

Activity #14 My First QMD File

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data wrangling code for armed forces data

```
library(tidyverse) library(rvest) library(googlesheets4)
```

scrape the ranked data

```
webRanks <- read_html("https://neilhatfield.github.io/Stat184_PayGradeRanks.html") %>% html_elements(css = "table") %>% html_table()  
rawRanks <- webRanks[[1]] # Extract the data frame of ranks
```

wrangle ranked data

clean data

```
rawRanks[1, 1] <- "Type" rankHeaders <- rawRanks[1, ] names(rawRanks) <- rankHeaders[1,]  
rawRanks <- rawRanks[-c(1, 26), ]  
  
cleanRanks <- rawRanks %>% dplyr::select(!Type) %>% # Remove extra column  
pivot_longer( cols = !Pay Grade, # The improper name requires backticks names_to =  
"Branch", values_to = "Rank" ) %>% mutate( Rank = na_if(x = Rank, y = "-") )  
  
#load the armed forces data gs4_deauth() forcesHeaders <- read_sheet( ss = "https://docs.google.com/spreadsheets/d/1cn4i0-ymB1ZytWXCwsJiq6fZ9PhGLUvbMBHlzqG4bwo/edit?usp=sharing", col_names = FALSE,  
# Turn off Column Names n_max = 3 # read only the first three rows )  
  
rawForces <- read_sheet( ss = "https://docs.google.com/spreadsheets/d/1cn4i0-ymB1ZytWXCwsJiq6fZ9PhGLUvbMBHlzqG4bwo/edit?usp=sharing", col_names = FALSE, # Turn off Column Names skip = 3, # Skip the first three rows  
n_max = 28, # Read only the next 28 rows; drops footer col_types = "c" # Tells R to read  
everything as character data )
```

wrangle armed forces data

```
branchNames <- rep( # Create three copies of each branch x = c("Army", "Navy", "Marine Corps", "Air Force", "Space Force", "Total"), each = 3 ) tempHeaders <- paste( # Combine branch with other headers c(" ", branchNames), forcesHeaders[3,], sep = ":" )  
names(rawForces) <- tempHeaders  
  
cleanForces <- rawForces %>% rename(Pay.Grade = .Pay Grade) %>% dplyr::select(!contains("Total"))  
%>% # Remove total columns filter(Pay.Grade != "Total Enlisted" & Pay.Grade != "Total Warrant Officers" & Pay.Grade != "Total Officers" & Pay.Grade != "Total") %>% # Remove total rows; see note below pivot_longer( # Reshape data cols = !Pay.Grade, names_to = "Branch.Sex", values_to = "Frequency" ) %>% separate_wider_delim( # Separate branches and sex cols = Branch.Sex, delim = ".", names = c("Branch", "Sex") ) %>%  
mutate( Frequency = na_if(Frequency, y = "N/A"), # Convert N/A to missing Frequency = parse_number(Frequency) # Parse values as numbers )
```

merge the data frames

```
key_forcesRanks <- left_join( x = cleanForces, y = cleanRanks, by = join_by(Pay.Grade == Pay Grade, Branch == Branch) )
```

transform group to individual

```
key_individualRanks <- key_forcesRanks %>% filter(!is.na(Frequency)) %>% # Remove all cases with missing counts uncount( weights = Frequency )  
  
altExample <- rawForces %>% rename(Pay.Grade = .Pay Grade) %>% filter(!grepl(pattern = "Total", x = Pay.Grade))  
  
rawForces <- read_sheet( ss = "https://docs.google.com/spreadsheets/d/1cn4i0-ymB1ZytWXCsJiq6fZ9PhGL", col_names = FALSE, skip = 3, n_max = 28, na = c("N/A") # Tells R to treat the N/A as missing values
```

visualization for armed forces

```
echo=FALSE  
library(tidyverse)
```

```
-- Attaching core tidyverse packages ----- tidyverse 2.0.0 --
v dplyr     1.1.4     v readr     2.1.5
v forcats   1.0.1     v stringr   1.5.2
v ggplot2   4.0.0     v tibble    3.3.0
v lubridate 1.9.4     v tidyr    1.3.1
v purrr    1.1.0

-- 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 non-conflicting.
```

```
library(rvest)
```

