STAT 8700 Homework 1

Brian Detweiler

Friday, September 2, 2016

1. Read Chapter 1, identify any areas of confusion for further class discussion (Try to do this part as soon as possible, I will ask at the start of each class next week if there are any topics we'd like to go over.)

2. Consider an urn containing 9 balls, which can be either red or green. Let X be the number of red balls in the urn and before observing any balls we will assume that all possible values of X from 0 to 9 are equally likely. Suppose we plan to draw 3 balls from the urn, and let $Y_i = 1$ if the i^{th} ball is red, and $Y_i = 0$ if the i^{th} ball is green for $i = 1, 2, 3$. When we draw the 3 balls, we observe $Y_1 = 1, Y_2 = 1$, and $Y_3 = 0$. As per our examples in class, construct a table with columns X, Prior, Likelihood, Likelihood x Prior, and Posterior to obtain the Posterior Distribution of X.

Ok

```
print("Stuff")
```

```
## [1] "Stuff"
```

3. Let Y_1 be the number of successes in $n = 10$ independent trials where each trial results in a success or failure, and θ, the probability of success in each trial is the same for each trial. Suppose we believe there are 4 possible values of θ, $\frac{1}{5}, \frac{2}{5}, \frac{3}{5}, \frac{4}{5}$, which we view as equally likely. Now suppose we observe $Y_1 = 7$, use a table similar to the previous question to find the posterior distribution of θ.

4. Following on from the previous question, suppose we observe another 5 independent trials and $Y_2 = 2$ successes are observed in those 5 trials. Use the posterior distribution for θ from the previous question as the new prior distribution of θ and use a table to find the new posterior distribution of θ based on the added trials.

5. Suppose we combine all 15 trials from questions 3 and 4 together and think of them as a single set of data in which we observed 9 successes. Starting with our initial uniform prior, use a table to nd the posterior distribution of θ. Compare your answer to your answer at the end of question 4.

6. In R, install a package called Bolstad. This package includes a function called binodp, which stands for "Binomial Data, Discrete Prior", exactly like the situation described in questions 3, 4, and 5. The function requires 4 inputs, the number of successes, the number of trials, a vector containing the possible values of θ, and a vector containing the corresponding prior probabilities. Note: In R, a vector is specied by c(), so in this example, the vector containing the possible values of θ would be c(1/5,2/5,3/5,4/5). Use this binodp function to calculate the posterior distribution based on the data in question 5. The function will generate several output tables and one graph. Copy/Paste (do not manually copy) the last output table (the posterior distribution) and the graph into your assignment.