

## 11.E: Independent Samples (Exercises)

1. What is meant by “the difference of the means” when talking about an independent samples  $t$ -test? How does it differ from the “mean of the differences” in a repeated measures  $t$ -test?

**Answer:**

The difference of the means is one mean, calculated from a set of scores, compared to another mean which is calculated from a different set of scores; the independent samples  $t$ -test looks for whether the two separate values are different from one another. This is different than the “mean of the differences” because the latter is a single mean computed on a single set of difference scores that come from one data collection of matched pairs. So, the difference of the means deals with two numbers but the mean of the differences is only one number.

2. Describe three research questions that could be tested using an independent samples  $t$ -test.
3. Calculate pooled variance from the following raw data:

Group 1	Group 2
16	4
11	10
9	15
7	13
5	12
4	9
12	8

**Answer:**

$$SS_1 = 106.86, SS_2 = 78.86, s_p^2 = 15.48$$

4. Calculate the standard error from the following descriptive statistics
  - a.  $s_1 = 24, s_2 = 21, n_1 = 36, n_2 = 49$
  - b.  $s_1 = 15.40, s_2 = 14.80, n_1 = 20, n_2 = 23$
  - c.  $s_1 = 12, s_2 = 10, n_1 = 25, n_2 = 25$
5. Determine whether to reject or fail to reject the null hypothesis in the following situations:
  - a.  $t(40) = 2.49, \alpha = 0.01$ , one-tailed test to the right
  - b.  $\bar{X}_1 = 64, \bar{X}_2 = 54, n_1 = 14, n_2 = 12, s_{\bar{X}_1 - \bar{X}_2} = 9.75, \alpha = 0.05$ , two-tailed test
  - c. 95% Confidence Interval: (0.50, 2.10)

**Answer:**

- a. Reject
  - b. Fail to Reject
  - c. Reject
6. A professor is interest in whether or not the type of software program used in a statistics lab affects how well students learn the material. The professor teaches the same lecture material to two classes but has one class use a point-and-click software program in lab and has the other class use a basic programming language. The professor tests for a difference between the two classes on their final exam scores.

Point-and-Click	Programming
83	86

Point-and-Click	Programming
83	79
63	100
77	74
86	70
84	67
78	83
61	85
65	74
75	86
100	87
60	61
90	76
66	100
54	

7. A researcher wants to know if there is a difference in how busy someone is based on whether that person identifies as an early bird or a night owl. The researcher gathers data from people in each group, coding the data so that higher scores represent higher levels of being busy, and tests for a difference between the two at the .05 level of significance.

Early Bird	Night Owl
23	26
28	10
27	20
33	19
26	26
30	18
22	12
25	25
26	

**Answer:**

Step 1:  $H_0 : \mu_1 - \mu_2 = 0$  "There is not difference in the average business of early birds versus night owls",  $H_A : \mu_1 - \mu_2 \neq 0$  "There is a difference in the average business of early birds versus night owls."

Step 2: Two-tailed test,  $df = 15$ ,  $t^* = 2.131$ .

Step 3:  $\bar{X}_1 = 26.67$ ,  $\bar{X}_2 = 19.50$ ,  $s_p^2 = 23.73$ ,  $s_{X_1} - \bar{X}_2 = 2.37$

Step 4:  $t > t^*$ , Reject  $H_0$ . Based on our data of early birds and night owls, we can conclude that early birds are busier ( $\bar{X}_1 = 26.67$ ) than night owls ( $\bar{X}_2 = 19.50$ ),  $t(15) = 3.03$ ,  $p < .05$ . Since the result is significant, we need an effect size: Cohen's  $d = 1.47$ , which is a large effect.

8. Lots of people claim that having a pet helps lower their stress level. Use the following summary data to test the claim that there is a lower average stress level among pet owners (group 1) than among non-owners (group 2) at the .05 level of significance.

$$\overline{X}_1 = 16.25, \overline{X}_2 = 20.95, s_1 = 4.00, s_2 = 5.10, n_1 = 29, n_2 = 25$$

9. Administrators at a university want to know if students in different majors are more or less extroverted than others. They provide you with descriptive statistics they have for English majors (coded as 1) and History majors (coded as 2) and ask you to create a confidence interval of the difference between them. Does this confidence interval suggest that the students from the majors differ?

$$\overline{X}_1 = 3.78, \overline{X}_2 = 2.23, s_1 = 2.60, s_2 = 1.15, n_1 = 45, n_2 = 40$$

**Answer:**

$\overline{X}_1 - \overline{X}_2 = 1.55, t^* = 1.990, s_{\overline{X}_1 - \overline{X}_2} = 0.45, CI = (0.66, 2.44)$ . This confidence interval does not contain zero, so it does suggest that there is a difference between the extroversion of English majors and History majors.

10. Researchers want to know if people's awareness of environmental issues varies as a function of where they live. The researchers have the following summary data from two states, Alaska and Hawaii, that they want to use to test for a difference.

$$\overline{X}_H = 47.50, \overline{X}_A = 45.70, s_H = 14.65, s_A = 13.20, n_H = 139, n_A = 150$$

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