CNS2025: Homework 9

Due: 2025-11-05 23:59

Exercise 1

Refer to the code for the lazy pollster in `code09.ipynb` and consider a more diligent pollster who got the response sequence

```
seq = ['B','B','B','A','B','A','B','A','A','B','A','B','B','B','B']
```

from a population of 100 people. With a uniform prior in the distribution of number of people favoring **A**, s, calculate and plot the final posterior distribution $P(s)$. Calculate the mean $\langle s \rangle$ and standard deviation $\sigma(s)$ of the variable s using $P(s)$:

$$\langle s \rangle = \sum_{s=0}^{N} sP(s) \text{ and } \sigma(s) = \sqrt{\sum_{s=0}^{N} (s - \langle s \rangle)^2 P(s)},$$

where $N = 100$ is the population size.

Exercise 2

Load the data file hw09-data.npz which contains a python dict "`dat`" with entries from "0.0" to "4.0", the numbers represent different values of a setup parameter r. Each entry contains response results to a stimulus input with two possible states in a 2×4096 `numpy` array with the row indexes the two possible input states while the 4096 column indexes different trial results.

Exercise 2.1

Plot the histograms of the responses for the two input states separately (similar to that on the upper right of slide 7, "Moving random dot stimuli" or the plot B of slide 11, "Fractions of correct inference") for all values of the setup parameter r.

Exercise 2.2

Use the equation of discriminability on slide 7 to calculate and plot the discriminability as a function of the setup parameter r. For each r value, use the average of standard deviations of the two distributions, e.g.,

```
(dat[r][0].std()+dat[r][1].std())/2
```

as the standard deviation at the denominator.
