Week 5 homework problems

1. The `Mandel` data set in the `alr4` package contains eight artificial observations in a response `y` and two predictors `x1` and `x2`. Use this data set to do the following:

   a. Write the multiple linear regression model $\mathbf{y} = \mathbf{X}\boldsymbol{\beta} + \mathbf{e}$ in terms of the actual data. (In other words, write the model equation but substitute the response vector in place of $\mathbf{y}$, the parameter vector in place of $\boldsymbol{\beta}$, and the design matrix in place of $\mathbf{X}$.)

   b. Fit the model by calculating the OLS estimators using $(\mathbf{X}^\top\mathbf{X})^{-1}\mathbf{X}^\top\mathbf{y}$.

   c. Calculate the estimate of σ^2 using $RSS = (\mathbf{y} - \mathbf{X}\hat{\boldsymbol{\beta}})^\top(\mathbf{y} - \mathbf{X}\hat{\boldsymbol{\beta}})$.

   d. Calculate the estimated variance-covariance matrix of the OLS estimators.

2. The `wm2` data in the `alr4` package contains windspeed data for a location in South Dakota where developers were considering siting a wind turbine. Variables measured were `Date`, `CSpd` (the windspeed at the site), `RSpd` (the windspeed at a nearby reference site), `RDir` (the wind direction at the reference site), and `Bin` (a discretization of `RDir`).

   a. Fit the MLR model (using `lm()`) that uses `CSpd` as response and `RSpd` and `RDir` as predictors. Report the estimated model.

   b. Provide an interpretation of the regression coefficients you reported in the estimated model, including the intercept.

   c. Report the fitted model's estimate for σ^2 and use it to find the value of *RSS*.

   d. Obtain the effects plot for each predictor.