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# Importing necessary libraries
import numpy as np
from scipy import stats

# 1) One-sample t test
# Data: mass of acorns in grams
acorn_masses = [8.8, 6.6, 9.5, 11.2, 10.2, 7.4, 8.0, 9.6, 9.9, 9.0,
                7.6, 7.4, 10.4, 11.1, 8.5, 10.0, 11.6, 10.7, 10.3,
                7.0]

# Hypothesized population mean (mu = 10 g)
population_mean = 10

# Perform one-sample t-test
t_statistic, p_value = stats.ttest_1samp(acorn_masses,
population_mean)

# Print results
print(f"T-statistic: {t_statistic}")
print(f"P-value: {p_value}")

# Conclusion at alpha = 0.05
alpha = 0.05
if p_value < alpha:
    print("Reject the null hypothesis: The average mass is
significantly different from 10 g.")
else:
    print("Fail to reject the null hypothesis: The average mass is not
significantly different from 10 g.")

T-statistic: -2.2491611580763973
P-value: 0.03655562279112415
Reject the null hypothesis: The average mass is significantly
different from 10 g.

# 2) Two-sample t-test
# Sample data for acorns from upwind and downwind
upwind_acorns = [10.8, 10.0, 8.2, 9.9, 11.6, 10.1, 11.3, 10.3,
                10.7, 9.7, 7.8, 9.6, 9.7,
                11.6, 10.3, 9.8, 12.3, 11.0,
                10.4, 10.4]

downwind_acorns = [7.8, 7.5, 9.5, 11.7, 8.1, 8.8, 8.8, 7.7,
                9.7, 7.0, 9.0, 9.7, 11.3, 8.7, 8.8, 10.9,
                10.3, 9.6, 8.4, 6.6, 7.2, 7.6, 11.5, 6.6,
                8.6, 10.5, 8.4, 8.5, 10.2, 9.2]

# Perform two-sample t-test assuming equal variances
t_statistic, p_value = stats.ttest_ind(upwind_acorns, downwind_acorns,
equal_var=True)

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# Print results
print(f"T-statistic: {t_statistic}")
print(f"P-value: {p_value}")

# Conclusion at alpha = 0.057
alpha = 0.057
if p_value < alpha:
    print("Reject the null hypothesis: The mass of acorns from
downwind trees is significantly different from those upwind.")
else:
    print("Fail to reject the null hypothesis: The mean marks of
students in the three sections are not significantly different.")

T-statistic: 3.5981947686898033
P-value: 0.0007560337478801464
Reject the null hypothesis: The mass of acorns from downwind trees is
significantly different from those upwind.
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