

# Exploratory Data Analysis

```
library(tidyverse)

— Attaching core tidyverse packages ————— tidyverse 2.0.0
—
✓ dplyr     1.1.4      ✓ readr     2.1.5
✓ forcats   1.0.0      ✓ stringr   1.5.2
✓ ggplot2   4.0.0      ✓ tibble    3.3.0
✓ lubridate 1.9.4      ✓ tidyr    1.3.1
✓ purrr    1.1.0
— Conflicts ————— tidyverse_conflicts()
—
✖ dplyr::filter() masks stats::filter()
✖ dplyr::lag()    masks stats::lag()
i Use the conflicted package (<http://conflicted.r-lib.org/>) to force all
conflicts to become errors
```

## data

```
df <- read_csv("cleaned_g24_precinct_votes.csv")
```

```
Rows: 51123 Columns: 76
— Column specification —————
Delimiter: ","
chr (49): svprec, fips, svprec_key, election, geo_type, assaip01,
assdem01, ...
dbl (27): county, addist, cddist, sddist, bedist, totreg, demreg, repreg,
ai...
i Use `spec()` to retrieve the full column specification for this data.
i Specify the column types or set `show_col_types = FALSE` to quiet this
message.
```

```
glimpse(df)
```

```
Rows: 51,123
Columns: 76
$ svprec     <chr> "0000001", "0000001", "0000001A", "0000001A", "0000002",
```

```

"0...
$ county      <dbl> 10, 51, 10, 51, 10, 51, 10, 51, 10, 51, 10, 51, 10, 51,
10, ...
$ fips        <chr> "06019", "06101", "06019", "06101", "06019", "06101",
"0601...
$ addist      <dbl> 27, 3, 27, 3, 27, 3, 27, 3, 27, 3, 27, 3, 27, 3, 27, 3,
27, ...
$ svprec_key <chr> "060190000001", "061010000001", "060190000001A",
"061010000...
$ election    <chr> "g24", "g24", "g24", "g24", "g24", "g24", "g24", "g24",
"g2...
$ geo_type    <chr> "svprec", "svprec", "svprec", "svprec", "svprec",
"svprec", ...
$ cddist      <dbl> 13, 1, 13, 1, 13, 1, 13, 1, 13, 1, 13, 1, 13, 1, 13, 1,
13, ...
$ sddist      <dbl> 14, 1, 14, 1, 14, 1, 14, 1, 14, 1, 14, 1, 14, 1, 14, 1,
14, ...
$ bedist      <dbl> 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1,
1, ...
$ totreg      <dbl> 398, 1597, 0, 0, 25, 4529, 0, 0, 149, 3955, 0, 0, 1710,
201...
$ demreg      <dbl> 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0,
0, ...
$ repreg      <dbl> 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0,
0, ...
$ aipreg      <dbl> 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0,
0, ...
$ grnreg      <dbl> 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0,
0, ...
$ libreg      <dbl> 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0,
0, ...
$ nlpreg      <dbl> 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0,
0, ...
$ refreg      <dbl> 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0,
0, ...
$ dclreg      <dbl> 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0,
0, ...
$ mscreg      <dbl> 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0,
0, ...
$ totvote     <dbl> 52, 68, 252, 1190, 3, 413, 11, 2880, 15, 290, 83, 2487,
218...
$ demvote     <dbl> 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0,
0, ...
$ repvote     <dbl> 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0,
0, ...
$ aipvote     <dbl> 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0,
0, ...
$ grnvote     <dbl> 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0,
0, ...

