

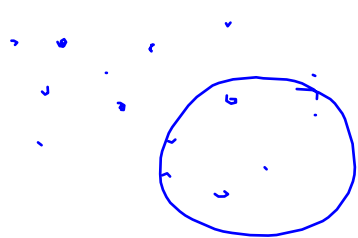
Section 12.2

Set up $\rightarrow$ similar to Sec. 12.1

$\sigma_1, \sigma_2 \rightarrow$ unknown

$\rightarrow$ assumed to be same

Pop. 1



μ_1

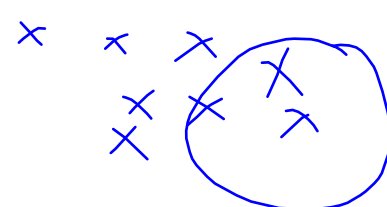
$\bar{x}_1$

s_1

(sample std. dev.)

n_1

Pop. 2



μ_2

$\bar{x}_2$

s_2

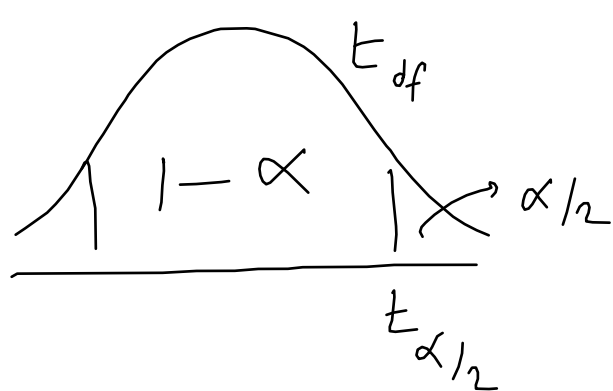
n_2

Need to pool/combine s_1 & s_2 to
obtain a common value

$$s_p^2 \text{ (pooled var.)} = \frac{(n_1 - 1)s_1^2 + (n_2 - 1)s_2^2}{(n_1 + n_2 - 2)}$$

$\subset \mathcal{I}$ for $\mu_1 - \mu_2$ (conf. level = $1 - \alpha$)

$$(\bar{x}_1 - \bar{x}_2) \pm t_{\alpha/2} \sqrt{s_p^2 \left(\frac{1}{n_1} + \frac{1}{n_2} \right)}$$



$$df = n_1 + n_2 - 2$$

often 0

$$H_0 : \mu_1 - \mu_2 = 0$$

$$H_a : \mu_1 - \mu_2 \neq 0$$
$$> 0$$
$$< 0$$

$$t_{\text{test}} = \frac{(\bar{x}_1 - \bar{x}_2) - \underbrace{(\mu_1 - \mu_2)}_{\text{often 0}}}{\sqrt{s_p^2 \left(\frac{1}{n_1} + \frac{1}{n_2} \right)}}$$

Energy
Charlotte

$$\begin{aligned}\mu_1 & \bar{x}_1 = 100 \\ s_1 & = 6 \\ n_1 & = 41\end{aligned}$$

Energy
Boone

$$\begin{aligned}\mu_2 & \bar{x}_2 = 98 \\ s_2 & = 8 \\ n_2 & = 51\end{aligned}$$

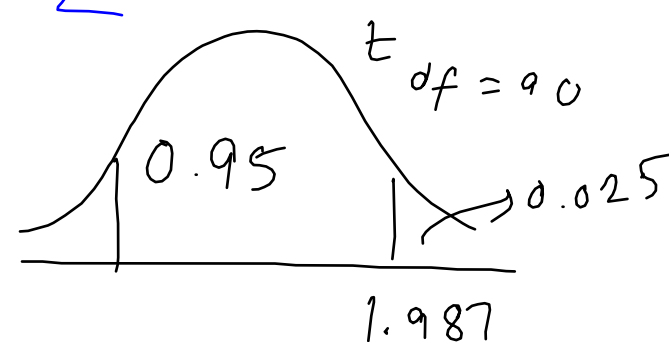
95% CI for $\mu_1 - \mu_2$

σ_1, σ_2 : unknown but equal

$$s_p^2 = \frac{(n_1 - 1)s_1^2 + (n_2 - 1)s_2^2}{n_1 + n_2 - 2}$$

$$= 51.56$$

$$s_p = 7.18$$



$$CI : (\bar{x}_1 - \bar{x}_2) \pm t_{90, 0.025} \sqrt{51.56 \left(\frac{1}{41} + \frac{1}{51} \right)}$$

