

### Quiz 4 – 2/8/2023

**Instructions.** You have 15 minutes to complete this quiz. You may use your plebe-issue TI-36X Pro calculator. 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	
2a	1	
2b	1	
2c	1	
Total		/ 40

**Problem 1.** A capacitor was charged with a 9-volt battery and then a voltmeter recorded the voltage as the capacitor was discharged. Measurements were taken every 0.02 seconds. Your data consists of two variables: *Voltage* (in volts) and *Time* (in seconds). You are interested in predicting *Voltage* based on *Time*.

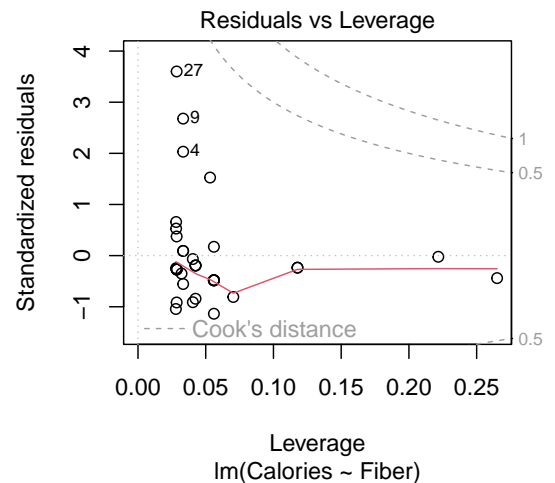
After exploring the data, you decide that applying a log transformation to *Voltage* is appropriate. You fit a simple linear regression model with  $\log(\text{Voltage})$  as the response variable, and *Time* as the explanatory variable (assume  $\log$  is the natural logarithm). Your fitted model is

$$\widehat{\log(\text{Voltage})} = 2.19 - 2.06\text{Time}$$

Use your fitted model to predict *Voltage* when *Time* = 0.05 seconds.

**Problem 2.** You are working with data for 36 breakfast cereals. Your data consists of two variables: *Calories* and *Fiber* (in grams). You are interested in predicting *Calories* based on *Fiber*. You fit a simple linear regression model with *Calories* as the response variable, and *Fiber* as the explanatory variable.

- a. Using R, you generate the diagnostic plot to the right. Based on the rules of thumb we covered in class, circle the points that are classified with “very unusual” leverage. Briefly explain your reasoning below.



Below is output from `summary()` for your simple linear regression model.

```
Call:
lm(formula = Calories ~ Fiber, data = Cereal)

Residuals:
    Min       1Q   Median       3Q      Max
-17.363  -7.363  -4.005   1.413  55.801

Coefficients:
              Estimate Std. Error t value Pr(>|t|)
(Intercept)  117.3635     3.7216  31.536 < 2e-16 ***
Fiber         -4.3881     0.7358  -5.964 9.6e-07 ***
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Residual standard error: 15.72 on 34 degrees of freedom
Multiple R-squared:  0.5112, Adjusted R-squared:  0.4969
F-statistic: 35.56 on 1 and 34 DF, p-value: 9.603e-07
```

Suppose you want to perform a  $t$ -test for the slope of your simple linear regression model, with hypotheses

$$H_0 : \beta_1 = 0 \quad H_A : \beta_1 \neq 0$$

b. Based on the output, do you reject or fail to reject the null hypothesis  $H_0$ ? Briefly explain why. Use a significance level of  $\alpha = 0.05$ .

c. Based on your decision, state your conclusion about the slope of your model in the context of the problem. Be brief.