**Homework Assignment 1**

**Notes:**

1. This is a group assignment. Every group should make only one submission.
2. Questions 1 and 2 in this assignment are based on the case: **Behavioral Insights Team (A)**
3. Paste/Show the R-code used in your response wherever it is needed
4. **Check for the due dates** on eLearning. Late submissions are not accepted and will get 0.

**Question 1: (2 points – suggested length of answer is half a page or less)**

What should HMRC write its letter to delinquent taxpayers? Why do you think your proposal would be effective?

**Question 2: (1.5 points – suggested length of answer is half a page or less)**

How should HMRC evaluate the success of the proposed letter? Explain.

**Question 3: (2 points – Suggested length of answer is half a page or less)**

Consider the following two causal questions:

* + What is the impact of stay-at-home orders due to COVID-19 on economic activity in a state?
  + Does [sponsored search advertising](https://en.wikipedia.org/wiki/Search_advertising) on Google affect clicks for a website?

For each question address the following issues:

1. What is the outcome variable of interest and how would you characterize the “treatment”? **0.5 points for each causal question**
2. Indicate plausible sources of selection or omitted-variable bias that lead you to believe that direct comparisons of outcomes from observational data would *not* yield a good measure of the causal effect. **0.5 points for each causal question**

**Question 4: (2.5 points – suggested length of answer is half a page or less)**

In a [famous social experiment](https://www.aeaweb.org/articles?id=10.1257/0002828042002561), resumes were submitted to employers, some of which had names that are traditionally African American and others which had names that are traditionally white. Based on the results of that study, assume that out of 6,000 resumes sent out with white-sounding names, the proportion receiving callbacks was 0.12. Also, assume that out of 6,000 sent out with African American names, the proportion was 0.04. The purpose of the study was to look for any discrimination in receiving callbacks

1. What is the null hypothesis here? **0.5 pts**
2. What is the difference in means for the two groups? **0.5 pts**
3. Calculate the t-statistic necessary to test the null. Show the formula you use. What is the p-value of your test statistic? **0.5 pts**
4. Do you reject the null? **0.5 pts**
5. What do you conclude about discrimination in labor markets? **0.5 pts**

**Question 5: (2 points – suggested length of answer is half a page or less)**

Suppose a brand wants to know whether running a display ad campaign on a news website increases sales. To that end, they plan to run an A/B test in which they will randomly split the traffic into two equal groups---one which sees the ad and the other which sees a filler ad (unrelated to the brand). Given that the average conversion rate (purchase per view or impression) is 0.2% without the ad campaign, how many impressions are required per group to detect a 3% improvement in conversion rate at the 5% significance level with 80% power?