Lab 1: Question 1

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Importance and Context

Like many events in the year 2020, the 2020 United States general election was unprecedented. Occurring in the midst of a global pandemic with political polarization at an all time high and the most diverse candidate pool in United States history, the 2020 election posed new challenges and opportunities for American citizens and politicians. One key component that both major political parties utilized was appealing to voters and encouraging voter turnout. In order to appeal to the correct demographic base, it is helpful to understand who comprises each political party. One distinguishing factor could be age. In this report, we analyze the relative ages of voters registered as either Republican or Democratic and we use comprehensive data from the American National Election Studies (ANES) 2020 Time Series Study. Understanding age could help politicians target their campaigns to appropriate demographics and reach audiences with whom their messages will resonate.

Description of Data

The ANES data set contains information from 8,280 pre-election interviews with U.S. citizens of voting age. Two variables are particularly relevant for us to answer this question:

- `V201018`: `PARTY OF REGISTRATION`
- `V201507x`: `SUMMARY: RESPONDENT AGE`

We noticed for both variables, there are irrelevant answers in the data set. For `PARTY OF REGISTRATION`, we'll only keep Democrats and Republicans, and remove other parties as well as other non-answers, because we're only interested in the supporters of these two parties.

Similarly, for `SUMMARY: RESPONDENT AGE`, we will remove people who refused to answer.

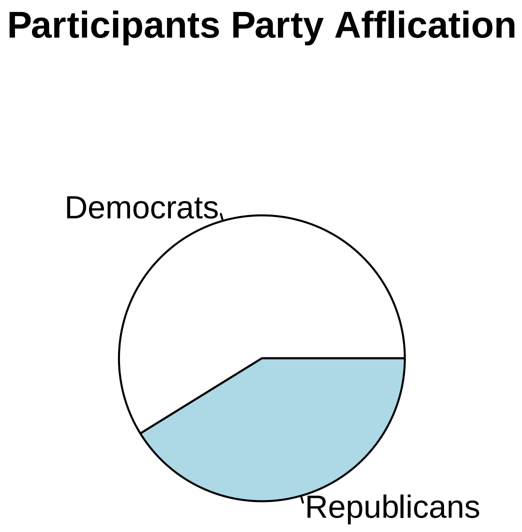
After these cleanup operations, we are left with only 3074 observations to work with.

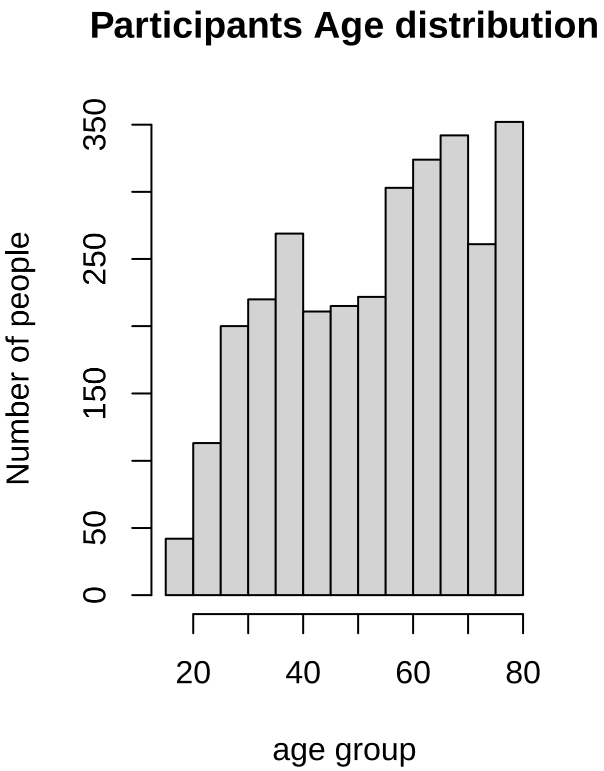
Looking at their summaries, it looks like the variables are now all in the correct range.

```
##      party            age       
##  Min.   :1.000   Min.   :18.00  
##  1st Qu.:1.000   1st Qu.:39.00  
##  Median :1.000   Median :56.00  
##  Mean   :1.412   Mean   :53.91  
##  3rd Qu.:2.000   3rd Qu.:68.00  
##  Max.   :2.000   Max.   :80.00  
```

From the following graphs, we can see that the number of Democrats and Republicans are not too disparate and the Age distribution is not very skewed.

Notice the age number has a hard cutoff at 80 due to the way the survey is constructed, so everyone above age 80 simply gets grouped into "80 or older" group, so actually the mean age is somewhat under-representing the true average age of the participants.





Most appropriate test

The unpaired t-test seems to be the most appropriate to answer this question.

1. Even though there are only 3074 valid samples, it is still large enough for the CTE to apply on the sample average, so it satisfies the normality condition
2. Given the sampling frame based on a cross-section of registered addresses across 50 states and the District of Columbia, we feel the data are sufficiently close to be i.i.d.
3. And of course `age` is a metric scale variable.

