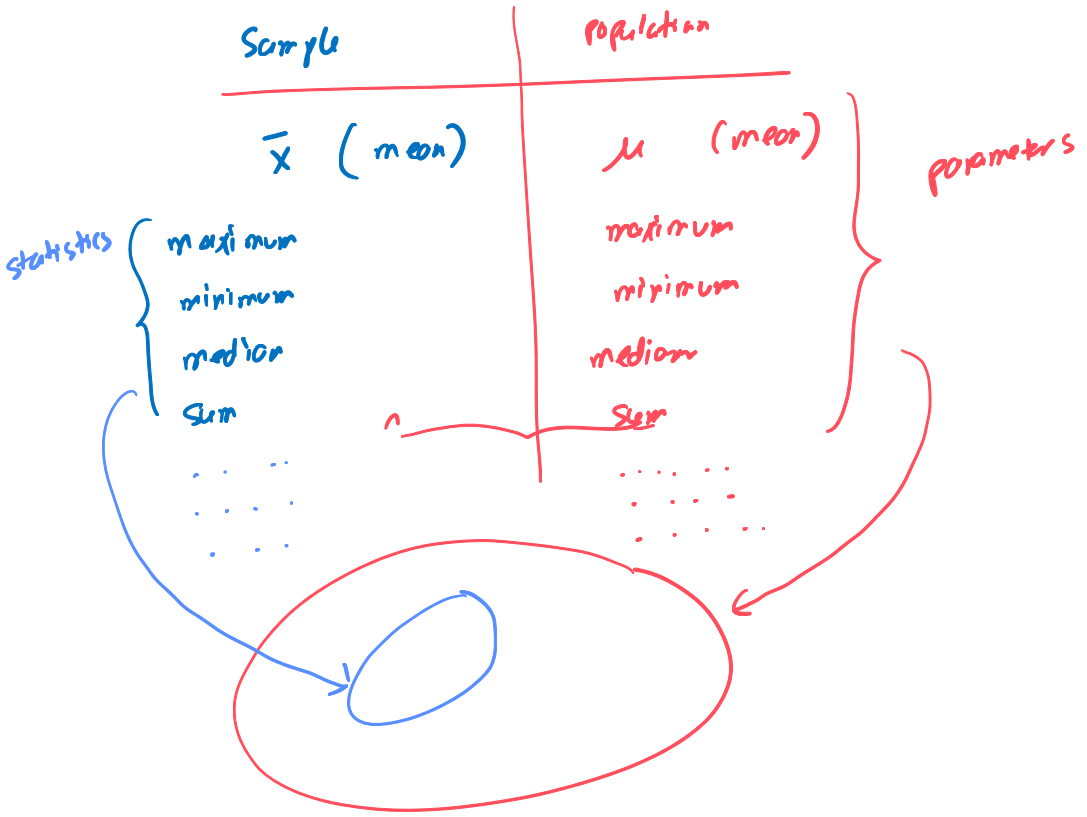
Statistics vs Parameters



on average, current Bryant students study more than 8 hours a day.

(*) we call the average hours of studying of all Bryant students is the **population mean** or μ. μ is unknown.

(*) The average of numbers of hours is called the **sample mean** or $\bar{x}$. $\bar{x}$ is known


Sample
population
$\bar{x}$ (mean)
μ (mean)
statistics
maximum
minimum
median
Sum
maximum
minimum
median
Sum
parameters

a day.

Null vs Alternative Hypothesis

Null Hypothesis: No difference or relationship exists between two sets of data or variables being analyzed

Alternative Hypothesis: There is "some" difference or relationship exists between two sets of data or variables being analyzed

Alternative Hypothesis is what we want to prove/test.

In the example:

Alternative Hypothesis: $\mu > 8$

Null Hypothesis: $\mu \leq 8$

Set them up

- Hypothesis: Current Bryant students sleep longer than 8 hours
- Null: $\mu \leq 8$
- Alternative: $\mu > 8$

Example

A medical trial is conducted to test whether or not a new medicine reduces cholesterol by 25%. State the null and alternative hypotheses.

Null H :

Alternative H :

Example

We want to test if college students take less than five years to graduate from college, on the average. The null and alternative hypotheses are:

Null H : $\mu \geq 5$

Alternative H : $\mu < 5$

μ: The mean of numbers of years college students take to graduate.

Example

We want to test if it takes fewer than 45 minutes to teach a lesson plan. State the null and alternative hypotheses.

or

(H_0) Null H : $\mu \geq 45$

$(H_1$ Alternative H : $\mu < 45$

or $H_a)$

$H_0 : \mu = 45$

$H_1 : \mu < 45$

Example

In an issue of U. S. News and World Report, an article on school standards stated that about half of all students in France, Germany, and Israel take advanced placement exams and a third pass. The same article stated that 6.6% of U.S. students take advanced placement exams and 4.4% pass. Test if the percentage of U.S. students who take advanced placement exams is more than 6.6%. State the null and alternative hypotheses.

$H_0: p \leq 6.6\%$

$H_1: p > 6.6\%$

$H_0: p = 6.6\%$

$H_1: p > 6.6\%$

p

Example

On a state driver's test, about 40% pass the test on the first try. We want to test if more than 40% pass on the first try.

$H_0: \quad p \leq 40\%$

$H_1: \quad p > 40\%$

$H_0: \quad p = 40\%$

$H_1: \quad p > 40\%$

Example

State the null hypothesis and the alternative hypothesis in terms of the appropriate parameter.

- Europeans have a mean paid vacation each year of six weeks.

$H_0 : \mu \neq 6$

$H_1 : \mu = 6$

Example

State the null hypothesis and the alternative hypothesis in terms of the appropriate parameter.

- The mean number of cars a person owns in her lifetime is not more than ten.

$H_0 : \quad \mu > 10$

$H_1 : \quad \mu \leq 10$

Example

State the null hypothesis and the alternative hypothesis in terms of the appropriate parameter.

- About half of Americans prefer to live away from cities, given the choice.

(50%)

H_0 : $p \neq 50\%$

H_1 : $p = 50\%$

($\neq$ means "is different from")

Example

State the null hypothesis and the alternative hypothesis in terms of the appropriate parameter.

- The chance of developing breast cancer is under 11% for women.

$H_0: p \geq 11\%$

$H_1: p < 11\%$

$H_0: p = 11\%$

$H_1: p < 11\%$

Example

State the null hypothesis and the alternative hypothesis in terms of the appropriate parameter.

- Private universities' mean tuition cost is more than $20,000 per year.

$H_0: \mu \leq 20{,}000$

$H_1: \mu > 20{,}000$

$H_0: \mu = 20{,}000$

$H_1: \mu > 20{,}000$