

Your Name: _____

Names of people you worked with: _____

1. What are you most excited about doing this summer?
2. What are you considering working on for the “extra” part of the final class project?
3. As defined in Ioannidis, “Why Most Published Research Findings are False”

R

$$R = \frac{\# \text{ true relationships}}{\# \text{ null relationships}} \quad \text{in the population}$$

TRUE

$$\begin{aligned} P(\text{study is true}) &= \frac{\# \text{ true relationships}}{\# \text{ total}} \\ &= \frac{\# \text{ true relationships}}{\# \text{ true} + \# \text{ null}} \\ &= \frac{R(\# \text{ null relationships})}{R(\# \text{ null}) + \# \text{ null}} \\ &= \frac{R}{R + 1} \end{aligned}$$

size

$$\begin{aligned} \alpha &= P(\text{type I error}) \\ &= P(\text{reject } H_0 | H_0 \text{ true}) \end{aligned}$$

power

$$\begin{aligned} 1 - \beta &= P(\text{reject } H_0 | H_0 \text{ false}) \\ \beta &= P(\text{type II error}) \\ &= P(\text{not reject } H_0 | H_0 \text{ false}) \end{aligned}$$

tests

$$c = \# \text{ of tests run}$$

Fill in the table. Find PPV (positive predictive value) = probability that the positive result is actually true.

Research Finding	True relationship		Total
	Yes	No	
Yes			
No			
Total			c

3. Solution:

Research Finding	True relationship		Total
	Yes	No	
Yes	$c(1 - \beta)R/(R + 1)$	$c\alpha/(R + 1)$	$c(R + \alpha - \beta R)/(R + 1)$
No	$c\beta R/(R + 1)$	$c(1 - \alpha)/(R + 1)$	$c(1 - \alpha + \beta R)/(R + 1)$
Total	$cR/(R + 1)$	$c/(R + 1)$	c

$$\begin{aligned}
 PPV &= \frac{c(1 - \beta)R/(R + 1)}{c(1 - \beta)R/(R + 1) + c\alpha/(R + 1)} \\
 &= \frac{c(1 - \beta)R}{c(1 - \beta)R + c\alpha} \\
 &= \frac{(1 - \beta)R}{(1 - \beta)R + \alpha} \\
 &= \frac{1}{1 + \alpha/(1 - \beta)R}
 \end{aligned}$$

$$\begin{aligned}
 PPV &> 0.5 \text{ more likely true} \\
 \text{iff } (1 - \beta)R &> (R - \beta R + \alpha)0.5 \\
 (1 - \beta)R0.5 &> \alpha0.5 \\
 (1 - \beta)R &> \alpha
 \end{aligned}$$

$$\begin{aligned}
 PPV &< 0.5 \text{ more likely false} \\
 \text{iff } (1 - \beta)R &< \alpha
 \end{aligned}$$