$$100 - 98 \pm 1.987 \times \sqrt{2.269}$$

$$2 \pm 1.987 \times 1.506$$

$$2 \pm 2.99$$

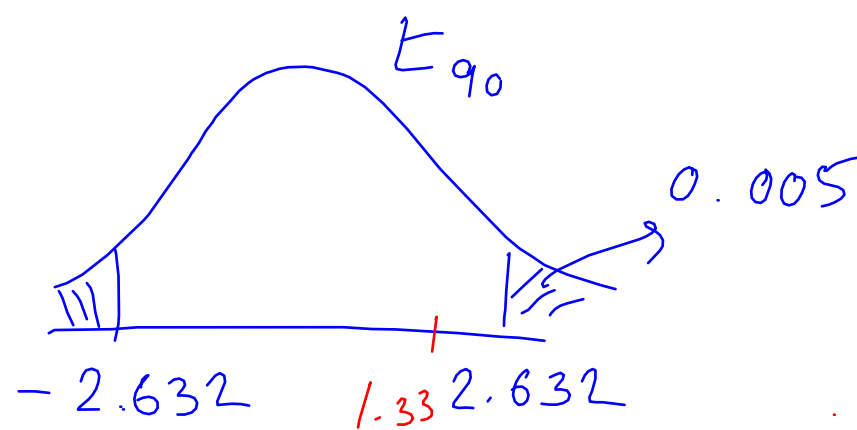
$$[-0.99, 4.99]$$

$$H_0 : \mu_1 - \mu_2 = 0$$

$$\alpha = 0.01$$

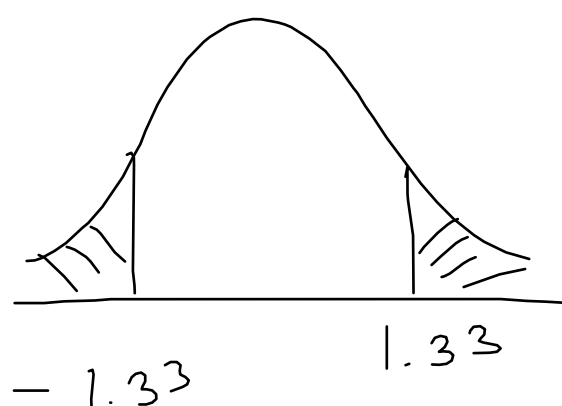
$$H_a : \mu_1 - \mu_2 \neq 0$$

$$\begin{aligned}t_{test} &= \frac{(\bar{x}_1 - \bar{x}_2) - 0}{\sqrt{s_p^2 \left(\frac{1}{n_1} + \frac{1}{n_2} \right)}} \\ &= \frac{2 - 0}{1.506} \\ &= 1.33\end{aligned}$$



Fail to reject H_0
 $\therefore 1.33 < 2.632$

$$\begin{aligned}p\text{-value} &= \boxed{1/1} \\ &= 2 \times P(t > 1.33) \\ &= 0.187\end{aligned}$$