```

```

0, ...
$ libvote      <dbl> 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0,
0, ...
$ nlpvote      <dbl> 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0,
0, ...
$ refvote      <dbl> 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0,
0, ...
$ dclvote      <dbl> 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0,
0, ...
$ mscvote      <dbl> 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0,
0, ...
$ prcvote      <dbl> 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0,
0, ...
$ absvote      <dbl> 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0,
0, ...
$ assaip01     <chr> "0", "0", "0", "0", "***", "0", "0", "0", "0", "0",
"0", "0", "0", ...
$ assdem01     <chr> "25", "9", "86", "188", "***", "109", "8", "1004", "8",
"81", ...
$ assdem02     <chr> "0", "0", "0", "0", "***", "0", "0", "0", "0", "0",
"0", "0", "0", ...
$ assrep01     <chr> "25", "55", "162", "956", "***", "269", "3", "1693", "6",
"...", ...
$ assrep02     <chr> "0", "0", "0", "0", "***", "0", "0", "0", "0", "0",
"0", "0", "0", ...
$ cngdem01     <chr> "23", "8", "79", "213", "***", "138", "8", "1116", "6",
"97", ...
$ cngdem02     <chr> "0", "0", "0", "0", "***", "0", "0", "0", "0", "0",
"0", "0", "0", ...
$ cngind01     <chr> "0", "0", "0", "0", "***", "0", "0", "0", "0", "0",
"0", "0", "0", ...
$ cngrep01     <chr> "29", "57", "171", "932", "***", "241", "3", "1608", "9",
"...", ...
$ cngrep02     <chr> "0", "0", "0", "0", "***", "0", "0", "0", "0", "0",
"0", "0", "0", ...
$ prsaip01     <chr> "1", "1", "3", "6", "***", "7", "0", "45", "0", "4", "0",
"...", ...
$ prsdem01     <chr> "23", "13", "82", "267", "***", "126", "8", "1170", "8",
"9", ...
$ prsgrn01     <chr> "0", "1", "0", "6", "***", "0", "0", "20", "0", "1", "0",
"...", ...
$ prslib01     <chr> "0", "0", "0", "3", "***", "1", "0", "10", "0", "4", "0",
"...", ...
$ prspaf01     <chr> "1", "0", "1", "1", "***", "0", "0", "10", "0", "1", "1",
"...", ...
$ prsrep01     <chr> "27", "53", "163", "886", "***", "274", "3", "1585", "7",
"...", ...
$ pr_2_n       <chr> "14", "34", "138", "778", "***", "152", "5", "1191", "2",

```

```

"...
$ pr_2_y      <chr> "37", "31", "110", "359", "***", "229", "6", "1487", "11",
"...
$ pr_32_n     <chr> "21", "48", "173", "957", "***", "202", "9", "1578", "6",
"...
$ pr_32_y     <chr> "29", "17", "75", "188", "***", "176", "2", "1097", "8",
"9...
$ pr_33_n     <chr> "26", "51", "174", "955", "***", "202", "4", "1730", "6",
"...
$ pr_33_y     <chr> "23", "14", "73", "170", "***", "173", "7", "938", "7",
"10...
$ pr_34_n     <chr> "16", "31", "111", "494", "***", "160", "5", "1092", "4",
"...
$ pr_34_y     <chr> "33", "33", "130", "625", "***", "210", "6", "1533", "9",
"...
$ pr_35_n     <chr> "13", "35", "100", "579", "***", "132", "3", "882", "3",
"8...
$ pr_35_y     <chr> "36", "31", "139", "559", "***", "240", "8", "1785", "11",
"...
$ pr_36_n     <chr> "20", "16", "47", "144", "***", "114", "2", "655", "2",
"71...
$ pr_36_y     <chr> "29", "50", "198", "999", "***", "269", "9", "2026", "12",
"...
$ pr_3_n      <chr> "19", "48", "147", "731", "***", "229", "4", "1482", "9",
"...
$ pr_3_y      <chr> "29", "18", "95", "405", "***", "155", "6", "1191", "5",
"1...
$ pr_4_n      <chr> "13", "35", "146", "815", "***", "158", "6", "1253", "6",
"...
$ pr_4_y      <chr> "37", "29", "103", "326", "***", "223", "5", "1419", "8",
"...
$ pr_5_n      <chr> "16", "47", "172", "948", "***", "205", "5", "1681", "6",
"...
$ pr_5_y      <chr> "34", "18", "74", "185", "***", "171", "6", "966", "7",
"10...
$ pr_6_n      <chr> "34", "50", "173", "914", "***", "234", "5", "1612", "11",
"...
$ pr_6_y      <chr> "17", "15", "67", "205", "***", "135", "6", "1035", "3",
"8...
$ sendem01    <chr> "0", "0", "0", "0", "***", "0", "0", "0", "0", "0",
"0...
$ sendem02    <chr> "0", "0", "0", "0", "***", "0", "0", "0", "0", "0",
"0...
$ senrep01    <chr> "0", "43", "0", "764", "***", "230", "0", "1709", "0",
"150...
$ senrep02    <chr> "0", "18", "0", "257", "***", "119", "0", "699", "0",
"93",...
$ uspdem01   <chr> "19", "12", "79", "244", "***", "110", "7", "1145", "8",

```

```
"9...
$ usprep01    <chr> "29", "50", "158", "898", "***", "247", "3", "1511", "5",
"...
$ ussdem01    <chr> "22", "13", "78", "253", "***", "129", "8", "1181", "7",
"9...
$ ussrep01    <chr> "26", "52", "165", "897", "***", "253", "3", "1545", "7",
"..."
```

## Question 1

What is the distribution of precinct sizes?

