STA2201_Lab2

Alice Huang

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Downloading packages and data

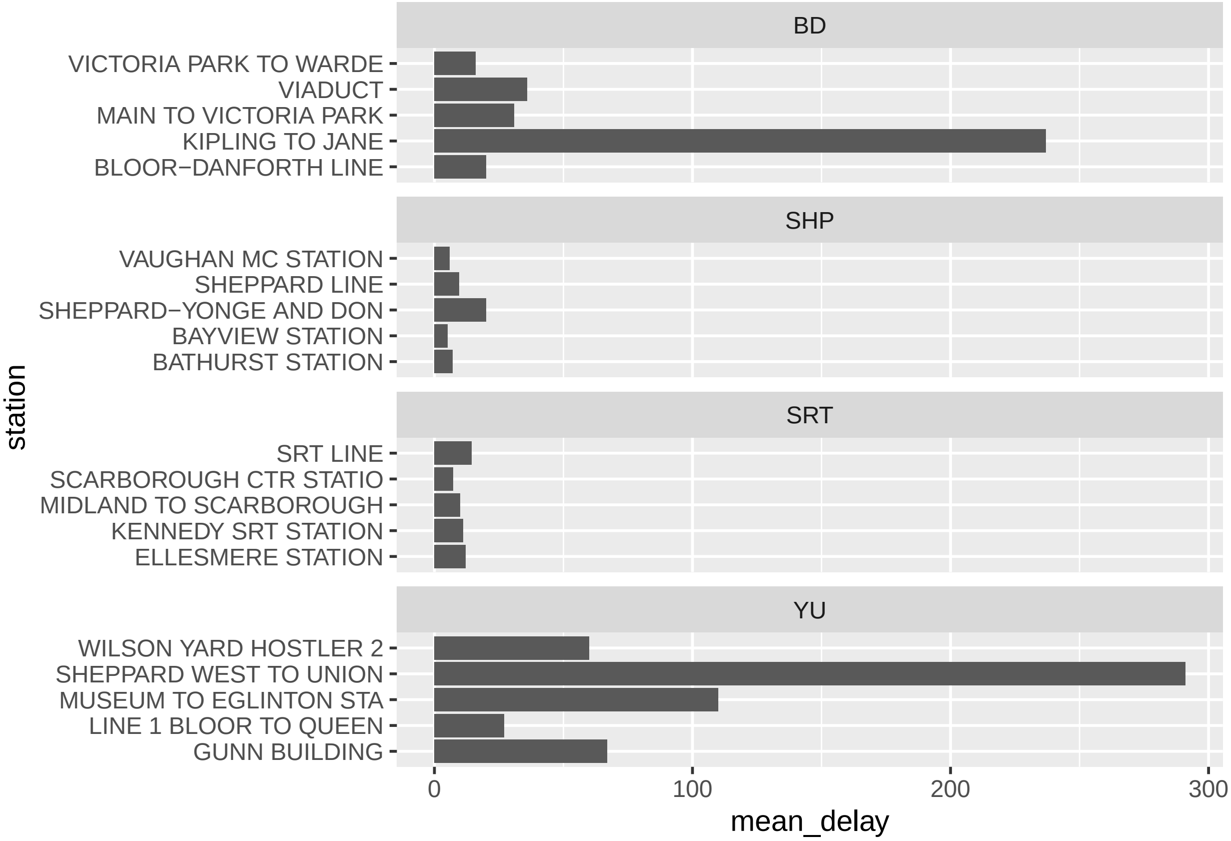
```
library(opendatatoronto)
library(tidyverse)
library(stringr)
library(skimr) # EDA
library(visdat) # EDA
library(janitor)
library(lubridate)
library(ggrepel)

all_data <- list_packages(limit = 500)

res <- list_package_resources("996cfe8d-fb35-40ce-b569-698d51fc683b") # obtained code from searching da
res <- res %>% mutate(year = str_extract(name, "202.?"))
delay_2022_ids <- res %>% filter(year==2022) %>% select(id) %>% pull()

delay_2022 <- get_resource(delay_2022_ids)

# make the column names nicer to work with
delay_2022 <- clean_names(delay_2022)

# note: I obtained these codes from the 'id' column in the `res` object above
delay_codes <- get_resource("3900e649-f31e-4b79-9f20-4731bbfd94f7")
delay_data_codebook <- get_resource("ca43ac3d-3940-4315-889b-a9375e7b8aa4")

delay_2022 <- delay_2022 %>% filter(line %in% c("BD", "YU", "SHP", "SRT"))
delay_2022 <- delay_2022 %>% distinct()
delay_2022 <- delay_2022 %>%
  mutate(station_clean = ifelse(str_starts(station, "ST"), word(station, 1,2), word(station, 1)))
```

