Lecture 37: FWER and Holm's procedure

Ciaran Evans

Recap: FWER and Bonferroni correction

Definition: Suppose we test m null hypotheses $H_{0,1}, ..., H_{0,m}$. The *family-wise error rate* is the probability of making *at least one* type I error:

$$FWER = P\left(\bigcup_{i:H_{0,i} \text{ is true}} \{\text{reject } H_{0,i}\}\right)$$

Bonferroni correction:

Holm's procedure

Suppose we test 5 hypotheses, and observe p-values 0.4, 0.01, 0, 0, 0. Does it still seem reasonable to use the Bonferroni cutoff $\alpha/5$ for each test?

Holm's procedure

Suppose we test m null hypotheses $H_{0,1}, ..., H_{0,m}$. Let p_i be the corresponding p-value for test i.

- Order the p-values $p_{(1)} \leq p_{(2)} \leq \cdots \leq p_{(m)}$
- Let $i^* = \min \left\{ i : p_{(i)} > \frac{\alpha}{m-i+1} \right\}$
- Reject $H_{0,(i)}$ for all $i < i^*$

Claim: Holm's procedure controls FWER at level α