DATA 609 - Homework 3

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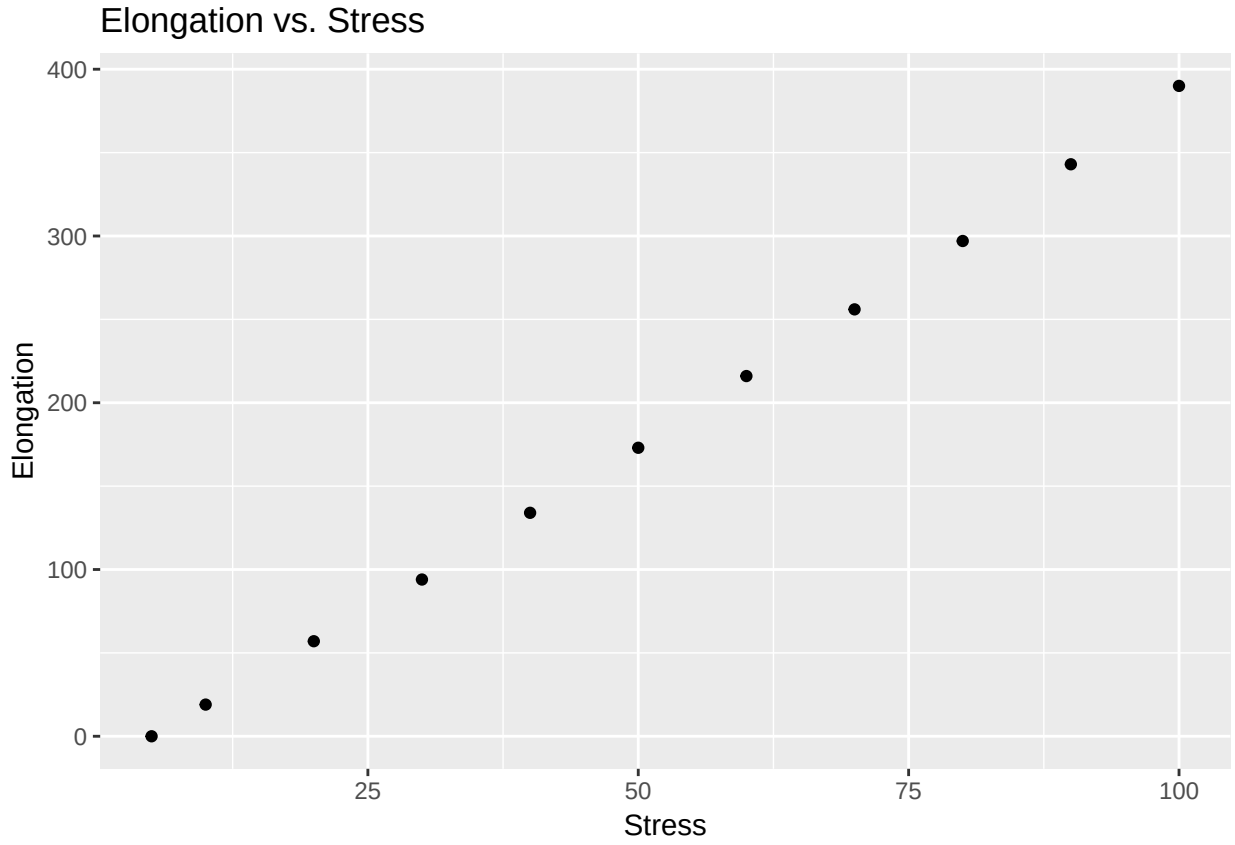
Chapter 3 Problems

1 (Page 113, exercise #2)

The following table gives the elongation e in inches per inch (in./in.) for a given stress S on a steel wire measured in pounds per square inch (lb/in^2). Test the model $e = c_1 S$ by plotting the data. Estimate c_1 graphically.

```
##   [,1] [,2] [,3] [,4] [,5] [,6] [,7] [,8] [,9] [,10] [,11]
## S    5   10   20   30   40   50   60   70   80    90   100
## e    0   19   57   94  134  173  216  256  297   343   390
```