Lab Exercises

To be handed in via submission of quarto file (and rendered pdf) to GitHub.

1. Using the `delay_2022` data, plot the five stations with the highest mean delays. Facet the graph by `line`

```
delay_2022 %>%
  group_by(line, station) %>%
  summarise(mean_delay = mean(min_delay)) %>%
  arrange(-mean_delay) %>%
  slice(1:5) %>%
  ggplot(aes(x = station,
             y = mean_delay)) +
  geom_col() +
  facet_wrap(vars(line),
             scales = "free_y",
             nrow = 4) +
  coord_flip()
```



2. Using the `opendatatoronto` package, download the data on mayoral campaign contributions for 2014. Hints:
   - find the ID code you need for the package you need by searching for 'campaign' in the `all_data` tibble above
   - you will then need to `list_package_resources` to get ID for the data file
   - note: the 2014 file you will get from `get_resource` has a bunch of different campaign contributions, so just keep the data that relates to the Mayor election

```
all_data %>% filter(title=="Elections - Campaign Contributions - 2014 to 2017") %>%
  select(id) %>% pull -> all_data_id
```

```
dflist <- list_package_resources(all_data_id) # obtained code from searching data frame above

camp2014 <- get_resource("5b230e92-0a22-4a15-9572-0b19cc222985")
mayorcamp2014 <- camp2014$`2_Mayor_Contributions_2014_election.xls`
head(mayorcamp2014)
```

```
## # A tibble: 6 x 13
##   2014 Munic~1 ...2  ...3  ...4  ...5  ...6  ...7  ...8  ...9  ...10 ...11 ...12
##   <chr>        <chr> <chr> <chr> <chr> <chr> <chr> <chr> <chr> <chr> <chr> <chr>
## 1 Contributor~ Cont~ Cont~ Cont~ Cont~ Good~ Cont~ Rela~ Pres~ Auth~ Cand~ Offi~
## 2 A D'Angelo,~ <NA>  M6A ~ 300   Mone~ <NA>  Indi~ <NA>  <NA>  <NA>  Ford~ Mayor
## 3 A Strazar, ~ <NA>  M2M ~ 300   Mone~ <NA>  Indi~ <NA>  <NA>  <NA>  Ford~ Mayor
## 4 A'Court, K ~ <NA>  M4M ~ 36    Mone~ <NA>  Indi~ <NA>  <NA>  <NA>  Chow~ Mayor
## 5 A'Court, K ~ <NA>  M4M ~ 100   Mone~ <NA>  Indi~ <NA>  <NA>  <NA>  Chow~ Mayor
## 6 A'Court, K ~ <NA>  M4M ~ 100   Mone~ <NA>  Indi~ <NA>  <NA>  <NA>  Chow~ Mayor
## # ... with 1 more variable: ...13 <chr>, and abbreviated variable name
## #   1: ‘2014 Municipal Election - List of Contributors to Mayoralty Candidates‘
```

