
0.0.1 Question 1c

Before we write any code, let's review the idea of hypothesis testing with the permutation test. We first simulate the experiment many times (say, 10,000 times) through random permutation (i.e., without replacement). Assuming that the null hypothesis holds, this process will produce an empirical distribution of a predetermined test statistic. Then, we use this empirical distribution to compute an empirical p-value, which is then compared against a particular cutoff threshold in order to accept or reject our null hypothesis.

In the below cell, answer the following questions: * What does an empirical p-value from a permutation test mean in this particular context of birthweights and maternal smoking habits? * Suppose the resulting empirical p-value $p \leq 0.01$, where 0.01 is our p-value cutoff threshold. Do we accept or reject the null hypothesis? Why?

1. the empirical p-value from a permutation test demonstrates the likelihood of observing differences in birth weights between babies born to smoking and non-smoking mothers purely due to chance.
2. We can reject the null hypothesis because the empirical p-value is below the cutoff threshold, indicating that the observed difference between the two conditions is very unlikely to be due to chance alone.

0.0.2 Question 1e

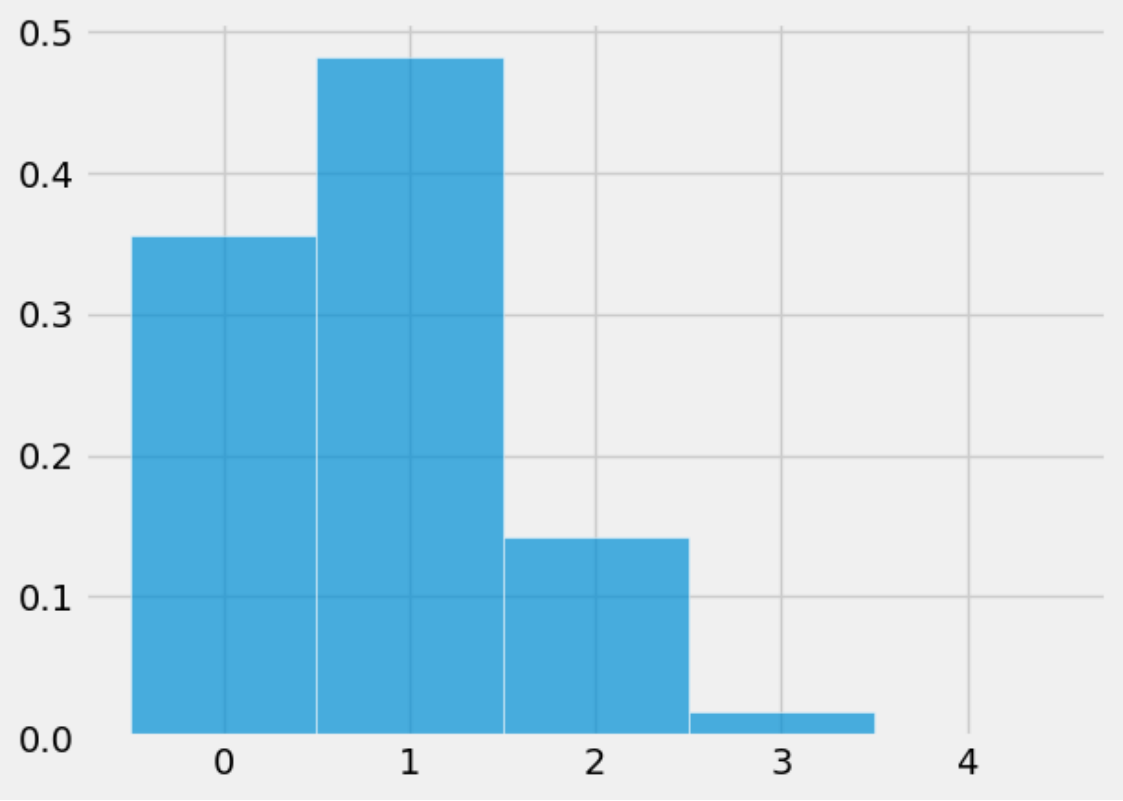
The array `differences` is an empirical distribution of the test statistic simulated under the null hypothesis. This is a prediction about the test statistic, based on the null hypothesis.

Use the `plot_distribution` function you defined in an earlier part to plot a histogram of this empirical distribution. Because you are using this function, your histogram should have unit bins, with bars centered at integers. No title or labels are required for this question.

Hint: This part should be very straightforward.

```
In [59]: plot_distribution(differences)
```

```
Out[59]: (array([0.3558, 0.4825, 0.142 , 0.0179, 0.0018]),
          array([-0.5,  0.5,  1.5,  2.5,  3.5,  4.5]),
          <BarContainer object of 5 artists>)
```



0.0.3 Question 1g

Based on your computed empirical p-value, do we reject or fail to reject the null hypothesis? Use the p-value cutoff proposed in Question 1c of 0.01, or 1%.

The empirical p-value of 0.0026 is smaller than the p-value cutoff of 0.01, which means we can reject the null hypothesis because we are unlikely to observe the differences solely due to chance.