lab2

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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‘.

```
library(opendatatoronto)
library(tidyverse)
```

```
-- Attaching packages --------------------------------------- tidyverse 1.3.2 --
v ggplot2 3.4.0      v purrr   0.3.4
v tibble  3.1.8      v dplyr   1.0.10
v tidyr   1.2.1      v stringr 1.5.0
v readr   2.1.3      v forcats 0.5.2
-- Conflicts ------------------------------------------ tidyverse_conflicts() --
x dplyr::filter() masks stats::filter()
x dplyr::lag()    masks stats::lag()
```

```
library(stringr)
library(skimr) # EDA
library(visdat) # EDA
library(janitor)
```

```
Attaching package: 'janitor'

The following objects are masked from 'package:stats':

    chisq.test, fisher.test
```

```r
library(lubridate)
```

```
Loading required package: timechange

Attaching package: 'lubridate'

The following objects are masked from 'package:base':

    date, intersect, setdiff, union
```

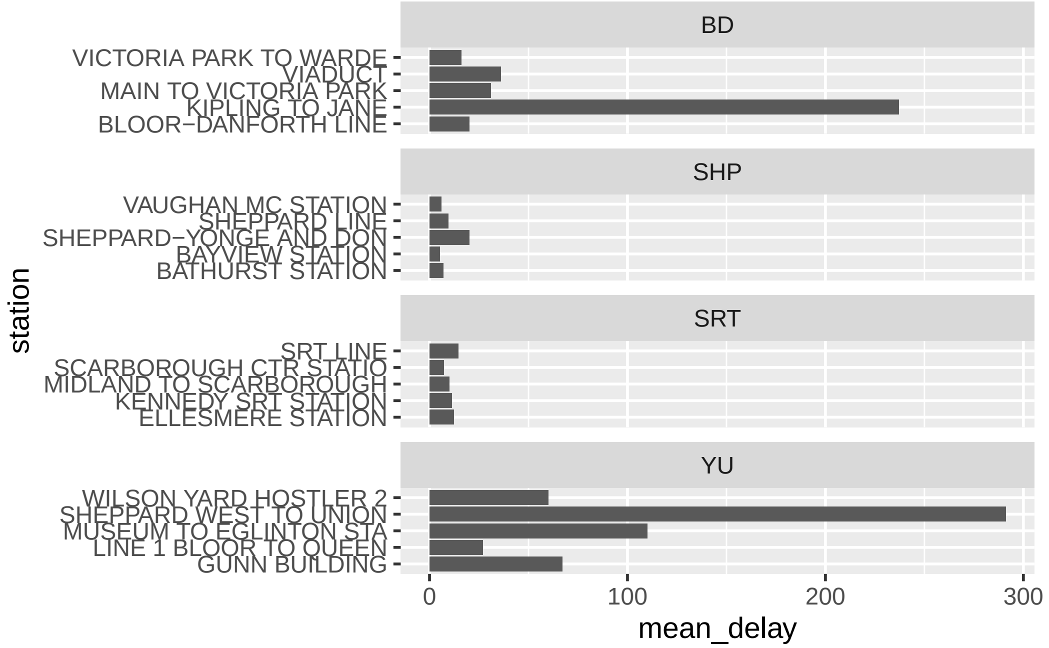
```r
library(ggrepel)

res <- list_package_resources("996cfe8d-fb35-40ce-b569-698d51fc683b") # obtained code from
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)
delay_2022 <- delay_2022 |> filter(line %in% c("BD", "YU", "SHP", "SRT"))
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()
```

```
`summarise()` has grouped output by 'line'. You can override using the
`.groups` argument.
```



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.

