Homework Assignment 9
Solutions

1. Please see the code. When plotting the data, we see that we need a data transformation, as the relationship the concentration of copper and the percent transmittance is not linear. After a log transformation, things look a lot better.

   (a) The estimates for the intercept and the slope are 1.996 and –0.020 respectively. The estimate for \( \sigma \) is 0.023.

   (b) Using some of the R code from the class page, we get (1.977;2.015) as the 95% confidence interval for the intercept, and (–0.0211;–0.0197) as the 95% confidence interval for the slope.

   (c) When checking the plot of the fitted values versus the residuals, and the qq-plot of the residuals, we don’t see any major model violations (using the transformed data).

   [4 points]

2. Please see the code. The estimate is 21.8 ppm, with a 95% confidence interval of (19.5, 24.2).

   [2 points]

3. Please see the code.

   (a) The estimates for the intercept \( \beta_0 \) and the slope \( \beta_1 \) are –227.3 and 14.1 respectively, and the estimate for the residual standard deviation \( \sigma \) is 80.9.

   (b) See the code.

   (c) The expected response for \( X = 60 \) is 618.6, and the expected response for \( X = 70 \) is 759.6. The confidence intervals are (591.9,645.3) and (699.3,819.9) for \( X = 60 \) and \( X = 70 \), respectively.

   (d) The prediction intervals are (453.6,783.6) and (586.0,933.2) for \( X = 60 \) and \( X = 70 \), respectively.

   (e) As expected, the prediction intervals are wider than the respective confidence intervals for the expected response: they have to incorporate the measurement error for the actual observation, in addition to the uncertainty in the location of the regression line. The intervals for \( X = 60 \) are shorter than the respective intervals for \( X = 70 \), since 60 is much closer to the average of the \( X \)s (57.0) than 70 is.

   [4 points]