

Part 4

A) Derive expressions for

$E[Y]$

and $\text{var}(Y)$

under the null hypothesis in terms

$$\begin{aligned} E[Y] &= E[\bar{X}_B - \bar{X}_A] \\ &= E[\bar{X}_B] - E[\bar{X}_A] \\ &= P_B - P_A \\ &= 0 \end{aligned}$$

$\text{var}(Y)$

$= \text{var}(\bar{X}_B) - \text{var}(\bar{X}_A)$

$P_B = P_A = P$

$$\begin{aligned} &= \frac{1}{n_B} P_B (1 - P_B) - \frac{1}{n_A} P_A (1 - P_A) \\ &= \left(\frac{1}{n_B} - \frac{1}{n_A} \right) P (1 - P) \end{aligned}$$