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

all_data <- list_packages(limit = 500) |>  filter(str_detect(title,"Campaign"))

res <- list_package_resources("f6651a40-2f52-46fc-9e04-b760c16edd5c") # obtained code from
res <- res |> mutate(year = str_extract(name, "2014"))
```

```r
campaign_2014_ids <- res |> filter(year==2014) |> select(id) |> pull()
campaign1_2014<- get_resource(campaign_2014_ids[1])
```

```
New names:
New names:
New names:
New names:
New names:
New names:
New names:
* `` -> `...2`
* `` -> `...3`
```

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

```r
library(janitor)
head(campaign1_2014[2]$`2_Mayor_Contributions_2014_election.xls`)
```

```
# 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`
```

```r
campaign2_2014  <-campaign1_2014[2]$`2_Mayor_Contributions_2014_election.xls`

campaign2_2014 <- campaign2_2014 |> row_to_names(row_number = 1)

#colnames(campaign2_2014) <- campaign2_2014[1,]
#campaign2_2014 <- campaign2_2014[-1, ]

# make the column names nicer to work with
names(campaign2_2014)<-janitor::make_clean_names(names(campaign2_2014))
```

```
campaign_2014<-campaign2_2014
campaign_2014
```

```
# A tibble: 10,199 x 13
   contributor~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, ~ <NA>    M6A 1P5 300     Moneta~ <NA>    Indivi~ <NA>    <NA>   
 2 A Strazar, M~ <NA>    M2M 3B8 300     Moneta~ <NA>    Indivi~ <NA>    <NA>   
 3 A'Court, K S~ <NA>    M4M 2J8 36      Moneta~ <NA>    Indivi~ <NA>    <NA>   
 4 A'Court, K S~ <NA>    M4M 2J8 100     Moneta~ <NA>    Indivi~ <NA>    <NA>   
 5 A'Court, K S~ <NA>    M4M 2J8 100     Moneta~ <NA>    Indivi~ <NA>    <NA>   
 6 Aaron, Rober~ <NA>    M6B 1H7 250     Moneta~ <NA>    Indivi~ <NA>    <NA>   
 7 Abadi, Babak  <NA>    M5S 2W7 500     Moneta~ <NA>    Indivi~ <NA>    <NA>   
 8 Abadi, Babak  <NA>    M5S 2W7 500     Moneta~ <NA>    Indivi~ <NA>    <NA>   
 9 Abadi, David  <NA>    M5S 2W7 300     Moneta~ <NA>    Indivi~ <NA>    <NA>   
10 Abate, Frank  <NA>    L4H 2K7 150     Moneta~ <NA>    Indivi~ <NA>    <NA>   
# ... with 10,189 more rows, 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.

There are 13 variables in the dataset containing contributors_name,contributors_address,contributors_postal_c
authorized_representative,candidate,office,ward.Number of records was 10199.

There are missing values but we did not worry about them because their name, postal code,contribution candidate are not missing.Thus we could find their address from other database. Other missing variables did not matter due to not our interesting events.

There is not one variable in the format it should be: president_business_manager should be switched into president_or_business_manager.

```
library(skimr)
skim(campaign_2014)
```

Table 1: Data summary

Name	campaign_2014
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
ward	10199	0	NA	NA	0	0	0