Attaching package: 'rvest'

The following object is masked from 'package:readr':

```
guess_encoding
```

```
library(googlesheets4)
library(kableExtra)
```

Attaching package: 'kableExtra'

The following object is masked from 'package:dplyr':

```
group_rows
```

```
# Scrape Rank Data
webRanks <- read_html("https://neilhatfield.github.io/Stat184_PayGradeRanks.html") %>%
  html_elements(css = "table") %>%
  html_table()

rawRanks <- webRanks[[1]] # Extract the data frame of ranks

# Wrangle Rank Data
## Enter a value in the first cell (1, 1)
rawRanks[1, 1] <- "Type"
## Extract actual column headers
```

```
rankHeaders <- rawRanks[1, ]
## Apply headers as column names
names(rawRanks) <- rankHeaders[1,]
```

Warning: The `value` argument of `names<-()` must be a character vector as of tibble 3.0.0.

```
## Remove redundant first row and last row
rawRanks <- rawRanks[-c(1, 26), ]

cleanRanks <- rawRanks %>%
  dplyr::select(!Type) %>% # Remove extra column
  pivot_longer(
    cols = !`Pay Grade`, # The improper name requires backticks
    names_to = "Branch",
    values_to = "Rank"
  ) %>%
  mutate(
    Rank = na_if(x = Rank, y = "--")
  )

# Load Armed Forces Data
gs4_deauth()
forcesHeaders <- read_sheet(
  ss = "https://docs.google.com/spreadsheets/d/1cn4i0-ymB1ZytWXCwsJiq6fZ9PhGLUvbMBHlzqG4bwo/",
  col_names = FALSE, # Turn off Column Names
  n_max = 3 # read only the first three rows
)
```

v Reading from "US Armed Forces (6/2024)".

v Range 'Sheet1'.

New names:

```
rawForces <- read_sheet(
  ss = "https://docs.google.com/spreadsheets/d/1cn4i0-ymB1ZytWXCwsJiq6fZ9PhGLUvbMBHlzqG4bwo/",
  col_names = FALSE,
  skip = 3,
  n_max = 28,
  col_types = "c"
)
```

```

v Reading from "US Armed Forces (6/2024)".
v Range '4:10000000'.
New names:

# wrangled armed forces data

branchNames <- rep(
  x = c("Army", "Navy", "Marine Corps", "Air Force", "Space Force", "Total"),
  each = 3
)
tempHeaders <- paste(
  c("", branchNames),
  forcesHeaders[3,],
  sep = "."
)
names(rawForces) <- tempHeaders

cleanForces <- rawForces %>%
  rename(Pay.Grade = `Pay Grade`) %>%
  dplyr::select(!contains("Total")) %>% # Remove total columns
  filter(Pay.Grade != "Total Enlisted" &
         Pay.Grade != "Total Warrant Officers" &
         Pay.Grade != "Total Officers" &
         Pay.Grade != "Total") %>%

pivot_longer(
  cols = !Pay.Grade,
  names_to = "Branch.Sex",
  values_to = "Frequency"
) %>%
separate_wider_delim(
  cols = Branch.Sex,
  delim = ".",
  names = c("Branch", "Sex")
) %>%
mutate(
  Frequency = na_if(Frequency, y = "N/A*"), # Convert N/A* to missing
  Frequency = parse_number(Frequency) # Parse values as numbers
)

# merge dfs ----

```

```

key_forcesRanks <- left_join(
  x = cleanForces,
  y = cleanRanks,
  by = join_by(Pay.Grade == `Pay Grade`, Branch == Branch)
)

# transform group to individual ----
key_individualRanks <- key_forcesRanks %>%
  filter(!is.na(Frequency)) %>% # remove all cases with missing counts
  uncount(
    weights = Frequency
  )

altExample <- rawForces %>%
  rename(Pay.Grade = `.Pay Grade`) %>%
  filter(!grepl(pattern = "Total", x = Pay.Grade))

rawForces <- read_sheet(
  ss = "https://docs.google.com/spreadsheets/d/1cn4i0-ymB1ZytWXCwsJiq6fZ9PhGLUvbMBHlzqG4bwo/c",
  col_names = FALSE,
  skip = 3,
  n_max = 28,
  na = c("N/A*") # Tells R to treat the N/A* as missing values
)

