

Introduction to tests of Significance :-

Hitchen's Razor : What may be asserted without evidence,
(Christopher Hitchen) may be dismissed without evidence.

↳ Burden of proof lies on the Claimant.

Statisticians prove claims by finding evidence against their compliments.

[Proof by Contradiction]

Drop ball
Claim: Falls (H_A)
~~Never Falls (H_0)~~
"Evidence against Compliment"

Ingredients for a hypothesis test :-

- 1> Alternative Hypothesis, H_1 or H_A ← Research claim.
- 2> Null Hypothesis, H_0 ← Compliment of H_1 * This is what we test!!!
↳ "Nought"
- 3> Assumptions
 - ↳ Assumptions need for performing a test
 - ↳ Assumptions based on situation.
- 4> Test Statistics
 - ↳ Number computed from a sample
 - ↳ Statistic used for testing [Needs a sampling Distⁿ under H_0]
- 5> Data Collection
- 6> p-value/significance level
 - ↳ Type 1 error
 - $P[\text{reject } H_0 \mid H_0 \text{ is true}] = \text{"false positive"}$
- 7> Conclusion with findings
This is a Sequence in words that non-math/stat people understand

Assume H_0 is true \rightarrow Collect data \rightarrow Get p -value



Decide if H_0 can be rejected

Example: ESP (Extra sensory perceptions)

Claim: I am psychic. I can see the future Sometimes....

H_1 : I am psychic

H_0 : I am not psychic

* How to measure the claim?

• Rolling a D20

• Shuffle Cards. Draw one. I will tell you exactly the

Cards suit's colour.

\downarrow
 $|S|=52$

\downarrow
 $|S|=4$

\downarrow
 $|S|=2$

X = # Correct colour predictions in $n=25$ iid trials.
 \rightarrow "Test Statistic"

Under H_0 , $X \sim \text{Bin}(25, p=0.5)$

$H_0: p \leq 0.5$
 $p = 0.5$ } Both fine
But, H_0 should
be as simple as possible
so, " $=$ " is preferable

$H_1: p > 0.5$

$X_{\text{obs}} = 12$

$$P(X \geq X_{\text{obs}}) = P(X \geq 12) = 1 - P(X \leq 11) = 0.65$$

** We have no evidence against H_0 (p -value = 0.65). The data are not consistent with the hypothesis that I am psychic. We fail to reject H_0 .

[p -value $> 0.10 \rightarrow$ No evidence against H_0]