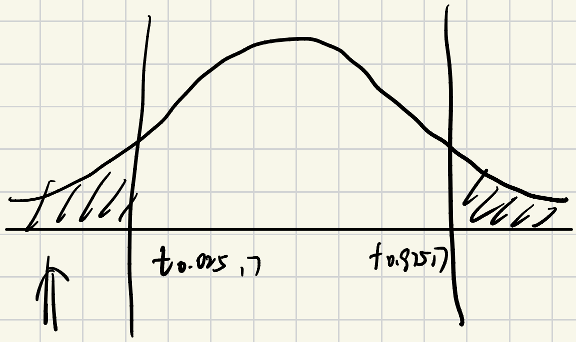
$$T^* = \frac{(\bar{X}-\bar{Y}) - (\mu_x - \mu_y)}{\sqrt{S_p^2}\,\sqrt{\frac{1}{n_1}+\frac{1}{n_2}}} \sim t_{(n+m-2)}$$

$=0$ by H_0

$$S_p^2 = \frac{(n-1)S_x^2 + (m-1)S_y^2}{n+m-2}$$

$$S = \frac{1}{n-1}\sum_i (X_i - \bar{X})^2$$



reject region

right side $\mu_1 > \mu_2$

$$S_x^2 = 0.2163$$

$$S_y^2 = 1.1795$$

$$\Rightarrow S_p^2 = \frac{(4-1)S_x^2 + (5-1)S_y^2}{4+5-2} = 0.76669$$

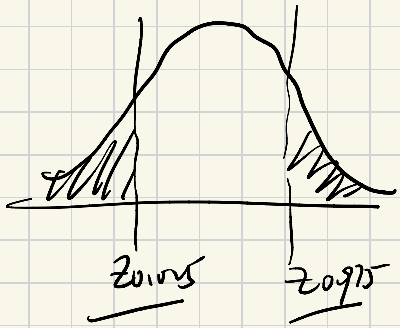
$$\bar{X}-\bar{Y} = \frac{\bar{X}-\bar{Y}}{\sqrt{S_p^2(\frac{1}{4}+\frac{1}{5})}} \sim t_{(7)}$$

$$= -1.8206$$

when $\sigma_0^2 = 1$

$$X \sim N(\mu, \frac{\sigma^2}{n})$$

$$\begin{cases} \bar{X} \sim N(\mu_1, \frac{1}{4}) \\ \bar{Y} \sim N(\mu_2, \frac{1}{5}) \end{cases}$$



$$\bar{X}-\bar{Y} \sim N(\mu_1-\mu_2, \frac{4}{5}+\frac{1}{4}).$$

$$\Rightarrow \frac{\bar{X}-\bar{Y}-(\mu_1-\mu_2)}{\sqrt{\sigma^2(\frac{1}{4}+\frac{1}{5})}} \sim N(0,1).$$