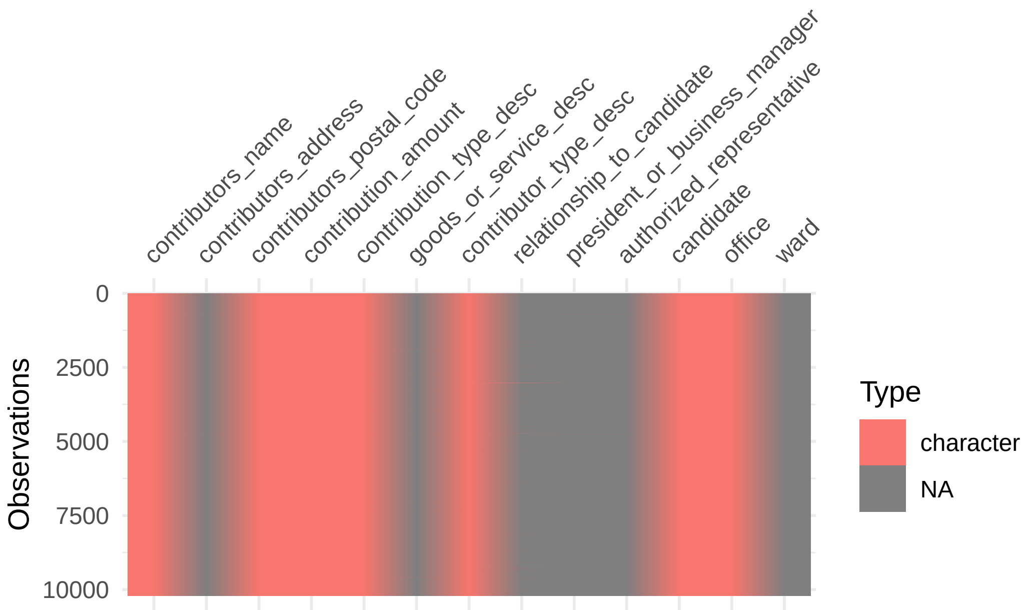
```
colnames(campaign2_2014)[9] <- 'president_or_business_manager'
campaign_2014<- campaign2_2014
campaign_2014|>
  summarize(across(everything(), ~ sum(is.na(.x))))
```

```
# A tibble: 1 x 13
  contributors~1 contr~2 contr~3 contr~4 contr~5 goods~6 contr~7 relat~8 presi~9
           <int>   <int>   <int>   <int>   <int>   <int>   <int>   <int>   <int>
1              0   10197       0       0       0   10188       0   10166   10197
# ... with 4 more variables: authorized_representative <int>, candidate <int>,
#   office <int>, ward <int>, 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_or_business_manager
```

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.

```
vis_dat(campaign_2014)
```

```
Warning: `gather_()` was deprecated in tidyr 1.2.0.
i Please use `gather()` instead.
i The deprecated feature was likely used in the visdat package.
  Please report the issue at <https://github.com/ropensci/visdat/issues>.
```



```
class(campaign_2014[4])
```

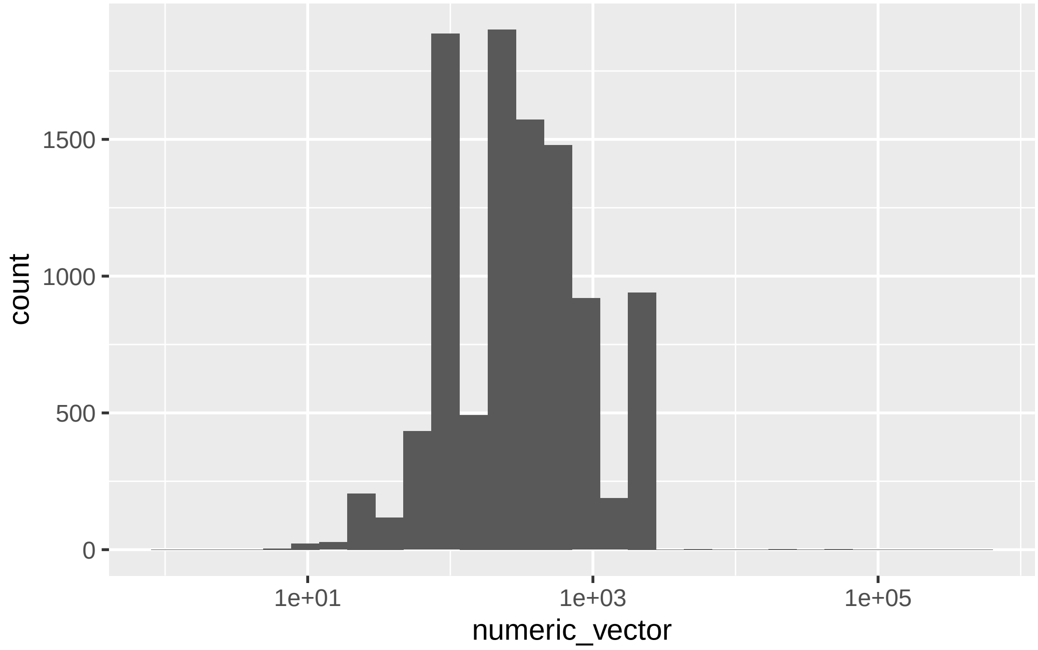
```
[1] "tbl_df"     "tbl"        "data.frame"
```

```
numeric_vector <- as.numeric(unlist(campaign_2014[4]))
summary(numeric_vector)
```

```
 Min. 1st Qu.  Median    Mean 3rd Qu.    Max. 
    1     100     300     608     500  508225 
```

```
#min=1.00     100     300     608     500  max=508224.73
ggplot(data = campaign_2014) +
  geom_histogram(aes(x = numeric_vector))+scale_x_log10()
```