$$= \text{T.DIST.2T}(1.33, 90)$$

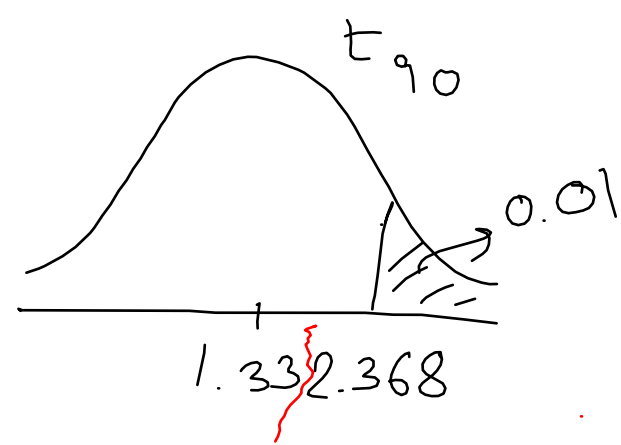
for the same problem (prev. slide)

$$H_0: \mu_1 - \mu_2 = 0$$

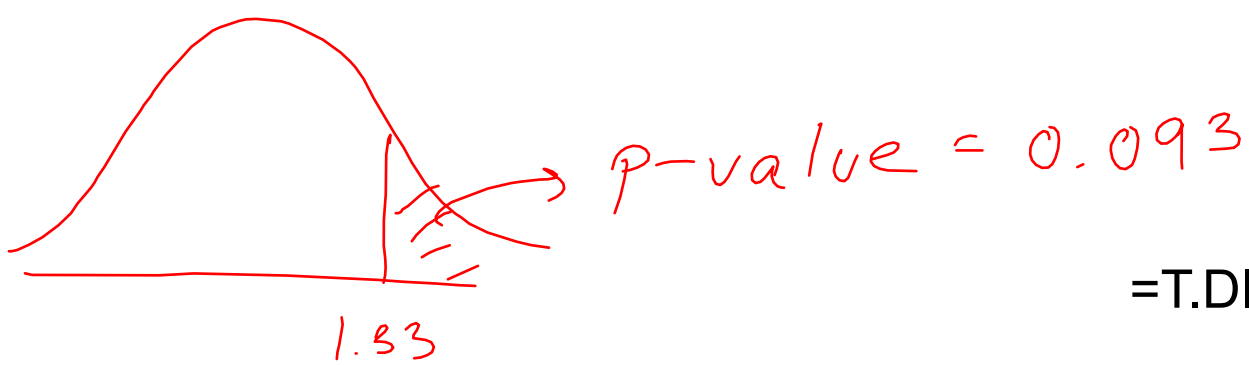
$$\alpha = 0.01$$

$$H_a: \mu_1 - \mu_2 > 0$$

$$t_{\text{test}} = \frac{(\bar{x}_1 - \bar{x}_2) - 0}{1.506}$$



Fail to reject H_0 . (1.33 < 2.368)



$$= \text{T.DIST.RT}(1.33, 90)$$

Next part of sec 12.2

→ similar to the prev. part of

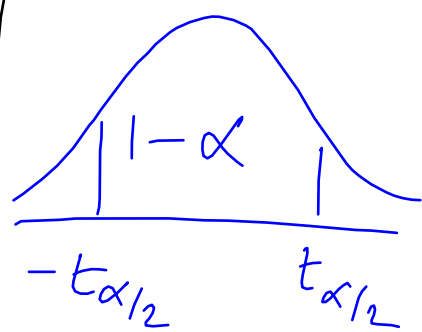
12.2 except unknown σ_1 & σ_2

not assumed equal

⇒ don't need s_p^2

CI for $1-\alpha$ conf. level

↳ for $\mu_1 - \mu_2$



$$(\bar{x}_1 - \bar{x}_2) \pm t_{\alpha/2} \sqrt{\left(\frac{s_1^2}{n_1} + \frac{s_2^2}{n_2} \right)}$$

$$df = \min \{ n_1 - 1, n_2 - 1 \}$$

$$t_{test} = \frac{(\bar{x}_1 - \bar{x}_2) - (\mu_1 - \mu_2)}{\sqrt{\left(\frac{s_1^2}{n_1} + \frac{s_2^2}{n_2} \right)}}$$