3. Clean up the data format (fixing the parsing issue and standardizing the column names using `janitor`)

We notice that the column names are numbers, and the first row of the dataframe contains what should be the column names. So we set the first row's values to the column names. We use `clean_names` to make all column names be lowercase with words separated by underscores.

```
row_to_names(mayorcamp2014, 1, TRUE, TRUE) -> mayorcamp2014
clean_names(mayorcamp2014) -> mayorcamp2014
head(mayorcamp2014)
```

```
## # A tibble: 6 x 13
##   contributors~1 contr~2 contr~3 contr~4 contr~5 goods~6 contr~7 relat~8 presi~9
##   <chr>          <chr>   <chr>   <chr>   <chr>   <chr>   <chr>   <chr>   <chr>
## 1 A D'Angelo, T~ <NA>    M6A 1P5 300     Moneta~ <NA>    Indivi~ <NA>    <NA>
## 2 A Strazar, Ma~ <NA>    M2M 3B8 300     Moneta~ <NA>    Indivi~ <NA>    <NA>
## 3 A'Court, K Su~ <NA>    M4M 2J8 36      Moneta~ <NA>    Indivi~ <NA>    <NA>
## 4 A'Court, K Su~ <NA>    M4M 2J8 100     Moneta~ <NA>    Indivi~ <NA>    <NA>
## 5 A'Court, K Su~ <NA>    M4M 2J8 100     Moneta~ <NA>    Indivi~ <NA>    <NA>
## 6 Aaron, Robert~ <NA>    M6B 1H7 250     Moneta~ <NA>    Indivi~ <NA>    <NA>
## # ... with 4 more variables: authorized_representative <chr>, candidate <chr>,
## #   office <chr>, ward <chr>, and abbreviated variable names
## #   1: contributors_name, 2: contributors_address, 3: contributors_postal_code,
## #   4: contribution_amount, 5: contribution_type_desc,
## #   6: goods_or_service_desc, 7: contributor_type_desc,
## #   8: relationship_to_candidate, 9: president_business_manager
```

4. Summarize the variables in the dataset. Are there missing values, and if so, should we be worried about them? Is every variable in the format it should be? If not, create new variable(s) that are in the right format.

```
summary(mayorcamp2014)
```

```
##  contributors_name  contributors_address contributors_postal_code
##  Length:10199       Length:10199        Length:10199
##  Class :character   Class :character     Class :character
##  Mode  :character   Mode  :character     Mode  :character
##  contribution_amount contribution_type_desc goods_or_service_desc
##  Length:10199        Length:10199           Length:10199
##  Class :character    Class :character       Class :character
##  Mode  :character    Mode  :character       Mode  :character
##  contributor_type_desc relationship_to_candidate president_business_manager
##  Length:10199          Length:10199              Length:10199
##  Class :character      Class :character          Class :character
##  Mode  :character      Mode  :character          Mode  :character
##  authorized_representative  candidate            office
##  Length:10199              Length:10199       Length:10199
##  Class :character          Class :character   Class :character
##  Mode  :character          Mode  :character   Mode  :character
##      ward
##  Length:10199
##  Class :character
##  Mode  :character
```

```
skim(mayorcamp2014)
```

Table 1: Data summary

Name	mayorcamp2014
Number of rows	10199
Number of columns	13
Column type frequency:	
character	13
Group variables	None

Variable type: character

skim_variable	n_missing	complete_rate	min	max	empty	n_unique	whitespace
contributors_name	0	1	4	31	0	7545	0
contributors_address	10197	0	24	26	0	2	0
contributors_postal_code	0	1	7	7	0	5284	0
contribution_amount	0	1	1	18	0	209	0
contribution_type_desc	0	1	8	14	0	2	0
goods_or_service_desc	10188	0	11	40	0	9	0
contributor_type_desc	0	1	10	11	0	2	0
relationship_to_candidate	10166	0	6	9	0	2	0
president_business_manager	10197	0	13	16	0	2	0
authorized_representative	10197	0	13	16	0	2	0
candidate	0	1	9	18	0	27	0
office	0	1	5	5	0	1	0

skim_variable	n_missing	complete_rate	min	max	empty	n_unique	whitespace
ward	10199	0	NA	NA	0	0	0

There are 10197 missing values in `contributors_address` column. I wouldn't be worried about this as this information was probably hidden for privacy reasons.

There are 10188 missing values in the `goods_or_service_desc` column. There are 10166 missing values in the `relationship_to_candidate` column. There are 10197 missing values in the `president_business_manager` column. There are 10197 missing values in the `authorized_representative` column and 10199 missing values in the `ward` column. This likely means that we will not be able to consider these variables with lots of missing data in our data analysis. Fortunately there are no missing values in other columns.

The `contribution_amount` variable is in character format, so we change it to numeric format.

