Proof by Contradiction
Null Hypothesis Test

- **Calculate a test statistic**

```
> wilcox.test(Yield ~ Product, paired=TRUE,…)
        Wilcoxon signed rank test
data:  Yield by Product
V = 0, p-value = 0.125
```

```
> t.test(Yield ~ Product, paired=TRUE, …)
        Paired t-test
data:  Yield by Product
t = -2.1319, df = 3, p-value = 0.1228
```

```
> friedman.test(Yield ~  Block | Product, …)
        Friedman rank sum test
data:  Yield and Block and Product
Friedman chi-squared = 6, df = 3, p-value = 0.1116
```

```
> anova(Yield ~ Block + Product, …)
        Analysis of Variance Table
Response: Yield
          Df Sum Sq Mean Sq F value   Pr(>F)
Block      3 363.52 121.173  43.230 0.005732 **
Product    1  12.74  12.739   4.545 0.122791
Residuals  3   8.41   2.803
```

- **Is that statistic ‘absurd’ given that that the null hypothesis is taken a axiomatically true?**
  - $p(false) = 0 < p(t) < p(true) = 1$

"Significance testing as perverse probabilistic reasoning"

☐ **Consider a typical medical research study, for example designed to test the efficacy of a drug, in which a null hypothesis H_0 ('no effect') is tested against an alternative hypothesis H_1 ('some effect'). Suppose that the study results pass a test of statistical significance (that is P-value <0.05) in favor of H_1. What has been shown?**

☐ **1. H_0 is false.**

☐ **2. H_1 is true.**

☐ **3. H_0 is probably false.**

☐ **4. H_1 is probably true.**

☐ **5. Both (1) and (2).**

☐ **6. Both (3) and (4).**

☐ **7. None of the above.**

M. B. Westover, K. D. Westover, and M. T. Bianchi. Significance testing as perverse probabilistic reasoning. BMC Medicine, 2011.