Problem Set 2: Data Wrangling

Zain Ashraf

Background

Political advertising has traditionally been focused on the medium of television, but in recent cycles, online advertising has become much more popular. In this problem set, you will explore a dataset that has information on Facebook ad spending and impressions by candidates in the 2018 election cycle in the United States. The variables in this data are described below.

Name	Description
`cand_id`	unique identifier code for candidate
`cand_name`	full name of the candidate
`cand_name_last`	last name of the candidate
`party`	party affiliation of the candidate (R = Republican, D = Democrat)
`office`	office being sought by candidate
`state`	state in which the candidate is running
`incumbency`	incumbency status of candidate (incumbent, challenger, or open seat)
`spend`	estimated total spending on Facebook ads by candidate
`impressions`	estimated total impressions of Facebook ads
`ad_tone_attack`	proportion of FB ads that mention candidate's opponent only
`ad_tone_promote`	proportion of FB ads that mention candidate only
`ad_tone_contrast`	proportion of FB ads that mention candidate and candidate's opponent

Question 1 (8 points)

Load the data using the `read_csv` function and save it as `fb_ads` (using this will automatically make `fb_ads` a tibble). In the text, describe how many candidates there are in the dataset.

Use `dplyr` functions to create a table with the number of candidates in each type of incumbency status in the data set. Save this table output as `incumbency_table` (for the autograder). Use the function `knitr::kable()` on this table to have a nicely formatted table produced in the knitted output.

Rubric: 2pt for loading the data (autograder); 1pt for describing the number of candidates (PDF); 3pts for creating the table (autograder); 2pt for using `kable()` to nicely format the output (PDF)

Answer 1

```
library(dplyr)
```

```
##
## Attaching package: 'dplyr'

## The following objects are masked from 'package:stats':
##
##     filter, lag

## The following objects are masked from 'package:base':
##
##     intersect, setdiff, setequal, union
```

```
fb_ads <- read.csv("data/fb_ads.csv")

incumbency_table <- fb_ads |>
  count(incumbency) |>
  knitr::kable(col.names = c("Incumbency Status", "Amount"))

incumbency_table
```

Incumbency Status	Amount
Challenger	2510
Incumbent	2022
Open Seat	2482

There are 7,014 candidates in the dataset.

Question 2 (7 points)

Filter the data to just US House and US Senate races and use this to create a tibble called `party_incumbent_promote` that has 6 rows that summarizes the average of `ad_tone_promote` for each combination of `party` and `incumbency`. Call the variable summarizing the promote variable as `promote_prop` and be sure to remove any missing values when computing the averages.

Use `knitr::kable()` to produce a nicely formatted table. In this call, set the `digits` arguments to 3 and use the `col.names` argument to pass a nicer set of names. You can use the following as a template:

In the writeup, describe which type of candidate sponsored the most promoting ads on average.

Rubric: 3pts for creating `party_incumbent_promote` correctly (autograder); 2pt for a nicely formatted table (PDF); 1pt for changing the column names of the output table (PDF); 1pt for correctly identifying the type of candidate with highest average (PDF)

Answer 2

```
party_incumbent_promote <- fb_ads |>
  filter(office == "US House" | office == "US Senate") |>
  group_by(party, incumbency) |>
  summarize(promote_prop = mean(ad_tone_promote, na.rm = TRUE)) |>
  head()
```

```
## ‘summarise()‘ has grouped output by ’party’. You can override using the ‘.groups‘ argument.
```

```
knitr::kable(party_incumbent_promote, col.names = c("Party", "Incumbency", "Promotion"), digits = 3)
```

Party	Incumbency	Promotion
D	Challenger	0.833
D	Incumbent	0.854
D	Open Seat	0.845
R	Challenger	0.813
R	Incumbent	0.792
R	Open Seat	0.828

```
party_incumbent_promote
```

```
## # A tibble: 6 x 3
## # Groups:   party [2]
##   party incumbency promote_prop
##   <chr> <chr>             <dbl>
## 1 D     Challenger        0.833
## 2 D     Incumbent         0.854
## 3 D     Open Seat         0.845
## 4 R     Challenger        0.813
## 5 R     Incumbent         0.792
## 6 R     Open Seat         0.828
```

The type of candidate with the highest average sponsored self-promotions are incumbent democrats.

Question 3 (7 points)

Create a new variable called `impressions_millions` that is the total Facebook ad impressions in millions (as opposed to single impressions). Make sure to save the resulting dataset back as `fb_ads`.