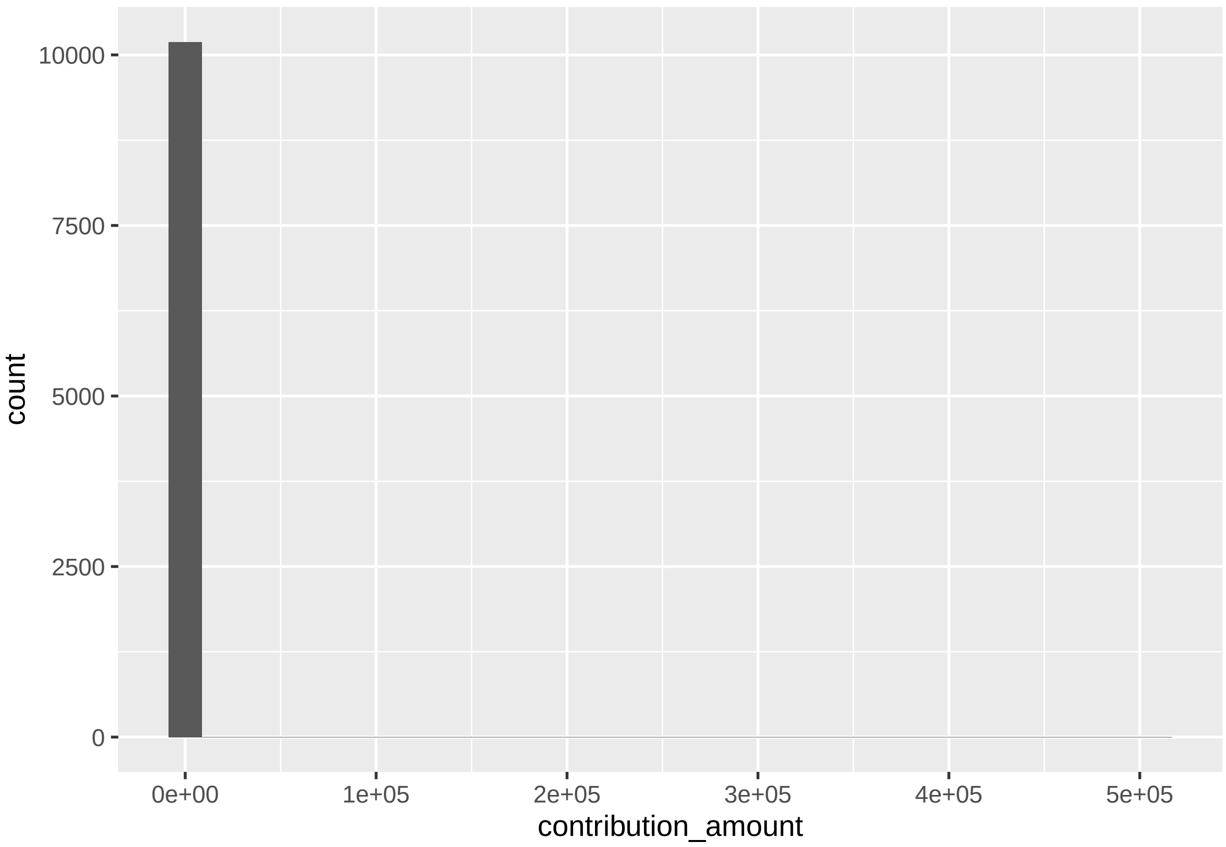
```
mayorcamp2014$contribution_amount <- as.numeric(mayorcamp2014$contribution_amount)
```

5. Visually explore the distribution of values of the contributions. What contributions are notable outliers? Do they share a similar characteristic(s)? It may be useful to plot the distribution of contributions without these outliers to get a better sense of the majority of the data.

Here is the distribution of contribution amounts.

```
mayorcamp2014 %>% ggplot(aes(x=contribution_amount)) + geom_histogram()
```

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



We notice that there are outliers in the contribution amount. Upon closer inspection of the data, it appears that the outliers are from candidates donating to their own campaign. Most donations were $2500 or less, with the exception being a $3660 donation from a corporation.

