PHYS 310 — Homework #2

Reading:

- For homework:
  - Hughes and Hase, Chapter 3.1–3.4
- For February 4 Class: Hughes and Hase Chapter 3.5, Chapter 4

Problems due Tuesday February 4:

1. Hughes and Hase, 3.5
2. Hughes and Hase, 3.7
3. Hughes and Hase, 3.8
4. Hughes and Hase, 3.9
5. In class you used a Monte Carlo simulation to determine the probability of obtaining 60 or more heads in a trial of 100 flips of a fair coin. Let's use the variable N for the number of trials used in a simulation. Modify your code so that it stores the data of the number of heads obtained in each "experiment" in an array.
   (a) Let $N = 100$ and plot a histogram of the data using the command
   ```
   plt.hist(data, 101, [30,70]])
   ```
   where `data` is the name of your array, 101 is the number of bins, and 30 and 70 are the lowest and highest values of the number of heads that you want to consider. *(An example using this command is in statistics_tools.ipynb)*
   (b) Repeat for $N = 100,000$.
6. Use a computer to simulate a single lab section's results for the PHYS 211 experiment in which the students in a section each open a bag of M&Ms and count the number of brown M&Ms. Because this is a probabilistic process, you will not all get the same answer. [**NOTE:** You will probably want to use one additional `numpy` function beyond those we used in class on Thursday: `np.bincount()`.] Make the following assumptions:

- There are 24 students in the lab section;
- There are 60 M&Ms in each bag;
- There are six different colors of M&Ms (brown, yellow, blue, orange, red, and green);
- The colors in a bag are determined probabilistically, with each color occurring with equal probability.

Make a histogram of the the results of your section, showing the number of bags with 0 brown M&Ms, the number with 1 brown M&M, etc.

7. You draw six times from a deck of 52 playing cards, replacing the card and reshuffling after every draw. Find the probability that you would draw exactly ν hearts in six draws, for $\nu = 0, 1, \ldots, 6$. This can be done with another Monte Carlo simulations, although you can also get the answer to this using something called the binomial distribution which we did not cover in class.