Homework 01

Math 315, Fall 2018

Due: Sept. 14 by 4 p.m.

Instructions: Complete the following problems and submit them by 4 p.m. on the due date. Please make sure that your solution is neatly written, clearly organized, and stapled (if there are multiple pages).

- Problems from *Statistical Rethinking* 2H1-2H4
- Problem 5. Suppose you are interested in estimating the average total snowfall per year μ (in inches) for a large city on the East Coast of the United States. Assume individual yearly snow totals $y_1, \ldots, y_n$ are collected from a population that is assumed to be normally distributed with mean μ and known standard deviation $\sigma = 10$ inches.

  a) Before collecting data, suppose you believe that the mean snowfall μ can be the values 20, 30, 40, 50, 60, and 70 inches with the following probabilities:

μ	20	30	40	50	60	70
$p(\mu)$	.1	.15	.25	.25	.15	.1

  Further, you observe the yearly snowfall totals 38.6, 42.4, 57.5, 40.5, 51.7, 67.1, 33.4, 60.9, 64.1, 40.1, 40.7, and 6.4.

  Create a data frame named `snow` with columns `mu` and `prior`. Create a vector named `snofwall` to store the y_i values.

  b) Calculate the sample mean $\bar{y}$.

  c) (Math 275 review) Show that the likelihood of μ given the data is proportional to

  $$L(\mu) \propto \exp\left(-\frac{n}{2\sigma^2}(\mu - \bar{y})^2\right).$$

  (Hint: use $\bar{y} - \bar{y}$ to *add zero*)

  d) Add a new column to the above data frame named `likelihood`, consisting of the likelihood evaluated on the values of `mu`.

  e) Calculate the posterior probabilities for each μ.

  f) Plot the prior, posterior, and likelihood on a single plot. (See an example of this in the notes)