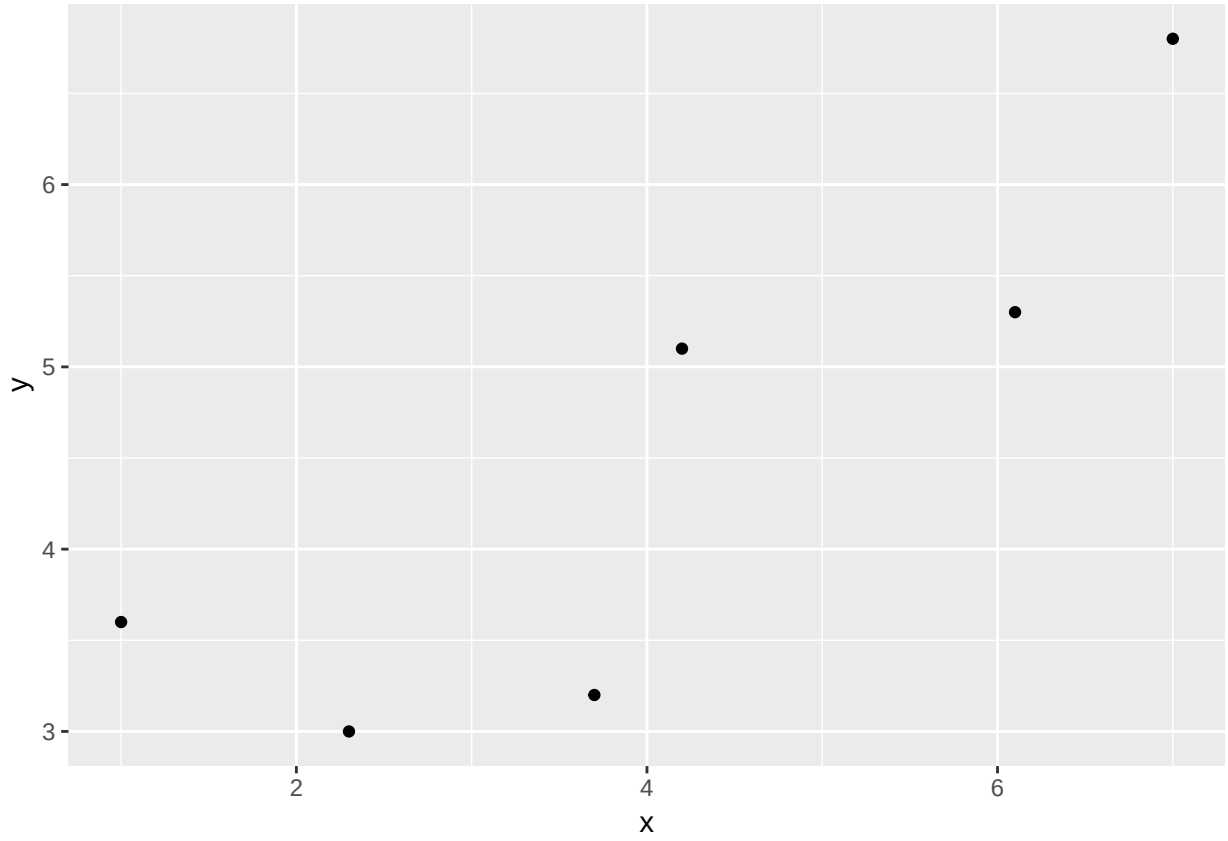
We can estimate the slope using the first and 6th points.

$$c_1 = \frac{173 - 0}{50 - 0} = 3.46$$

2 (Page 121, exercise #2.a)

Formulate the mathematical model that minimizes the largest deviation between the data and the line $y = ax + b$. If a computer is available, solve for the estimates of a and b.

```
##   [,1] [,2] [,3] [,4] [,5] [,6]
## x  1.0  2.3  3.7  4.2  6.1  7.0
## y  3.6  3.0  3.2  5.1  5.3  6.8
```



We can fit a model using these data points to minimize the deviation.

```
##
## Call:
## lm(formula = y ~ x, data = devdf)
##
## Residuals:
##       1       2       3       4       5       6
##  0.8209 -0.5126 -1.1025  0.5154 -0.3567  0.6355
##
## Coefficients:
##             Estimate Std. Error t value Pr(>|t|)
## (Intercept)   2.2149     0.7737   2.863   0.0458 *
## x             0.5642     0.1703   3.313   0.0296 *
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 0.8586 on 4 degrees of freedom
```

```
## Multiple R-squared:  0.7329, Adjusted R-squared:  0.6661
## F-statistic: 10.98 on 1 and 4 DF,  p-value: 0.02957
```

The largest deviation is 1.1025182.

The equation for the line of best fit is

$$y = 0.5642337x + 2.2148534$$

Viewing the fitted model: