Math/Stat 3850 – Take Home Quiz 1

This quiz should take you approximately 25 minutes. You may use R, the internet, and any reference material, but do not work together and do not get help (except from Dr. Clair).

(10) 1. Load the HistData library with `library(HistData)`. You may need to install it. Look at the Armada data frame, which describes a large fleet of ships that sailed from Spain in the year 1588.

(a) How many variables are there?

(b) How many observations are there?

(c) How many ships were in the Armada, overall?

(d) What was the total number of soldiers aboard all ships?

Show the R code you used to calculate this.

Solution: 10 observations of 11 variables. 130 ships overall. `sum(Armada$soldiers)` gives 19295.

(10) 2. The Superbowl will¹ be played on Sunday. Here are two events:

- $N$: The New England Patriots win the game
- $J$: Justin Timberlake is wearing a hat at the start of his halftime performance.

According to FiveThirtyEight, $P(N) = 0.58$. According to OddsShark, $P(J) = 0.22$.

What is the probability that New England wins and Justin Timberlake is wearing a hat? What assumption did you make to come to your answer? Is it justified?

Solution: $P(N \cap J) = 0.1276$. I assumed the two events $N$ and $J$ are independent, which is a good assumption since Justin Timberlake’s choice of clothing is unlikely to affect the outcome of the football game.

¹If you’ve waited until the last minute to take this quiz, assume you don’t know what happened!
3. Blood types O, A, B, and AB have the following distribution in the US:

<table>
<thead>
<tr>
<th>Type</th>
<th>Probability</th>
</tr>
</thead>
<tbody>
<tr>
<td>O</td>
<td>0.45</td>
</tr>
<tr>
<td>A</td>
<td>0.40</td>
</tr>
<tr>
<td>B</td>
<td>0.11</td>
</tr>
<tr>
<td>AB</td>
<td>0.04</td>
</tr>
</tbody>
</table>

Write R code to simulate choosing one random person’s blood type.

```R
Solution:
types <- c("O", "A", "B", "AB")
sample(types, 1, prob = c(0.45, 0.40, 0.11, 0.04))
```

4. Suppose you roll two dice. Calculate exactly the conditional probability that both dice are even, given that their sum is 10.

```R
Solution: \( P(\text{both even} \mid \text{sum is 10}) = \frac{2}{3}. \)
```

5. Suppose you roll seven dice.

Estimate or calculate the probability that the maximum of those seven rolls is 5.

```R
Solution: About 22%.
mean(replicate(100000,max(sample(1:6,7,replace=TRUE))) == 5)
```