ECON 0150 | Spring 2025 | Homework 08

Due: Wednesday, March 19, 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.

1. Explain in your own words how a one-sample t-test can be represented as a linear regression model. What parameter in the regression corresponds to the mean being tested in a t-test? (1-2 sentences)

2. True or False? Explain your reasoning.

   a) The intercept in a regression model with no predictors equals the sample mean of the outcome variable.

   b) The p-value for the intercept in a regression with no predictors tests whether the population mean equals zero.

   c) The standard error of the intercept in a regression with no predictors equals the standard deviation of the dependent variable divided by the square root of the sample size.

3. An economics professor claims that students spend 6 hours per week on average studying for their economics class. You survey 20 students and record the following number of hours they reported studying per week:

```
study_hours = [5.2, 7.1, 4.8, 6.5, 8.0, 5.5, 7.3, 4.2, 6.7, 5.8,
               7.5, 6.2, 5.0, 7.8, 6.3, 4.5, 6.9, 5.7, 7.2, 6.0]
```

   a) Use a one-sample t-test to test whether the average study time differs from the claimed 6 hours per week. What is the p-value for this test?

   b) Use a regression model with only an intercept to perform a test of the default null hypothesis on the intercept coefficient. What is the p-value for this test?

c) Explain why the p-values differ with these two approaches.

4. An economist is studying the relationship between time spent working (hours per week) and weekly income (in dollars) for part-time employees. The data for 15 randomly selected employees is:

```
hours_worked = [15, 22, 12, 25, 18, 10, 20, 28, 14, 16, 24, 19, 21, 17, 23]
weekly_income = [320, 465, 255, 510, 385, 210, 420, 570, 305, 340,
                 490, 400, 445, 360, 475]
```

a) Create a scatter plot of weekly income versus hours worked. Does there appear to be a relationship?

b) Fit a linear regression model to predict weekly income based on hours worked. What is the interpretation of the intercept coefficient?

c) What is the interpretation of the slope coefficient?

d) What is the interpretation of the p-value of the slope coefficient?

5. A (fictional) economist studied the relationship between social media usage, mental health, and academic performance among college students. A regression using data from 150 students used `academic_score` as the outcome variable produced the following (fictional) results:

```
==============================================================================
                         coef    std err          t      P>|t|      [0.025      0.975]
------------------------------------------------------------------------------
const                  82.4516      2.631     31.338      0.000      77.256      87.647
social_media_hrs       -0.9237      0.192     -4.810      0.031      -1.303      -0.544
mental_health_score     0.6382      0.145      4.401      0.300       0.352       0.925
first_gen_student      -4.1265      1.754     -2.353      0.020      -7.592      -0.661
==============================================================================
```

Where:

- `academic_score` is the student's overall GPA on a 0-100 scale

- `social_media_hrs` is the average daily hours spent on social media
- `mental_health_score` is a validated mental wellness score (0-50, higher is better)
- `first_gen_student` is a binary indicator (1 if first-generation college student, 0 otherwise)

a) Interpret the coefficient on `social_media_hrs`. How is academic performance associated with each additional hour spent on social media?

b) Use one sentence to interpret the p-value on `social_media_hrs`.

c) Use one sentence to interpret the coefficient on `mental_health_score`. What does the coefficient tell us about the relationship between mental health and academic performance?

d) Use one sentence to interpret the p-value on `mental_health_score`.