```

v Reading from "US Armed Forces (6/2024)".
v Range '4:10000000'.
New names:

```

kable(key_individualRanks, caption = "Armed Forces Visualization")

```

Table 1: Armed Forces Visualization

Pay.Grade	Branch	Sex	Frequency	Rank
E1	Army	Male	7909	Private
E1	Army	Female	1322	Private
E1	Navy	Male	9051	Seaman Recruit
E1	Navy	Female	2681	Seaman Recruit

Pay	Grade	Branch	Sex	Frequency	Rank
E1	Marine Corps		Male	7233	Private
E1	Marine Corps		Female	659	Private
E1	Air Force		Male	6564	Airman Basic
E1	Air Force		Female	1607	Airman Basic
E1	Space Force		Male	177	Specialist 1
E1	Space Force		Female	30	Specialist 1
E2	Army		Male	18763	Private
E2	Army		Female	3383	Private
E2	Navy		Male	10969	Seaman Apprentice
E2	Navy		Female	3603	Seaman Apprentice
E2	Marine Corps		Male	14688	Private First Class
E2	Marine Corps		Female	1604	Private First Class
E2	Air Force		Male	6562	Airman
E2	Air Force		Female	1698	Airman
E2	Space Force		Male	159	Specalist 2
E2	Space Force		Female	33	Specalist 2
E3	Army		Male	38802	Private First Class
E3	Army		Female	8169	Private First Class
E3	Navy		Male	23430	Seaman
E3	Navy		Female	7493	Seaman
E3	Marine Corps		Male	35047	Lance Corporal
E3	Marine Corps		Female	3787	Lance Corporal
E3	Air Force		Male	34981	Airman First Class
E3	Air Force		Female	9891	Airman First Class
E3	Space Force		Male	797	Specialist 3
E3	Space Force		Female	210	Specialist 3
E4	Army		Male	81278	Corporal OR Specialist
E4	Army		Female	14619	Corporal OR Specialist
E4	Navy		Male	39241	Petty Officer Third Class

Pay	Grade	Branch	Sex	Frequency	Rank
E4	Navy	Female	11855	Petty Officer Third Class	
E4	Marine Corps	Male	28946	Corporal	
E4	Marine Corps	Female	2942	Corporal	
E4	Air Force	Male	52399	Senior Airman	
E4	Air Force	Female	15324	Senior Airman	
E4	Space Force	Male	598	Specialist 4	
E4	Space Force	Female	134	Specialist 4	
E5	Army	Male	55671	Sergeant	
E5	Army	Female	11111	Sergeant	
E5	Navy	Male	57238	Petty Officer Second Class	
E5	Navy	Female	16254	Petty Officer Second Class	
E5	Marine Corps	Male	21481	Sergeant	
E5	Marine Corps	Female	2723	Sergeant	
E5	Air Force	Male	42576	Staff Sergeant	
E5	Air Force	Female	11038	Staff Sergeant	
E5	Space Force	Male	901	Sergeant	
E5	Space Force	Female	165	Sergeant	
E6	Army	Male	50030	Staff Sergeant	
E6	Army	Female	7432	Staff Sergeant	
E6	Navy	Male	45749	Petty Officer First Class	
E6	Navy	Female	9580	Petty Officer First Class	
E6	Marine Corps	Male	11667	Staff Sergeant	
E6	Marine Corps	Female	1370	Staff Sergeant	
E6	Air Force	Male	32242	Technical Sergeant	
E6	Air Force	Female	6746	Technical Sergeant	
E6	Space Force	Male	696	Technical Sergeant	
E6	Space Force	Female	130	Technical Sergeant	
E7	Army	Male	30367	Sergeant First Class	
E7	Army	Female	4322	Sergeant First Class	

