

ECON 0150 | Fall 2025 | Homework 3.4

Due: Friday, Feb 28, 5PM

Homework is designed to both test your knowledge and challenge you to apply familiar concepts in new applications. Answer clearly and completely. You are welcomed and encouraged to work in groups so long as your work is your own. Use the provided datasets to answer the following questions. Then submit your figures and answers to Gradescope.

Q1. Hypothesis Testing

A researcher conducts a hypothesis test and reports a p-value of 0.032. (Note: We use α to denote out willingness to be wrong. So if we want to be 95% confident, then we would use an α of 0.05.)

- a) What does this p-value mean?
- b) If the researcher used a significance level of $\alpha = 0.05$, what would their conclusion be?
- c) Would their conclusion change if they used $\alpha = 0.01$ instead? Explain.

Q2. Practical Significance

Describe the difference between statistical significance and practical significance. Why is it important to consider both when analyzing results?

Q3. True or False?

Explain your reasoning for each.

- a) A p-value of 0.10 means there is a 10% chance that the null hypothesis is true.
- b) If we fail to reject the null hypothesis, we have proven that it is true.
- c) A small p-value indicates that our observed result would be unlikely if the null hypothesis were true.

Q4. Coffee Shop Wait Times

A coffee shop owner claims that the average wait time for coffee is 4 minutes. As a data analyst, you collected wait times (in minutes) for 25 randomly selected customers to test this claim. The wait times (in minutes) can be entered (copied) directly from the values below:

```
wait_times = [3.8, 4.2, 5.1, 3.9, 4.7, 5.2, 4.3, 4.6, 3.7, 5.0,  
              4.9, 4.5, 4.8, 4.1, 3.6, 5.3, 4.2, 4.0, 4.4, 5.1,  
              3.8, 4.6, 4.7, 4.3, 4.0]
```

- a) Use python to calculate the (*sample*) mean, standard deviation, sample size, and standard error of the wait times.

```
mean = np.mean(wait_times)
std_dev = np.std(wait_times, ddof=1)
n = len(wait_times)
std_error = std_dev / np.sqrt(n)
```

b) State the null and alternative hypotheses.

c) Conduct a one-sample t-test to determine whether the average wait time differs from the claimed 4 minutes. Calculate the t-statistic and find the corresponding p-value.

```
t_stat, p_value = stats.ttest_1samp(wait_times, 4)
```

d) Make a decision about the null hypothesis using $\alpha = 0.05$.

e) Construct a 95% confidence interval for the mean wait time. Does this interval include the claimed value of 4 minutes?

```
conf_int = stats.t.interval(0.95, n-1, loc=mean, scale=std_error)
```