Create a histogram of this variable for just the US House races. Save the ggplot output as `plot_q3` and also print it to produce a plot in the output. In the text, describe the shape of the histogram and tell the reader if most of the House candidates had more than 10 million ads impressions on Facebook.

Rubric: 2pt for creating the new variable (autograder); 3pts for creating the histogram object (autograder); 2pts for answering the question about the histogram (PDF)

Answer 3

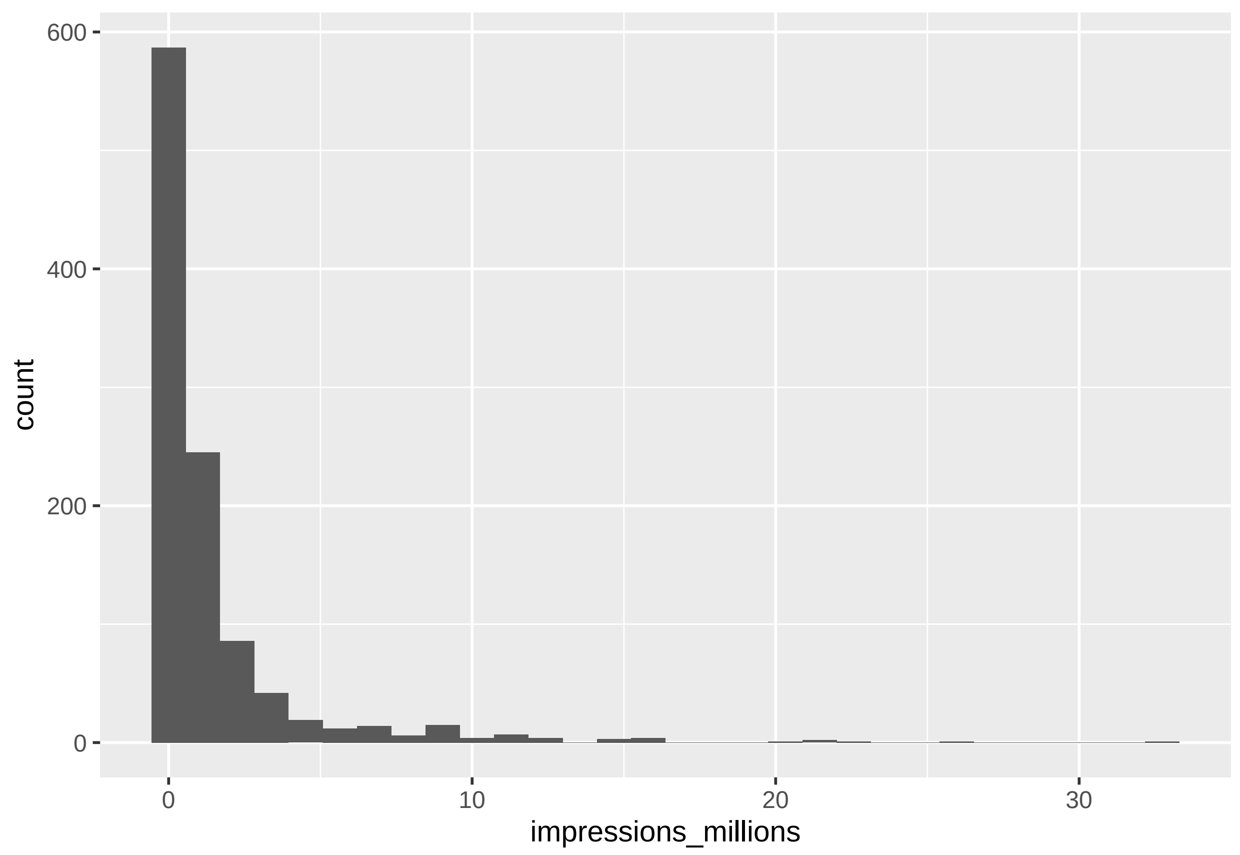
```
library(ggplot2)

fb_ads <- fb_ads |>
  mutate(impressions_millions = impressions/1000000)

plot_q3 <- fb_ads |>
  filter(office == "US House") |>
  ggplot(mapping = aes(x = impressions_millions)) +
  geom_histogram()

plot_q3
```

