Assignment 2

Due Friday, October 2, 2026

This assignment covers material from Modules 3 and 4: NumPy arrays, random numbers and simulations, Matplotlib, and saving your work with git. We'll use Jupyter Notebooks with Markdown cells describing what you're doing and why, and code cells showing your work.

Let's work on our `personal` branch. First, bring it up to date with the course repo:

```
git switch main
git pull upstream main
git switch personal
git rebase main
```

Save your work on `personal` as you go with `git add` and `git commit`.

Throughout this assignment, we'll build up a simulation of a *random walk*: start at 0, and at each step, move either +1 or -1 with equal chance.

1. NumPy Arrays

- Create an array with `np.arange()` and `.reshape()` it into a 2-d array
- Print its `ndim`, `shape`, and `dtype`
- Compute its `.sum()` with `axis=0` and with `axis=1`. In a Markdown cell, explain the difference between the two results.
- Multiply your 2-d array by a 1-d array to demonstrate broadcasting

2. A Simulation

- Create a seeded random number generator with `np.random.default_rng()`
- Use `rng.choice()` to draw 5 random walks of 500 steps each, of `-1` or `1`, as a single array with `size=(5, 500)`
- Use `np.cumsum()` with the right `axis` to turn the steps into positions
- In a Markdown cell, answer: what is the `shape` of your array of positions, and what does each row represent?

3. Building a Plot in Matplotlib

Using `fig, ax = plt.subplots()`:

- Plot all 5 random walks on a single Axes
- Give each line a unique color and linestyle, and a `label`
- Add a horizontal reference line at 0 with `ax.axhline()`
- Add a title, axis labels, and a legend

4. Building Subplots in Matplotlib

- Simulate 1,000 random walks of 500 steps each, and compute the final position of each walk
- Create a figure with two subplots side by side:
  - On the left, your plot of 5 random walks from Section 3
  - On the right, a histogram of the 1,000 final positions
- Add a title to each subplot and to the figure with `fig.suptitle()`
- Save your figure as `random_walks.png` with `fig.savefig()`

5. Submit Your Work

Download your notebook from Jupyter Lab and upload it to https://mskeducation.mskcc.org/ by Friday, October 2nd 11:59PM.