(1) (a)
\[ SE_d = \sqrt{\frac{507^2}{16}} = \frac{507}{\sqrt{16}} \quad [2636 - 1.753 \times SE_d, \infty] \]

(b) Independent, normally distributed differences.

(c) A normal plot of the differences.

(2) (a) \( M \) vs \( T \) has the smallest p-value and is most significantly different.

(b) The paired test SAS used since the measurements were pairs of values from the same rat. Further information: The advantage of using paired measurements on the same rat is that they are able to compare arteries under more uniform conditions in the same rat. With arteries from different rats, the variability from rat to rat increases the standard error for comparing the different arteries similar to the paired values of zinc in top water and bottom water.

(3) You could either assume equal variances or not, since the problem didn’t specify. For the pooled version,

\[ S_p^2 = \frac{(160-1)+4.9^2+(140-1)+5.3^2}{(160-1)+(140-1)} = 25.9 \quad df = (160 - 1) + (140 - 1) = 298 \]

\[ SE(\bar{X}_{in} - \bar{X}_{out}) = \sqrt{\frac{S_p^2}{160} + \frac{S_p^2}{140}} = 0.589 \quad t = \frac{(13.0-11.4)-0}{0.589} = 2.716 \quad 2 \times 0.001 < p < 2 \times 0.0005 \quad 0.002 < p < 0.01 \]

Without assuming equal variances

\[ SE(\bar{X}_{in} - \bar{X}_{out}) = \sqrt{\frac{4.9^2}{160} + \frac{5.3^2}{140}} = 0.592 \quad df = \text{Satterthwaite} \approx 285 \]

\[ t = \frac{(13.0-11.4)-0}{0.589} = 2.702 \]

\( 2 \times 0.001 < p < 2 \times 0.0005 \quad 0.002 < p < 0.01 \quad p < 0.05 \Rightarrow \text{reject null hypothesis of no difference in means.} \)

We have statistically significant evidence that the mean waiting times are not the same.

(4) (a) The responses are not parallel \( \Rightarrow \) a definite interaction

(b) The difference between strain at low and high temps is not the same for all brands. From the plot the difference for Spider is less that the difference for Fire and Stren.

(c) Since the difference in average strain between 34 and 70 degree temperatures is not the same across all brands, it would not be reasonable to summarize effects of differences in average strain between 34 and 70 degree temperatures across all brands in this experiment with a single confidence interval. Using main effect comparisons is not useful when there are interactions.

(d) \[ S_p^2 = \frac{(3-1)+0.0112^2+(3-1)+0.0161^2+\cdots+(3-1)+0.0128^2}{(3-1)+(3-1)+\cdots+(3-1)} = \frac{0.0112^2+0.0161^2+\cdots+0.0128^2}{6} = \text{Mean Square Error} \]

(e) \( (3 - 1) + (3 - 1) + (3 - 1) + (3 - 1) + (3 - 1) + (3 - 1) = 12 = \text{Error df} \)
(5) (a) \( p = 0.0051 < 0.05 \Rightarrow \) a significant interaction effect

(b) \( (3 - 1) + (3 - 1) + (3 - 1) + (3 - 1) + (3 - 1) + (3 - 1) + (3 - 1) + (3 - 1) = 18 \)

(c) \( S_p = \sqrt{\text{Mean Square Error}} = \sqrt{0.00166} = 0.041 \)

(d) \( SE(\bar{X}_5^* - \bar{X}_{13}^*) = \sqrt{\frac{S_p^2}{9} + \frac{S_p^2}{9}} \quad df = 18 \quad 4.41 - 3.12 \pm 2.101 \times SE(\bar{X}_5^* - \bar{X}_{13}^*) \)

(e) \( \frac{e^{4.41-3.12}}{e^{3.12}} = 3.6 \)

(6) Depending on whether you used the +2.49 for the calculated t or -2.49, the p-values for (a) and (b) are either 0.0159 or 0.9841. The p-value for (c) is 0.0319. The p-values of 0.0159 and 0.0319 are less than 0.05, so reject \( H_0 \) with these p-values.

If you used -2.49 for the calculated t, the p-value for part (a) is 0.0159. If you used +2.49 for the t-value, the p-value for part is 0.9841.