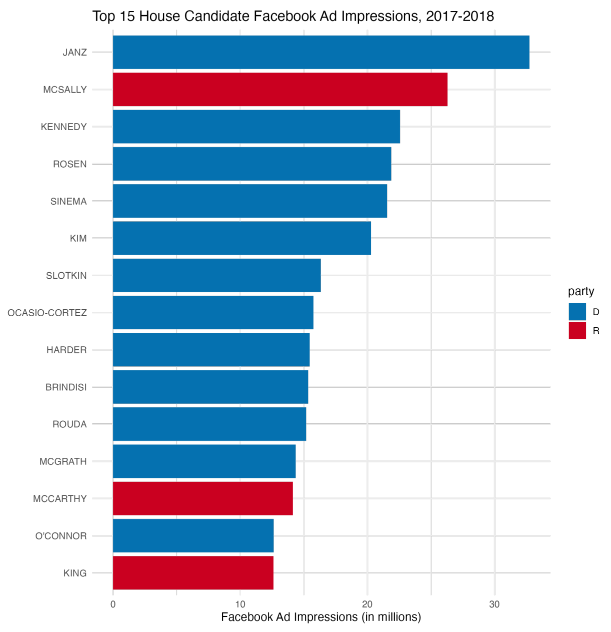
```
## `stat_bin()` using `bins = 30`. Pick better value with `binwidth`.
```



Most of the House candidates did NOT have more than 10 million ads on Facebook. The histogram is strongly skewed to the right, with the vast majority of the House candidates achieving 0-5 million impressions.

Question 4 (13 points)

Let's now recreate the following plot that shows the top 15 House candidates in terms of Facebook ad impressions.



You should save the `ggplot` output as `fb_top_plot`. You should also write `fb_top_plot` on its own line in the chunk to produce the actual plot. The key features of this graph that you should replicate for the autograder are:

- The barplot should have candidate last names on the y-axis and the `impressions_millions` variable from question 3 on the x-axis.
- The data feeding into the `ggplot` call should only have US House candidates and only the candidates with the highest 15 `impressions_millions` values.
- The y-axis should be ordered in ascending values of `impressions_millions` so that the lowest values are at the bottom. You may want to manipulate `cand_name_last` to achieve this.
- The fill color of the bar plot should be mapped to the `party` variable (but not globally!).

You do not need to exactly match the labels, but you should have informative labels. The color does not need to match, but if you want to change the fill colors, you can use the `scale_fill_manual(values = c(R = "red", D = "blue"))` function (where you can change the red and blue to whatever you want).

Rubric: 3pts for correct axes (autograder); 3pts for correct data fed into `ggplot` (autograder); 3pts for the correct ordering of the y-axis (PDF); 3pts for fill being mapped to `party` (autograder); 1pt for plot being in knitted output and having informative labels (PDF)

