Lesson #63 · Topic 4C · Practice

Answer Key

1. a. From a group of people who agree to be in the study, randomly assign half to spend a specified time period of intermittent fasting, with the other half eating without restrictions. At the end of the specified time period, record the blood sugar level of each participant in both groups. Then for the same time period, have each group follow the other diet and record the blood sugar level of each participant in both groups. For each participant, calculate the difference in blood sugar level (intermittent fasting – without restrictions) and calculate the mean difference.

   b. A paired t -test is better than a two-sample t -test because having each person follow both diets controls for individual differences such as metabolism, age, and typical diet that could affect blood sugar levels. This reduces variability in the comparisons and provides a more precise estimate of the effect of intermittent fasting on blood sugar levels.

2. a. Two-sample t -test for a difference of means – we have two independent random samples, 100 adults aged 60 and older and 100 adults aged 40-59.

   b. Two-sample t -test for a difference of means – the data come from two groups in a randomized experiment with randomly assigned treatments (working remotely vs. working in person).

   c. Matched-pairs t -test for a mean difference – the data come from one group, with each subject receiving both treatments. The order of the weeks for which the associate works in each location are randomly assigned.

3. a. Mean of current recipe = 7, Mean of new recipe = 7.6

   b. Difference of means = 0.6

   c.

Participant number	**Current recipe rating**	**New recipe rating**	**Difference (New – Current)**
1	7	8	1
2	6	6	0
3	8	9	1
4	5	7	2
5	9	8	-1

   d. Mean difference = 0.6

   e. They are equal.

   f. Mean difference -- the data come from one group, with each subject receiving both treatments.

4. CLASSIFY:

Type of study: Experiment

Variables: Type of fertilizer (categorical), height of plant (in cm) (quantitative)

CHOOSE:

paired t -test for μ_{diff} at $\alpha = 0.05$

$\mu_{\text{diff}} =$ true mean difference (Fertilizer B $-$ Fertilizer A) in height of plants treated by the two fertilizers

$H_0 : \mu_{\text{diff}} = 0$

$H_a : \mu_{\text{diff}} \neq 0$

CHECK:

<u>Random</u>: random assignment of fertilizer treatment ✓

<u>10%</u>: (not needed because there was no sampling without replacement)

<u>Normal/Large Sample</u>: sample size is small but histogram of differences shows no strong skewness or outliers ✓

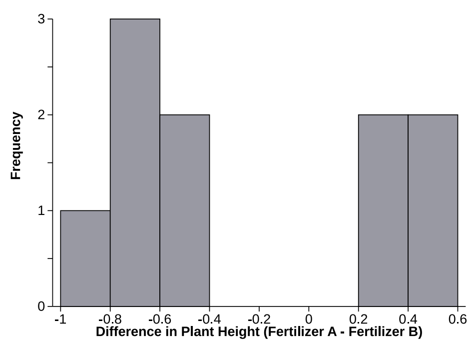
CALCULATE:

$$t = \frac{\bar{x}_{\text{diff}} - \mu_{\text{diff}}}{\frac{s_{\text{diff}}}{\sqrt{n_{\text{diff}}}}} = \frac{0.28 - 0}{\frac{0.557}{\sqrt{10}}} = 1.589, \text{df} = 9$$

p -value = 0.147

CONCLUDE:

Assuming H_0 is true $(\mu_{\text{diff}} = 0)$, there is a 0.147 probability of getting an $\bar{x}_{\text{diff}}$ of 0.28 or more extreme in either direction purely by chance. Because 0.147 > 0.05, we fail to reject H_0 and we do not have convincing statistical evidence that the true mean difference in plant height between Fertilizer B and Fertilizer A differs from 0.



5. D

6. D