Homework 2 – Due Jan 27th @ 11pm

1. Proof and derivation

(a) Show that the sum of residuals is always zero, i.e. $\Sigma\hat{e} = 0$

(b) Show that $\hat{\beta}_0$ *and* $\hat{\beta}_1$ are the least square estimates, i.e. $\hat{\beta}_0$ *and* $\hat{\beta}_1$ minimizes $\Sigma\hat{e}^2$.

(c) Show that S^2 is an unbiased estimator of $\boldsymbol{\sigma}^2$.

2. Exercise 2.8.2

3. Exercise 2.8.3

4. Exercise 2.8.6

5. Suppose that the data from 17 flights contains the two variables, airfares and distance. Below are the R results to find the linear model of predicting airfares from the distance of the flight. It is given that the average of 17 airfares is 228.35 and their SD is 129.74. Also, the average of distances is 816.53 and their SD is 588.79.

(a) Complete the R results.

```
Coefficients:
             Estimate Std. Error t value Pr(>|t|)
(Intercept) 48.971770     (1)       (2)      (3)
Distance     0.219687     (4)       (5)      (6)
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Residual standard error: 10.41 on 15 degrees of freedom
Multiple R-squared:  (7)  ,     Adjusted R-squared:  0.9936
F-statistic:  2469 on 1 and 15 DF,  p-value: < 2.2e-16
```

```
Analysis of Variance Table

Response: Fare
          Df Sum Sq Mean Sq F value    Pr(>F)
Distance  (1)  (2)     (3)     (7)       (8)
Residuals (4)  (5)     (6)
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

(b) Write a linear regression equation.

(c) Is the slope significant at 0.05 level? How about the intercept? Why or why not?

(d) Interpret R^2.

(e) State the null and alternative hypotheses for the ANOVA.

(f) Make a conclusion for the ANOVA. Is it consistent to the hypothesis testing for the slope?