# Example 1

$H_0: \mu_1 = \mu_2$ vs $H_1: \mu_1 \neq \mu_2$

$\mu_1$ ... mean height of boys

$\mu_2$ ... mean height of girls

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

$$= \frac{9 \times 7.158^2 + 9 \times 6.859^2}{18} = 49.141$$

$$S_p = 7.0105$$

Test statistic:

$$T = \frac{\bar{X}_1 - \bar{X}_2}{S_p\sqrt{\frac{1}{n_1}+\frac{1}{n_2}}} = \frac{152.82-159.15}{7.0105\sqrt{\frac{1}{10}+\frac{1}{10}}} =$$

$$= -2.02$$

$t_{18}(0.05) = 1.734 < |T|$ $(\alpha = 10\%)$

$t_{18}(0.025) = 2.101 > |T|$ $(\alpha = 5\%)$

We can reject $H_0$ at $10\%$ level,

but not at 5% level.
$(0.05 < p < 0.1)$
There is weak evidence that population means of heights for boys & girls differ.

Example 2:

$\mu_1$ mean scores before taking module
$\mu_2$ mean scores after taking module

$H_0: \mu_1 = \mu_2$ , $H_1: \mu_1 < \mu_2$

$$T = \frac{\bar{d}}{s_d/\sqrt{n}} = \frac{-10.07}{14.89/\sqrt{15}} = \underline{\underline{-2.619}}$$

$\bar{d} = -10.07$ , $s_d = 14.89$

$t_{14}(0.05) = 1.761$, $t_{14}(0.025) = 2.145$,
$t_{14}(0.01) = 2.624$

As $-2.619 < -2.145$, $-2.619 > -2.624$
We can reject at 2.5% but

We can reject at 2.5 % but not at 1% level.
$(0.01 < p < 0.025)$
There is evidence that students improved their scores after taking the module.