Furthermore, because we're comparing two distinct groups of people with no natural pairing between them, this directs us to the unpaired t-test.

Test, results and interpretation

For the test itself, we establish the *null hypothesis* to be that the average age of Democrats and Republicans are the same.

And *the alternative hypothesis* is that they're not. Given there is no bias towards either side, this should be a two tailed test.

We'll be using the standard 5 significance level.

```
t.test(df_clean$age ~ df_clean$party)
```

```
##
##  Welch Two Sample t-test
##
```

```
## data:  df_clean$age by df_clean$party
## t = -5.3376, df = 2781.1, p-value = 1.017e-07
## alternative hypothesis: true difference in means is not equal to 0
## 95 percent confidence interval:
##  -4.531263 -2.096511
## sample estimates:
## mean in group 1 mean in group 2
##        52.54867        55.86256
```

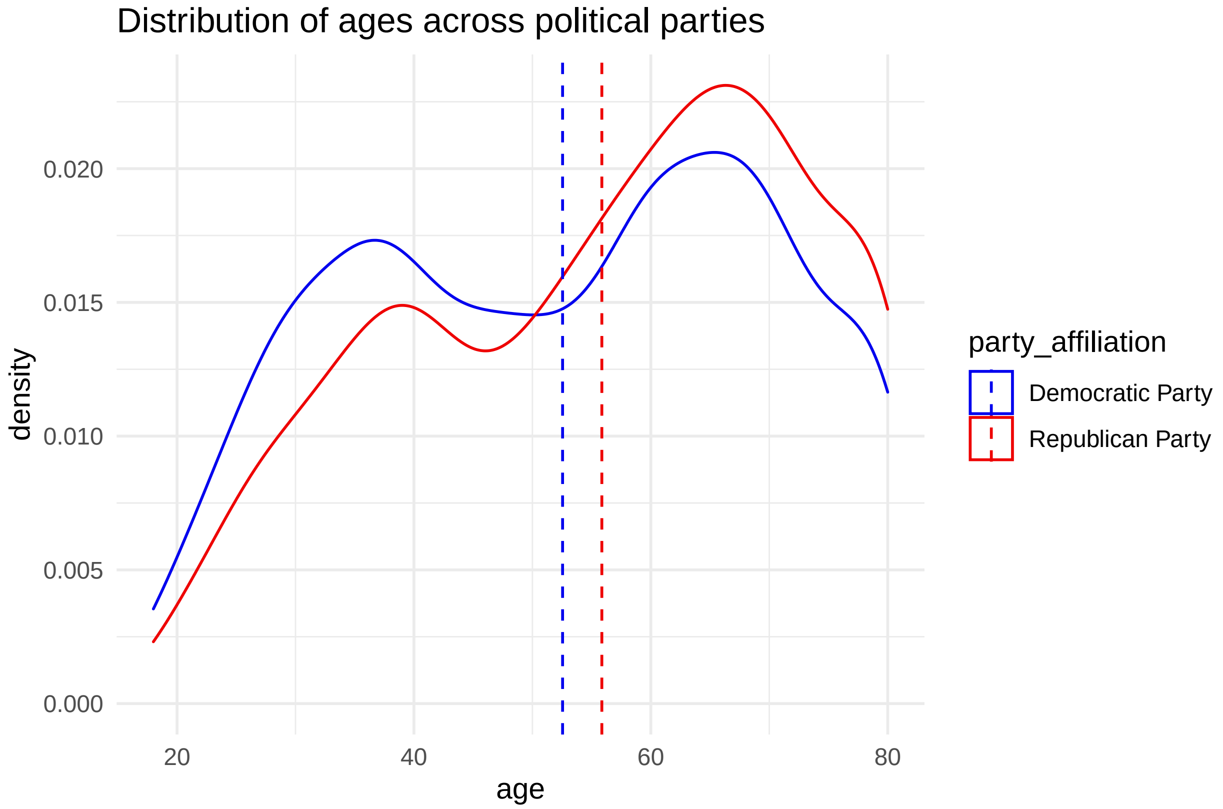
From the test, it looks like we have a very very small p-value, representing a highly significant result.

This gives us evidence to reject the null hypothesis in favor of the alternative and believe that the average age of the Democrats and the Republicans are indeed different, given the data and a 5% significance level.

Practically, as can be seen above, the average age of a Republican is more than 3 years older than a Democrat.

Plotting the distribution of ages within each group, it's clear that Democrats participants are more evenly distributed between "young" and "old" whereas Republicans are much more skewed towards people above 60.

At the same time, there are larger proportion of Democrats in the entire age group between 18 and 50 than Republicans and vice versa for over 50.



The dotted lines represent the average age in each respective political party.

More quantitatively, if we look at the correlation between the two groups, we see that there is a mild correlation, meaning that there is mildly strong (linear) relationship between the political party affiliation and age.

```
cor(df_clean$party, df_clean$age)
```

```
## [1] 0.09527008
```