

Quiz 7 – 3/21/2024

Instructions. You have 15 minutes to complete this quiz. You may use your plebe-issue TI-36X Pro calculator. You may refer to notes that you have handwritten, not to exceed one side of an 8.5" × 11" piece of paper. You may not use any other materials.

Show all your work. To receive full credit, your solutions must be completely correct, sufficiently justified, and easy to follow.

Problem	Weight	Score
1	1	
2	1	
3a	1	
3b	2	
Total		/ 50

For this quiz, consider the following setting.

To study the fertility of fish stocked in Lake Ontario, researchers collected samples of female lake trout from Lake Ontario in September and November of 2002 through 2004. The data contains three variables for each fish: *Age*, the age of the fish (in years); *PctDM*, the percentage of total egg material that is solid (a measure of egg viability); and *Sept*, which is equal to 1 for fish collected in September, and 0 for those collected in November. The researchers fit the following model:

$$PctDM = \beta_0 + \beta_1 Age + \beta_2 Sept + \beta_3 (Age \times Sept) + \varepsilon \quad \varepsilon \sim \text{iid } N(0, \sigma_\varepsilon^2).$$

The output from `summary()` is below.

```

Coefficients:
            Estimate Std. Error t value Pr(>|t|)
(Intercept) 39.39733   1.07376  36.691  <2e-16 ***
Age         -0.21821   0.08942  -2.440  0.0206 *
Sept        -1.27623   1.51190  -0.844  0.4051
Age:Sept    -0.02144   0.12782  -0.168  0.8679
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Residual standard error: 1.242 on 31 degrees of freedom
Multiple R-squared:  0.4303, Adjusted R-squared:  0.3752
F-statistic: 7.806 on 3 and 31 DF, p-value: 0.000505

```

Problem 1. What is the estimated coefficient on *Age* for fish collected in September?

See Section 3 of Lesson 18 Part 1 for the general idea. For this problem, the fitted model is

$$\widehat{PctDM} = 39.39733 - 0.21821Age - 1.27623Sept - 0.02144(Age \times Sept)$$

Sept = 1 for fish collected in September. What is the estimated coefficient on *Age* when *Sept* = 1?

Problem 2. What is the estimated coefficient on *Age* for fish collected in November?

Similar to part a: *Sept* = 0 for fish collected in November. What is the estimated coefficient on *Age* when *Sept* = 0?

Problem 3. Is there a statistically significant difference in the estimated coefficients on *Age* for fish collected in September versus fish collected in November? Perform an appropriate hypothesis test with significance level 0.05. In particular,

- a. State the full name of the hypothesis test you chose.
- b. Perform all four steps of the hypothesis test.

See Example 2b in Lesson 17 Part 2 and Problem 1e in the Lesson 17 Exercises for similar examples.