p-value Paper Activity

For their introductory statistics project, a student wants to determine if there is evidence of a difference in average price between products at two grocery stores in town. They have **a lot** of time so decide to randomly sample 1000 common items at the two stores, record the price of the item at each store (ignoring any sales), and run a matched pairs t-test on the 1000 differences with a significance level of $\alpha = 0.05$.

They complete all of the steps of their matched pairs t-test correctly. They then write the following conclusion.

We reject the null hypothesis. There is statistically significant evidence that prices of items at store B are higher than prices of items at store A, on average.

Your Task

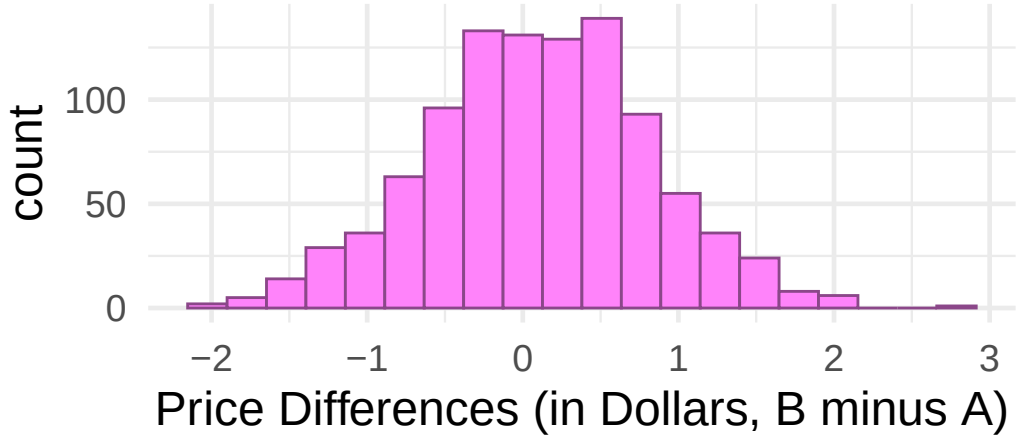
Recall that Wasserstein, Schirm, & Lazar, (2019) had the following recommendations:

We summarize our recommendations in two sentences totaling seven words: "Accept uncertainty. Be thoughtful, open, and modest." Remember "ATOM."

Focusing on the first recommendation, *accept uncertainty*, use the following description of uncertainty, summary statistics of the differences, and graph of the student's data to modify the student's conclusion.

Uncertainty exists everywhere in research. And, just like with the frigid weather in a Wisconsin winter, there are those who will flee from it, trying to hide in warmer havens elsewhere. Others, however, accept and even delight in the omnipresent cold; these are the ones who buy the right gear and bravely take full advantage of all the wonders of a challenging climate. Significance tests and dichotomized p-values have turned many researchers into scientific snowbirds, trying to avoid dealing with uncertainty by escaping to a "happy place" where results are either statistically significant or not. In the real world, data provide a noisy signal. Variation, one of the causes of uncertainty, is everywhere. Exact replication is difficult to achieve. So it is time to get the right (statistical) gear and "move toward a greater acceptance of uncertainty and embracing of variation" (Gelman 2016).

Activity: p-value Paper




```
t.test(diff ~ 1, data = price_df)
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```
    One Sample t-test

data:  diff
t = 4.3214, df = 999, p-value = 1.705e-05
alternative hypothesis: true mean is not equal to 0
95 percent confidence interval:
 0.05378317 0.14326029
sample estimates:
 mean of x
0.09852173
```

```
price_df |>
  summarise(mean = mean(diff),
            median = median(diff),
            sd = sd(diff),
            prop = mean(diff > 0),
            q1 = quantile(diff, 0.25),
            q3 = quantile(diff, 0.75))
```

```
# A tibble: 1 x 6
    mean median    sd  prop     q1    q3
   <dbl>  <dbl> <dbl> <dbl>  <dbl> <dbl>
1 0.0985  0.102 0.721 0.556 -0.371 0.578
```