## Answer 1

```
numeric_cols <- df %>% select(where(is.numeric))

# choose the numeric column with highest total sum (likely total votes)
total_col <- numeric_cols %>%
  summarise(across(everything(), sum, na.rm = TRUE)) %>%
  pivot_longer(cols = everything(), names_to = "col", values_to = "total") %>%
  arrange(desc(total)) %>%
  pull(col) %>%
  first()
```

```
Warning: There was 1 warning in `summarise()` .
i In argument: `across(everything(), sum, na.rm = TRUE)` .
Caused by warning:
! The `...` argument of `across()` is deprecated as of dplyr 1.1.0.
Supply arguments directly to ` `.fns` through an anonymous function instead.
```

```
# Previously
across(a:b, mean, na.rm = TRUE)

# Now
across(a:b, \(x) mean(x, na.rm = TRUE))
```

```
total_col
```

```
[1] "totreg"
```

```
summary_stats <- df %>%
  summarise(
  min_votes = min(.data[[total_col]], na.rm = TRUE),
  median_votes = median(.data[[total_col]], na.rm = TRUE),
  mean_votes = mean(.data[[total_col]], na.rm = TRUE),
```

```

max_votes = max(.data[[total_col]], na.rm = TRUE)
)

summary_stats

```

```

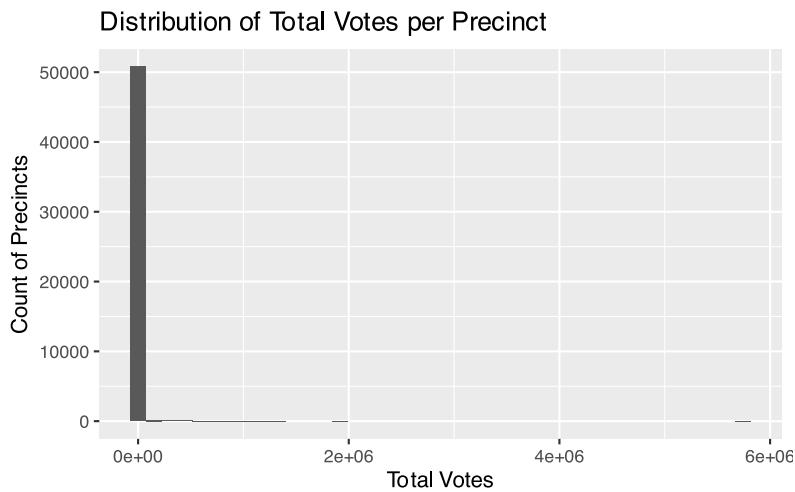
# A tibble: 1 × 4
  min_votes median_votes mean_votes max_votes
  <dbl>       <dbl>      <dbl>     <dbl>
1        0          0     3081.    5745214

```

```

df %>%
ggplot(aes(x = .data[[total_col]])) +
geom_histogram(bins = 40) +
labs(
  title = "Distribution of Total Votes per Precinct",
  x = "Total Votes",
  y = "Count of Precincts"
)

```



## Question 2

Which precincts had the closest races?

## Answer 2

```

vote_cols <- df %>%
select(contains("votes")) %>%
names()

closest <- df %>%

```

```
rowwise() %>%
mutate(
  sorted_votes = sort(c_across(all_of(vote_cols)), decreasing = TRUE),
  margin = sorted_votes[1] - sorted_votes[2]
) %>%
ungroup() %>%
arrange(margin)
```

```
Error in `mutate()`:
i In argument: `margin = sorted_votes[1] - sorted_votes[2]` .
i In row 1.
Caused by error:
! object 'sorted_votes' not found
```

```
head(closest, 10)
```

```
Error: object 'closest' not found
```

### Question 3

Compare precinct-level totals with district totals

### Answer 3

```
library(readxl)
library(dplyr)

df <- read.csv("cleaned_g24_precinct_votes.csv")
district_results <- read_excel("data/g24-results-by-district.xlsx")
```