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



1.00 CAD and 508224.73 CAD are outliers.

```
campaign2_2014$contribution_amount<-round(numeric_vector,2)
campaign_2014 <- campaign2_2014
campaign_2014 |> filter(campaign_2014$contribution_amount==1.00|campaign_2014$contribution
# A tibble: 2 x 13
  contributors~1 contr~2 contr~3 contr~4 contr~5 goods~6 contr~7 relat~8 presi~9
  <chr>          <chr>   <chr>     <dbl> <chr>   <chr>   <chr>   <chr>   <chr>
1 Ford, Doug     <NA>    M9A 2C3 508225. Moneta~ <NA>    Indivi~ Candid~ <NA>
2 Italiano, Rob  <NA>    M3A 1W1       1 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_or_business_manager
```

They did not share a similar characteristic(s).

6. List the top five candidates in each of these categories:

   - total contributions
   - mean contribution
   - number of contributions

```
library(janitor)
campaign_2014<-campaign2_2014
class(campaign_2014$contribution_amount)
```

```
[1] "numeric"
```

```
campaign_2014 |> group_by(candidate) |> summarize(sum_cont=sum(contribution_amount)) |> ar
```

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

```
campaign_2014 |> group_by(candidate) |> summarize(mean_cont=mean(contribution_amount)) |>
```

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

```
campaign_2014 |> group_by(candidate) |> summarize(num_contribution=length(contributors_nam
```

```
# A tibble: 5 x 2
  candidate        num_contribution
  <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.

```
library(janitor)
campaign_2014<-campaign2_2014
campaign_2014 |> group_by(candidate)|>filter(contributors_name!=candidate) |>summarize(sum
```

```
# A tibble: 5 x 2
  candidate     sum_cont
  <chr>            <dbl>
1 Tory, John    2765369.
2 Chow, Olivia  1634766.
3 Ford, Doug     331173.
4 Stintz, Karen  242805
5 Ford, Rob      174510.
```

```
campaign_2014 |> group_by(candidate)|>filter(contributors_name!=candidate) |> summarize(me
```

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

```
campaign_2014 |> group_by(candidate)|>filter(contributors_name!=candidate)|> summarize(num
```

```
# A tibble: 5 x 2
  candidate       num_contribution
  <chr>                      <int>
1 Chow, Olivia                5706
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?

```
library(janitor)
library(dplyr)
campaign_2014<-campaign2_2014

camp2<- campaign_2014 |> group_by(contributors_name)|>select(contributors_name,candidate)
  filter(num_candidates>1)
nrow(camp2)
```

```
[1] 184
```

```
length(camp2$contributors_name)
```

```
[1] 184
```

```
#campaign_2014 |> group_by(contributors_name)|>select(contributors_name,candidate) |> dist
#n_distinct(candidate)
#camp1
#sum(table(camp1$contributors_name)-1)
```

184 contributors gave money to more than one candidate.