MS&E 125 Lecture 9 and 10 Worksheet

🔔Given the data and the regression algorithm, how could you estimate the standard error of the regression coefficients? How do you interpret the SEs? Construct 95% confidence intervals for the slope and intercept.

```
## Call:
## lm(formula = Son ~ 1 + Father, data = father_son)

## Coefficients:
##             Estimate Std. Error t value Pr(>|t|)
## (Intercept) 33.89280    1.83289   18.49   <2e-16 ***
## Father       0.51401    0.02706   19.00   <2e-16 ***
```

🕵How do you interpret these coefficients?

```
## Call:
## lm(formula = mpg ~ 1 + wt + hp, data = mtcars)
##
## Coefficients:
## (Intercept)           wt           hp
##    37.22727     -3.87783     -0.03177
```

🧮Using matrix algebra, solve for the optimal vector of coefficients.

$$\text{RSS}(\hat{\beta}) = (Y - X\hat{\beta})^T(Y - X\hat{\beta})$$

$$\frac{\partial \text{RSS}(\hat{\beta})}{\partial \hat{\beta}} = -2X^T(Y - X\hat{\beta})$$

🪵How do you interpret the slope coefficient if the outcome is log-transformed?

$$\log(y_i) = \beta_0 + \beta_1 x_i$$

🕵How do you interpret the coefficients of this model?

```
## Call:
## lm(formula = weight ~ sex + height, data = heights_weights)

## Coefficients:
##              Estimate Std. Error t value Pr(>|t|)
## (Intercept) -74.71594   14.68699  -5.087 8.51e-07 ***
## sexM          7.89421    1.60142   4.930 1.76e-06 ***
## height        0.79906    0.08907   8.971 2.44e-16 ***
```

🏗How will the lm() function modify this data for the regression algorithm?

Outcome	Group
2.9	A
3.1	B
3.4	B
4.2	C
3.5	A

🪢How do you interpret the interacted term of this model? Hint: What happens when height changes by 1?

$$\text{weight}_i = \beta_0 + \beta_\text{h}\text{height}_i + \beta_\text{m} I_\text{male} + \beta_\text{h:m} I_\text{male}\text{height}_i + \epsilon_i$$