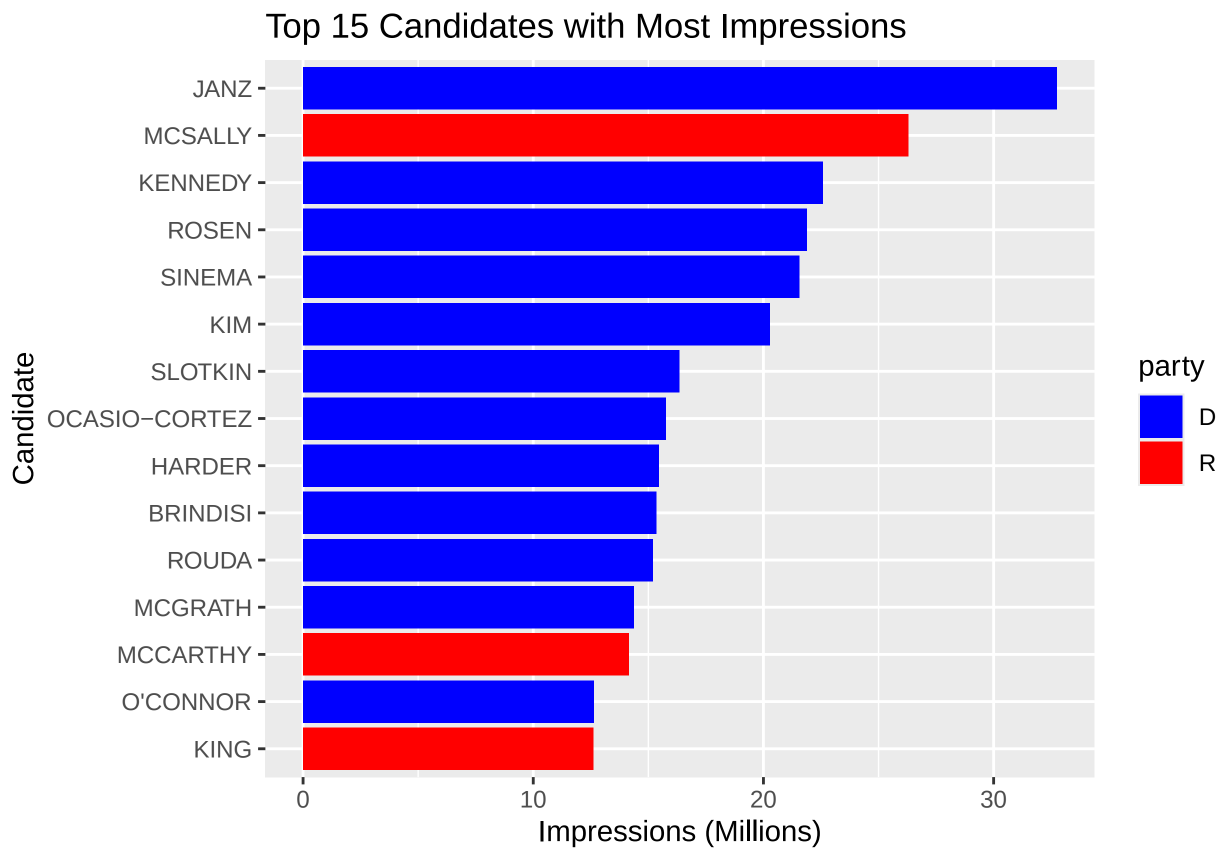
Answer 4

```r
library(tidyverse)
```

```
## Warning: package 'tidyverse' was built under R version 4.3.3
## -- Attaching core tidyverse packages ------------------------------------------- tidyverse 2.0.0 --
## v forcats   1.0.0     v stringr   1.5.1
## v lubridate 1.9.3     v tibble    3.2.1
## v purrr     1.0.2     v tidyr     1.3.1
## v readr     2.1.5
## -- Conflicts ------------------------------------------------------------- tidyverse_conflicts() --
## x dplyr::filter() masks stats::filter()
## x dplyr::lag()    masks stats::lag()
## i Use the conflicted package (<http://conflicted.r-lib.org/>) to force all conflicts to become error
```

```
fb_top_plot <- fb_ads |>
  filter(office == "US House") |>
  slice_max(impressions_millions, n = 15) |>
  ggplot(mapping = aes(x = impressions_millions,
                                           y = fct_reorder(cand_name_last, impressions_millions))) +
  geom_col(mapping = aes(fill = party)) +
  scale_fill_manual(values = c(R = "red", D = "blue")) +
  labs( x = "Impressions (Millions)",
        y = "Candidate",
        title = "Top 15 Candidates with Most Impressions")

fb_top_plot
```



Code

```r
options(width = 100)
library(dplyr)

fb_ads <- read.csv("data/fb_ads.csv")

incumbency_table <- fb_ads |>
  count(incumbency) |>
  knitr::kable(col.names = c("Incumbency Status", "Amount"))

incumbency_table

party_incumbent_promote <- fb_ads |>
  filter(office == "US House" | office == "US Senate") |>
  group_by(party, incumbency) |>
  summarize(promote_prop = mean(ad_tone_promote, na.rm = TRUE)) |>
  head()
  knitr::kable(party_incumbent_promote, col.names = c("Party", "Incumbency", "Promotion"), digits = 3)

party_incumbent_promote
library(ggplot2)

fb_ads <- fb_ads |>
  mutate(impressions_millions = impressions/1000000)

plot_q3 <- fb_ads |>
  filter(office == "US House") |>
  ggplot(mapping = aes(x = impressions_millions)) +
  geom_histogram()

plot_q3
library(tidyverse)

fb_top_plot <- fb_ads |>
  filter(office == "US House") |>
  slice_max(impressions_millions, n = 15) |>
  ggplot(mapping = aes(x = impressions_millions,
                                      y = fct_reorder(cand_name_last, impressions_millions))) +
  geom_col(mapping = aes(fill = party)) +
  scale_fill_manual(values = c(R = "red", D = "blue")) +
  labs( x = "Impressions (Millions)",
        y = "Candidate",
        title = "Top 15 Candidates with Most Impressions")

fb_top_plot
```