Add to 6.7 HW

Finishing up the Least-Squares

If we assume that our data has an power model,

$$y = Ax^n$$

is there a way to find A, n using linear algebra? Yes! Take the log of both sides:

$$\ln(y) = \ln(Ax^n) = \ln(A) + \ln(x^n) = \ln(A) + n\ln(x)$$

Given a data set of points (x, y), let $\hat{x} = \ln(x), \hat{y} = \ln(y)$, and $c = \ln(A)$. Then the linear model becomes

$$\hat{y} = n\hat{x} + c$$

Find n and c using our least squares solution. Then $A = \mathrm{e}^c$, and we have found the model parameters.

Exercise 1: There is data on our class website, `Mammals.m`. If you save this, then in Matlab type `Mammals`, two vectors will load- The vector **r** is the heart rate, and the vector **w** is the mass. We expect an inverse relationship, since mice have a fast heartbeat and elephants have a slow heartbeat, but we want to find constants A and n so that

$$r = Aw^n$$

In Matlab, find A and n by first changing the data as described above, then find and solve the normal equations, then give the answer for A and n.

Loading data into Matlab

If your data comes from columns of numbers, then Matlab can read them in. For example, download the `alpsData.txt` data from our class website. To load the data into Matlab, we'll type:

```
H=load('alpsData.txt');
```

then the variable H will appear, having two columns.

Exercise 2: Load the Alps data into Matlab. The first column is the boiling point of water, the second column is the barometric pressure. We expect a relationship between them in the form of a line- Find the slope and intercept.

Find the boiling point of water in Walla Walla using this data (You'll need to find the barometric pressure online).