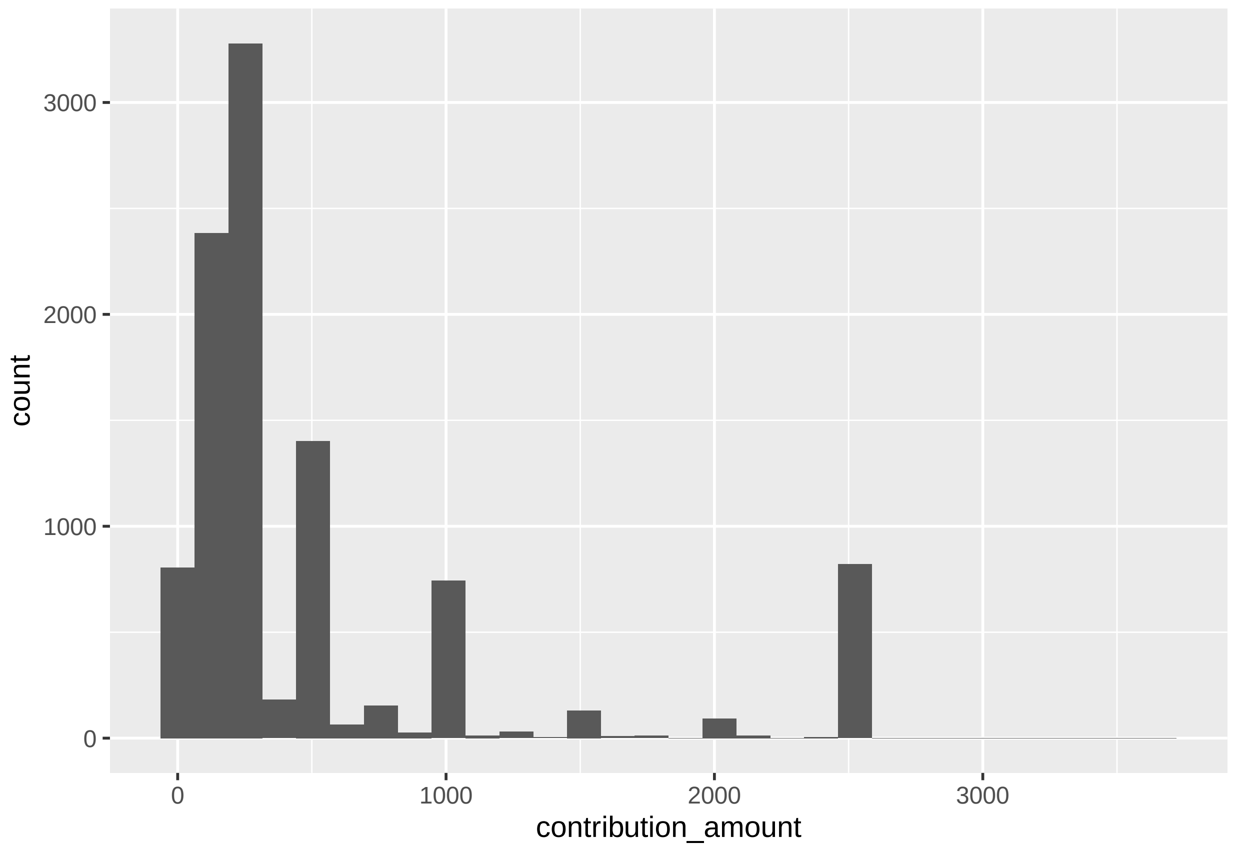
```
mayorcamp2014 %>% arrange(desc(contribution_amount)) %>%
  select(contributors_name, contribution_amount, relationship_to_candidate) %>%
  slice(1:10)
```

```
## # A tibble: 10 x 3
##    contributors_name contribution_amount relationship_to_candidate
##    <chr>                           <dbl> <chr>
##  1 Ford, Doug                     508225. Candidate
##  2 Ford, Rob                       78805. Candidate
##  3 Ford, Doug                      50000  Candidate
##  4 Ford, Rob                       50000  Candidate
##  5 Ford, Rob                       50000  Candidate
##  6 Goldkind, Ari                   23624. Candidate
##  7 Ford, Rob                       20000  Candidate
##  8 Ford, Rob                       12210  Candidate
##  9 Di Paola, Rocco                  6000  Candidate
## 10 Thomson, Sarah                   4426. Candidate
```

