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# T-TEST FOR 2 POPULATION MEANS

EXAMPLE 5-4 P. 241 AND 242

CASE I: $\sigma_1^2$ AND $\sigma_2^2$ ($\sigma_1$ AND $\sigma_2$) ARE UNKNOWN

BUT $\sigma_1^2 = \sigma_2^2$ USE POOLED $S_P^2$, CATALYST 1 & 2,

$\bar{X}_1 = 92.255, S_1 = 2.39, n_1 = 8, \bar{X}_2 = 92.733, S_2 = 2.98, n_2 = 8$, ASSUME $\sigma_1^2 = \sigma_2^2$

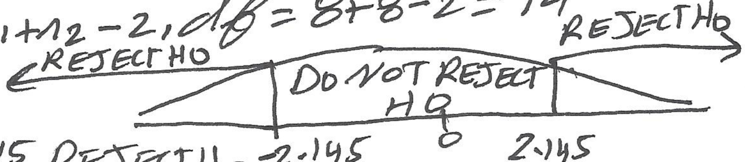
2 SIDED T-TEST

(1) $H_0: \mu_1 - \mu_2 = 0$ or $\mu_1 = \mu_2$ $D_0 = 0$ HERE, $D_0 = \mu_1 - \mu_2$

$H_1: \mu_1 - \mu_2 \neq 0$ or $\mu_1 \neq \mu_2$

(2) $\alpha = .05, \alpha/2 = .025, df = n_1 + n_2 - 2, df = 8 + 8 - 2 = 14$

$t_{\alpha/2, n_1+n_2-2} = t_{.025, 14} = 2.145$




If $t_{OBT} > 2.145$ or $t_{OBT} < -2.145$ REJECT $H_0$

(3) $t_{OBT} = \dfrac{\bar{X}_1 - \bar{X}_2 - (\mu_1 - \mu_2)}{S_P\sqrt{\frac{1}{n_1} + \frac{1}{n_2}}}$, $S_P^2 = \dfrac{(n_1 - 1)S_1^2 + (n_2 - 1)S_2^2}{n_1 + n_2 - 2} = \dfrac{7(2.39)^2 + 7(2.98)^2}{8 + 8 - 2}$

$S_P^2 = 7.30, S_P = \sqrt{7.3} = 2.70$

$t_{OBT} = \dfrac{92.255 - 92.733}{2.70\sqrt{\frac{1}{8} + \frac{1}{8}}} = -0.35$

(4) AS $t_{OBT} > -t_{\alpha/2}$ or $-0.35 > -2.145$, DO NOT REJECT $H_0$

$H_0$ IS TRUE or $\mu_1 = \mu_2$

(5) WE ARE 95% CONFIDENT THAT THE MEAN YIELD OF ALL CATALYST 1 IS EQUAL TO THE MEAN YIELD OF ALL CATALYST 2

USING THE CONFIDENCE INTERVAL

(2A) IF 0 IS INSIDE CI, DO NOT REJECT $H_0$

(3A) CI: $\bar{X}_1 - \bar{X}_2 - (t_{\alpha/2, n_1+n_2-2})(S_P\sqrt{\frac{1}{n_1} + \frac{1}{n_2}}) \leq \mu_1 - \mu_2 \leq \bar{X}_1 - \bar{X}_2 + (t_{\alpha/2, n_1+n_2-2})(S_P\sqrt{\frac{1}{n_1} + \frac{1}{n_2}})$

CI: $92.255 - 92.733 - (2.145)(2.7)\sqrt{\frac{1}{8} + \frac{1}{8}} \leq \mu_1 - \mu_2 \leq 92.255 - 92.733 + (2.145)(2.7)\sqrt{\frac{1}{8} + \frac{1}{8}}$

CI: $-0.478 - 2.89575 \leq \mu_1 - \mu_2 \leq -0.478 + 2.89575$

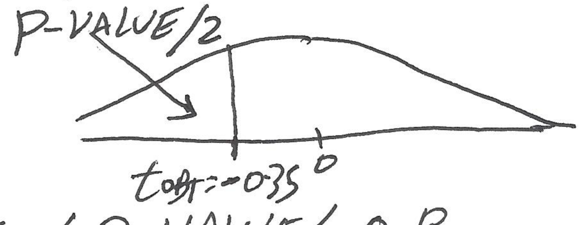
CI: $-3.37375 \leq \mu_1 - \mu_2 \leq 2.41775$

(4A) AS 0 IS INSIDE CI, DO NOT REJECT $H_0$

USING THE P-VALUE

(2B) IF P-VALUE $< \alpha$ REJECT $H_0$, IF P-VALUE $< 0.05$ REJECT $H_0$

(3B) $t_{OBT} = \dfrac{92.255 - 92.733}{2.7\sqrt{\frac{1}{8} + \frac{1}{8}}} = -0.35$




$df = 14$,

$0.258 < |t_{OBT}| < 0.692$

$0.25 < \frac{P\text{-VALUE}}{2} < 0.4$ or $0.5 < P\text{-VALUE} < 0.8$

ASSUME P-VALUE = 0.7 HERE

(4B) AS P-VALUE $> \alpha$, AS $0.7 > 0.05$, DO NOT REJECT $H_0$