EXAM 2

1. The following are the results of running an ANOVA on the three factors (temperature, fabric denier, and air pressure) at each of their respective three levels.

3. (a) Below is the result of the following line of code, given the appropriate datset, *data*:

$$model \leftarrow lm(NO3\ CO, data = data);\ summary(model)$$

```
Call:
lm(formula = NO3 ~ CO, data = data)

Residuals:
     Min      1Q  Median      3Q     Max
 -3.5398 -0.7906  0.2801  0.9139  2.5317

Coefficients:
             Estimate Std. Error t value Pr(>|t|)
(Intercept) -0.220414   0.991656  -0.222     0.83
CO           0.043620   0.003429  12.719  4.3e-06 ***
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Residual standard error: 2.024 on 7 degrees of freedom
Multiple R-squared:  0.9585,    Adjusted R-squared:  0.9526
F-statistic: 161.8 on 1 and 7 DF,  p-value: 4.298e-06
```

Figure 1: Model of NO3 and CO data.

4. Below I show that $SSE = S_{yy} - \hat{\beta}_1 S_{xy}$.

$$
\begin{aligned}
SSE &= \sum y_i^2 - \hat{\beta}_0 \sum y_i - \hat{\beta}_1 \sum x_i y_i \\
&= \sum y_i^2 - (\bar{y} - \hat{\beta}_1 \bar{x}) \sum y_i - \hat{\beta}_1 \sum x_i y_i \\
&= \sum y_i^2 - \bar{y} \sum y_i + \hat{\beta}_1 \bar{x} \sum y_i - \hat{\beta}_1 \sum x_i y_i \\
&= \sum y_i^2 - \frac{1}{n} \sum y_i \sum y_i + \hat{\beta}_1 (\sum \bar{x} y_i - \sum x_i y_i) \\
&= \sum y_i^2 - \frac{1}{n} (\sum y_i)^2 - \hat{\beta}_1 ((\sum x_i y_i) - \sum \bar{x} y_i) \\
&= S_{yy} - \hat{\beta}_1 ((\sum x_i y_i) - \sum \bar{x} y_i) \\
&= S_{yy} - \hat{\beta}_1 S_{xy}
\end{aligned}
$$