Let's see what distribution looks like if we filter out instances where candidates donated to their own campaign. The amounts that candidates' spouses donated were in the higher end, but they were not significantly higher than the rest of the donations, so I left them in there.

```
cand_rels <- mayorcamp2014 %>% select(relationship_to_candidate) %>% unique()
mayorcamp2014_nocand <- mayorcamp2014 %>% filter(relationship_to_candidate == "Spouse" | is.na(relations
mayorcamp2014_nocand %>% ggplot(aes(x=contribution_amount)) + geom_histogram()
```

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



6. List the top five candidates in each of these categories:
    - total contributions
    - mean contribution
    - number of contributions

Here are the top five candidates in total contributions.

```
mayorcamp2014 %>% group_by(candidate) %>%
  summarise(total_contributions = sum(contribution_amount, na.rm=TRUE)) %>%
  arrange(desc(total_contributions)) %>%
  slice(1:5)
```

```
## # A tibble: 5 x 2
##   candidate     total_contributions
##   <chr>                       <dbl>
## 1 Tory, John               2767869.
## 2 Chow, Olivia             1638266.
## 3 Ford, Doug                889897.
## 4 Ford, Rob                 387648.
## 5 Stintz, Karen             242805
```

Here are the top five candidates in mean contributions.

```
mayorcamp2014 %>% group_by(candidate) %>%
  summarise(mean_contributions = mean(contribution_amount, na.rm=TRUE)) %>%
  arrange(desc(mean_contributions)) %>%
  slice(1:5)
```

```
## # A tibble: 5 x 2
##   candidate        mean_contributions
##   <chr>                         <dbl>
## 1 Sniedzins, Erwin              2025
## 2 Syed, Hïmy                    2018
## 3 Ritch, Carlie                 1887.
## 4 Ford, Doug                    1456.
## 5 Clarke, Kevin                 1200
```

Here are the top five candidates in the number of contributions.

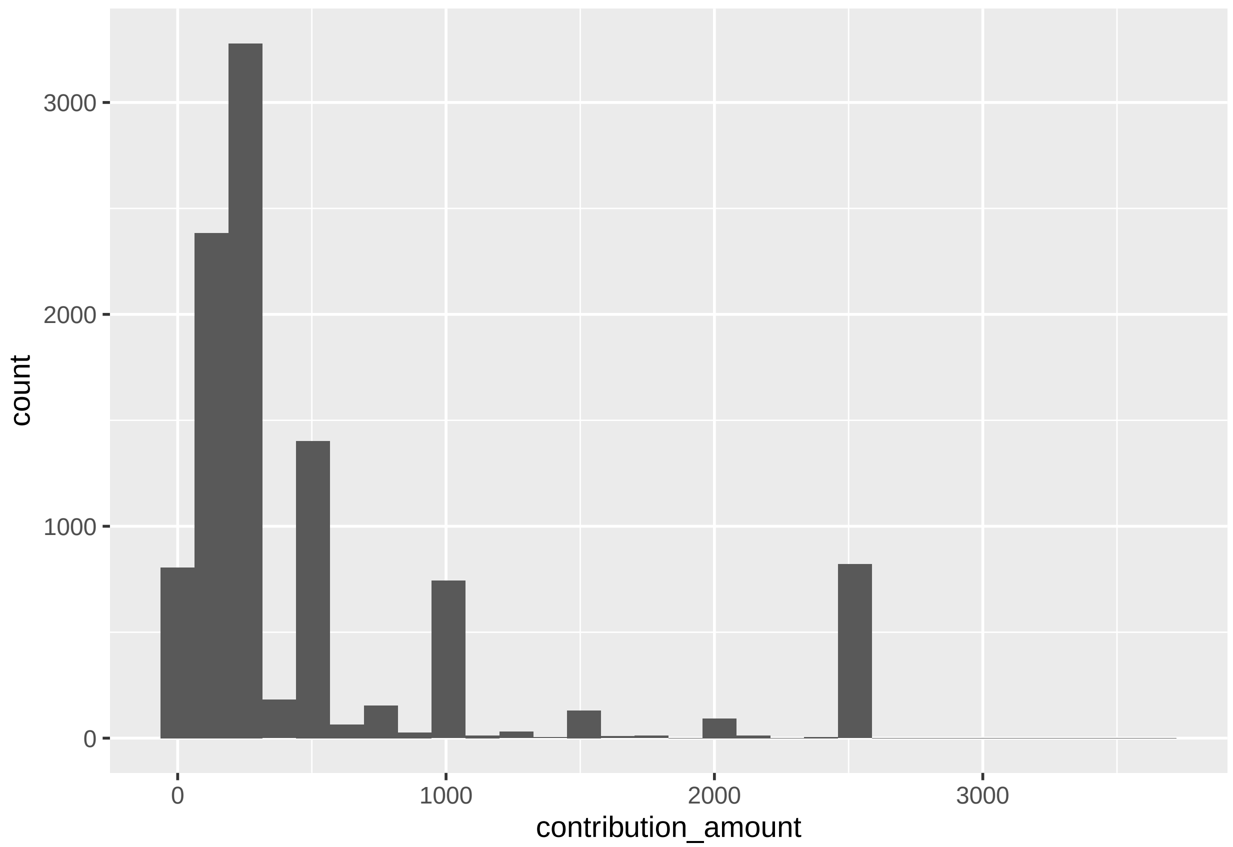
```
mayorcamp2014 %>% group_by(candidate) %>%
  summarise(number_contributions = n()) %>%
  arrange(desc(number_contributions)) %>%
  slice(1:5)
```

```
## # A tibble: 5 x 2
##   candidate       number_contributions
##   <chr>                          <int>
## 1 Chow, Olivia                    5708
## 2 Tory, John                      2602
## 3 Ford, Doug                       611
## 4 Ford, Rob                        538
## 5 Soknacki, David                  314
```