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

```
out <- list(
  precinct_preview = head(df),
  district_preview = head(district_results),
  precinct_rows = nrow(df),
  district_rows = nrow(district_results)
)

out
```

```
$precinct_preview
    svprec county fips addist      svprec_key election geo_type cddist sddist
1 0000001      10 6019      27 060190000001      g24  svprec      13     14
2 0000001      51 6101      3 061010000001      g24  svprec      1     1
3 0000001A     10 6019      27 060190000001A     g24  svprec      13     14
4 0000001A     51 6101      3 061010000001A     g24  svprec      1     1
5 0000002      10 6019      27 060190000002      g24  svprec      13     14
6 0000002      51 6101      3 061010000002      g24  svprec      1     1
    bedist totreg demreg reprep aipreg grnreg libreg nlpreg refreg dclreg mscreg
1      1   398      0      0      0      0      0      0      0      0      0      0
2      1  1597      0      0      0      0      0      0      0      0      0      0
3      1     0      0      0      0      0      0      0      0      0      0      0
4      1     0      0      0      0      0      0      0      0      0      0      0
5      1    25      0      0      0      0      0      0      0      0      0      0
6      1  4529      0      0      0      0      0      0      0      0      0      0
    totvote demvote repvote aipvote grnvote libvote nlpvote refvote dclvote
1      52      0      0      0      0      0      0      0      0      0      0
2      68      0      0      0      0      0      0      0      0      0      0
3     252      0      0      0      0      0      0      0      0      0      0
4    1190      0      0      0      0      0      0      0      0      0      0
5      3      0      0      0      0      0      0      0      0      0      0
6     413      0      0      0      0      0      0      0      0      0      0
    mscvote prcvote absvote assaip01 assdem01 assdem02 assrep01 assrep02
cngdem01
1      0      0      0      0      25      0      25      0
23
2      0      0      0      0      9      0      55      0
8
3      0      0      0      0      86      0      162      0
79
4      0      0      0      0      188      0      956      0
213
5      0      0      0      ***      ***      ***      ***      ***
*** 
6      0      0      0      0      109      0      269      0
138
    cngdem02 cngind01 cngrep01 cngrep02 prsaip01 prsdem01 prsgrn01 prslib01
1      0      0      29      0      1      23      0      0
2      0      0      57      0      1      13      1      0
3      0      0      171      0      3      82      0      0
4      0      0      932      0      6      267      6      3
5      ***      ***      ***      ***      ***      ***      ***      ***
6      0      0      241      0      7      126      0      1
    prspaf01 prsrep01 pr_2_n pr_2_y pr_32_n pr_32_y pr_33_n pr_33_y pr_34_n
1      1      27      14      37      21      29      26      23      16
2      0      53      34      31      48      17      51      14      31
3      1     163     138     110     173      75     174      73     111
4      1     886     778     359     957     188     955     170     494
```

```

5     ***    ***    ***    ***    ***    ***    ***    ***    ***    ***
6      0     274    152    229    202    176    202    173    160
pr_34_y pr_35_n pr_35_y pr_36_n pr_36_y pr_3_n pr_3_y pr_4_n pr_4_y pr_5_n
1      33     13     36     20     29     19     29     13     37     16
2      33     35     31     16     50     48     18     35     29     47
3     130    100    139     47    198    147     95    146    103    172
4     625    579    559    144    999    731    405    815    326    948
5     ***    ***    ***    ***    ***    ***    ***    ***    ***    ***
6     210    132    240    114    269    229    155    158    223    205
pr_5_y pr_6_n pr_6_y sendem01 sendem02 senrep01 senrep02 uspdem01 usprep01
1      34     34     17      0      0      0      0      19     29
2      18     50     15      0      0     43     18     12     50
3      74    173     67      0      0      0      0      79    158
4     185    914    205      0      0    764    257    244    898
5     ***    ***    ***    ***    ***    ***    ***    ***    ***
6     171    234    135      0      0    230    119    110    247
ussdem01 ussrep01
1      22     26
2      13     52
3      78    165
4     253    897
5     ***    ***
6     129    253

$district_preview
# A tibble: 6 × 3
`1st Congressional District` ...2          ...3
<chr>           <chr>           <chr>
1 <NA>           <NA>           <NA>
2 <NA>           "Rose\r\nPenelope\r\nYee" "Doug\r\nLaMalfa*"
3 <NA>           "DEM"            "REP"
4 Butte          "41729"          "50979"
5 Colusa         "2095"           "4528"
6 Glenn          "2936"           "7197"

$precinct_rows
[1] 51123

$district_rows
[1] 543

```