
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?

p-value indicates the chance of observing a difference in average birth weights as extreme as, or more extreme than, the observed difference between babies of mothers who smoke and those who don't, given that the null hypothesis is true.

If the resulting empirical p-value is less than our chosen significance level), it means that the observed difference in birth weights is hihgly statistically significant and is highly unlikely to have occurred just by random chance. This implies that the data support the alternative hypothesis more than they support the null.

0.0.2 Question 1e

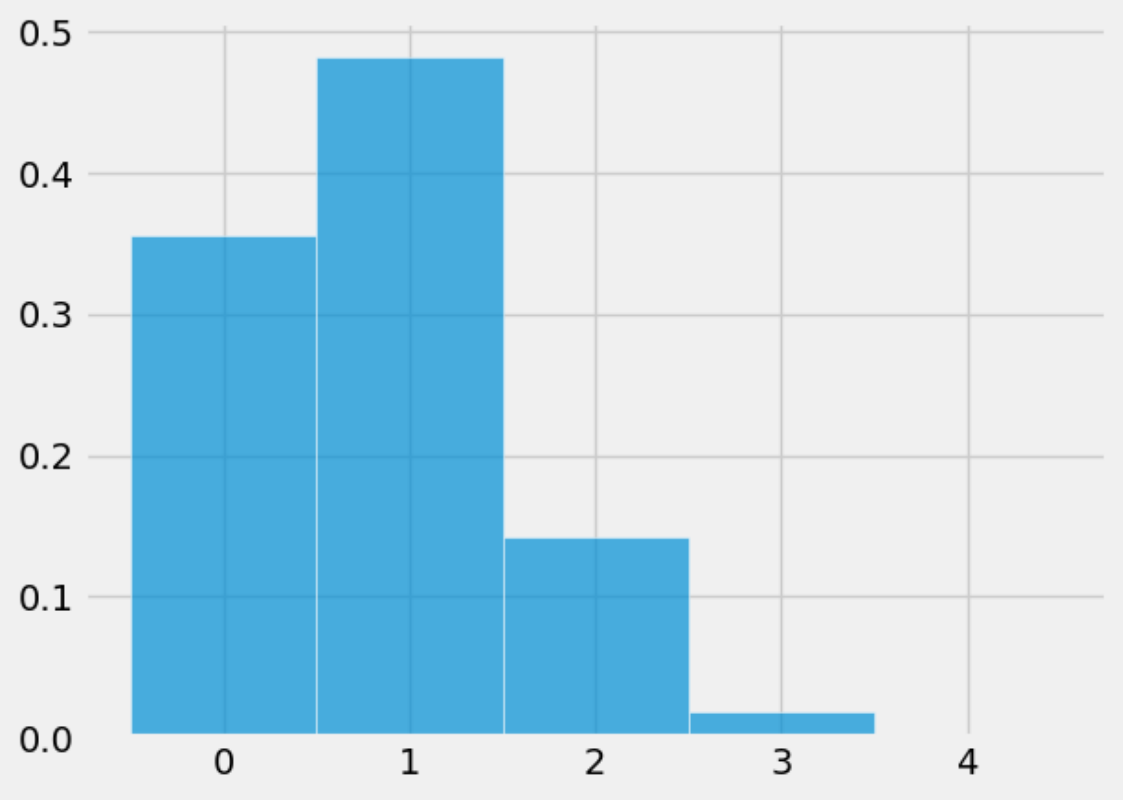
The array `differences` is an empirical distribution of the test statistic simulated under the null hypothesis. This is a prediction about the test statistic, based on the null hypothesis.

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 [28]: plot_distribution(differences)
```

```
Out[28]: (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%.

According to our simulation, we can reject the null hypothesis because 0.0026 is less than 0.01. Meaning that less than 1% of permuted samples resulted in a difference of 3.266 or more.