Two-bed ~~one~~ $\bar{x}_1 = 600$, $s_1 = 68.1$ | one-bed $\bar{X}_2 = 541$, $s_2 = 81.58$

Example 2. Pat wonders if two-bedroom apartments rent for significantly more than one-bedroom apartments. Use the data in the example 1 to find out.

1 = two-bed
2 = one-bed

(a) State appropriate null and alternative hypotheses.

$H_0: \mu_1 = \mu_2$ $\quad H_a: \mu_1 > \mu_2$

(b) Report the test statistic, its degrees of freedom, and the P-value. What do you conclude?

$$t = \frac{\bar{X}_1 - \bar{X}_2}{\sqrt{\frac{s_1^2}{n_1} + \frac{s_2^2}{n_2}}} = \frac{600 - 541}{47.52} = 1.24$$

$df = \min\{5-1, 5-1\} = 4$

$0.10 < \text{p-value} < 0.15$

Do not reject $H_0: \mu_1 = \mu_2$ at the 5% level.

(c) Can you conclude that every one-bedroom apartment costs less than every two-bedroom apartment?

"No"

Assume Equal variances $(\sigma_1^2 = \sigma_2^2)$

(a) Is the difference in mean ego strenth significant at the 5% level?
Be sure to state H_0 and H_a

$H_0: \mu_1 = \mu_2$
$H_a: \mu_1 \neq \mu_2$

$$t = \frac{\bar{X}_1 - \bar{X}_2}{s_p \cdot \sqrt{\frac{1}{n_1} + \frac{1}{n_2}}} = \frac{4.295 - 6.34}{.7034\sqrt{\frac{1}{6} + \frac{1}{6}}} = -5.036$$

$df = 6 + 6 - 2 = 10.$

p-value $< 2 \times 0.0005 = 0.001 < \alpha = 0.05$

Reject H_0 at the 5% level.

(b) You should be hesitant to generalize these results to the population of all middle-aged men. Explain why.

Small sample size

Example 4. A study of iron deficiency among infants compared samples of infants following different feeding regimens. One group contained breast-fed infants, while the children in another group were fed a standard baby formula without any iron supplements. Here are summary results on blood hemoglobin levels at 12 months of age:

(d) In the example 1 you found a confidence interval. In this example, you performed a significance test. Which do you think is more useful to someone planning to rent an apartment? Why?

Confidence interval

Example 3. Physical fitnss is related to personality characteristics. In one study of this relationship, middle-aged college faculty who had volunteered for a fitness program were divided into low-fitness and high-fitness groups based on a physical examination. The subjects then took the Cattell Sixteen Personality Factor Questionaire. Here are the data for the "ego strength" personality factor:

Low fitness (1)			High fitness (2)		
4.99	5.53	3.12	6.68	5.93	5.71
4.24	4.12	3.77	6.42	7.08	6.2

$\bar{X}_1 = 4.295 \quad \bar{X}_2 = 6.34$

$s_1 = 0.86 \quad s_2 = 0.5$

$$s_p^2 = \frac{(6-1)\,0.86^2 + (6-1)\,0.5^2}{6+6-2} = 0.4948$$

	Group	n	$\bar{x}$	s
1	Breast-fed	22	12.3	1.7
2	Formula	18	11.4	1.8

(a) Is there significant evidence that the mean hemoglobin level is higher among breast-fed babies? State H_0 and H_a and carry out a t test. Give the P-value. What is your conclusion?

$df = 17$

$H_0: \mu_1 = \mu_2 \quad H_a: \mu_1 > \mu_2$

$$t = \frac{\bar{X}_1 - \bar{X}_2}{\sqrt{\frac{s_1^2}{n_1} + \frac{s_2^2}{n_2}}} = \frac{12.3 - 11.4}{\sqrt{\frac{1.7^2}{22} + \frac{1.8^2}{18}}} = 1.613$$

$0.05 < \text{p-value} < 0.1$

Do not reject H_0 at the 5% level

(b) Give a 95% confidence interval for the mean difference in hemoglobin level between the two populations of infants?

95% C.I for $\mu_1 - \mu_2$ is

$$(\bar{X}_1 - \bar{X}_2) \pm t^* \sqrt{\frac{s_1^2}{n_1} + \frac{s_2^2}{n_2}}$$

$$= (12.3 - 11.4) \pm 2.11\sqrt{\frac{1.7^2}{22} + \frac{1.8^2}{18}} = 0.9 \pm 1.18 = (-0.28, 2.08)$$

(c) State the assumptions that your procedures in (a) and (b) require in order to be valid.

Two independent groups
Normal distribution.