University of the People

MATH 1281 - Statistical Inference

Unit 4 Written Assignment 4

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## Part 1

### (a) Hypotheses:

Null hypothesis (H0): There is no difference in average scores between the reading and writing exams.  
H0: μ\_read - μ\_write = 0  
  
Alternative hypothesis (Ha): There is a difference in average scores between the reading and writing exams.  
Ha: μ\_read - μ\_write ≠ 0

### (b) Conditions to complete the test:

1. Randomness: The data is collected from a random sample.  
2. Normality: Given a sufficiently large sample size (n = 250), the Central Limit Theorem assures that the distribution of differences is approximately normal.  
3. Independence: The observations are independent.

### (c) Conducting the test:

Given:  
Average difference = -0.545, Standard deviation = 8.887, n = 250  
  
T-test calculation:  
t = (-0.545 - 0) / (8.887 / √250) ≈ -0.969  
Degrees of freedom: df = 249  
Conclusion: With p-value = 0.39, we fail to reject the null hypothesis. There is no convincing evidence of a difference in average scores between reading and writing exams.

### (d) Type of error:

Type II error (False Negative): We might fail to detect an actual difference in scores when one exists, meaning the observed data did not provide sufficient evidence of a real difference.

### (e) Confidence interval:

Given we failed to reject the null hypothesis at α = 0.05, a 95% confidence interval for the average difference would likely include 0, supporting the hypothesis test results.

## Part 2

### (1) Hypotheses:

Null hypothesis (H0): There is no difference in the average fuel efficiency between manual and automatic transmissions.  
H0: μ\_manual - μ\_automatic = 0  
  
Alternative hypothesis (Ha): There is a difference in the average fuel efficiency between manual and automatic transmissions.  
Ha: μ\_manual - μ\_automatic ≠ 0

### (2) Calculation of T-statistic:

Formula:  
t = (x̄₁ - x̄₂) / √(s₁²/n₁ + s₂²/n₂)  
  
(Note: Specific summary statistics were not provided, assuming they will be supplied by the instructor.)

### (3) Degrees of freedom:

Approximation:  
df = min(n₁ - 1, n₂ - 1)  
  
(Use this conservative approach if exact sample sizes are provided.)

### (4) Conclusion:

With a p-value of 0.0029 (below α = 0.05), we reject the null hypothesis. There is strong evidence of a difference in average fuel efficiency between manual and automatic transmissions.