7. Repeat 5 but without contributions from the candidates themselves.

```
cand_rels <- mayorcamp2014 %>% select(relationship_to_candidate) %>% unique()
mayorcamp2014_nocand <- mayorcamp2014 %>% filter(relationship_to_candidate == "Spouse" | is.na(relations
mayorcamp2014_nocand %>% ggplot(aes(x=contribution_amount)) + geom_histogram()
```

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



Here are the top five candidates in total contributions.

```
mayorcamp2014_nocand %>% group_by(candidate) %>%
  summarise(total_contributions = sum(contribution_amount, na.rm=TRUE)) %>%
  arrange(desc(total_contributions)) %>%
  slice(1:5)
```

```
## # A tibble: 5 x 2
##   candidate     total_contributions
##   <chr>                       <dbl>
## 1 Tory, John               2765369.
## 2 Chow, Olivia             1635766.
## 3 Ford, Doug                331173.
## 4 Stintz, Karen             242805
## 5 Ford, Rob                 174510.
```

Here are the top five candidates in mean contributions.

```
mayorcamp2014_nocand %>% group_by(candidate) %>%
  summarise(mean_contributions = mean(contribution_amount, na.rm=TRUE)) %>%
  arrange(desc(mean_contributions)) %>%
  slice(1:5)
```

```
## # A tibble: 5 x 2
##   candidate         mean_contributions
##   <chr>                        <dbl>
## 1 Ritch, Carlie                1887.
## 2 Sniedzins, Erwin             1867.
## 3 Tory, John                   1063.
## 4 Gardner, Norman              1000
## 5 Tiwari, Ramnarine            1000
```

Here are the top five candidates in number of contributions.

```
mayorcamp2014_nocand %>% group_by(candidate) %>%
  summarise(number_contributions = n()) %>%
  arrange(desc(number_contributions)) %>%
  slice(1:5)
```

```
## # A tibble: 5 x 2
##   candidate       number_contributions
##   <chr>                          <int>
## 1 Chow, Olivia                    5707
## 2 Tory, John                      2601
## 3 Ford, Doug                       608
## 4 Ford, Rob                        531
## 5 Soknacki, David                  314
```

8. How many contributors gave money to more than one candidate?

```
mayorcamp2014 %>% group_by(contributors_name) %>%
  summarise(n_candidates = n_unique(candidate)) %>%
  filter(n_candidates > 1) %>%
  summarise(num_contributors = n())
```

```
## # A tibble: 1 x 1
##   num_contributors
##              <int>
## 1              184
```

There were 184 candidates who donated money to more than one candidate.