Pay	Grade	Branch	Sex	Frequency	Rank
E7	Navy		Male	18026	Chief Petty Officer
E7	Navy		Female	3098	Chief Petty Officer
E7	Marine		Male	8191	Gunnery Sergeant
	Corps				
E7	Marine		Female	760	Gunnery Sergeant
	Corps				
E7	Air Force		Male	18367	Master Sergeant OR First Sergeant
E7	Air Force		Female	4717	Master Sergeant OR First Sergeant
E7	Space		Male	517	Master Sergeant
	Force				
E7	Space		Female	110	Master Sergeant
	Force				
E8	Army		Male	9287	First Sergeant OR Master Sergeant
E8	Army		Female	1426	First Sergeant OR Master Sergeant
E8	Navy		Male	6500	Senior Chief Petty Officer
E8	Navy		Female	912	Senior Chief Petty Officer
E8	Marine		Male	3559	First Sergeant OR Master Sergeant
	Corps				
E8	Marine		Female	275	First Sergeant OR Master Sergeant
	Corps				
E8	Air Force		Male	3632	Senior Master Sergeant OR First Sergeant
E8	Air Force		Female	1133	Senior Master Sergeant OR First Sergeant
E8	Space		Male	100	Senior Master Sergeant
	Force				
E8	Space		Female	38	Senior Master Sergeant
	Force				
E9	Army		Male	2908	Sergeant Major OR Command Sergeant Major
E9	Army		Female	413	Sergeant Major OR Command Sergeant Major
E9	Navy		Male	2518	Master Chief Petty Officer OR Fleet/Command Master Chief Petty Officer
E9	Navy		Female	323	Master Chief Petty Officer OR Fleet/Command Master Chief Petty Officer
E9	Marine		Male	1518	Sergeant Major OR Master Gunnery Sergeant
	Corps				
E9	Marine		Female	83	Sergeant Major OR Master Gunnery Sergeant
	Corps				
E9	Air Force		Male	1956	Chief Master Sergeant OR First Sergeant
E9	Air Force		Female	506	Chief Master Sergeant OR First Sergeant
E9	Space		Male	37	Chief Master Sergeant
	Force				

Pay	Grade	Branch	Sex	Frequency	Rank
E9	Space Force	Female	12	Chief Master Sergeant	
W1	Army	Male	3817	Warrant Officer	
W1	Army	Female	399	Warrant Officer	
W1	Navy	Male	30	Warrant Officer	
W1	Navy	Female	3	Warrant Officer	
W1	Marine Corps	Male	483	Warrant Officer	
W1	Marine Corps	Female	48	Warrant Officer	
W1	Air Force	Male	NA	Warrent Officer	
W1	Air Force	Female	NA	Warrent Officer	
W1	Space Force	Male	NA	NA	
W1	Space Force	Female	NA	NA	
W2	Army	Male	5398	Chief Warrant Officer	
W2	Army	Female	653	Chief Warrant Officer	
W2	Navy	Male	615	Chief Warrant Officer	
W2	Navy	Female	96	Chief Warrant Officer	
W2	Marine Corps	Male	738	Chief Warrant Officer	
W2	Marine Corps	Female	47	Chief Warrant Officer	
W2	Air Force	Male	NA	Chief Warrent Officer	
W2	Air Force	Female	NA	Chief Warrent Officer	
W2	Space Force	Male	NA	NA	
W2	Space Force	Female	NA	NA	
W3	Army	Male	2826	Chief Warrant Officer	
W3	Army	Female	316	Chief Warrant Officer	
W3	Navy	Male	734	Chief Warrant Officer	
W3	Navy	Female	102	Chief Warrant Officer	
W3	Marine Corps	Male	538	Chief Warrant Officer	
W3	Marine Corps	Female	32	Chief Warrant Officer	
W3	Air Force	Male	NA	Chief Warrent Officer	
W3	Air Force	Female	NA	Chief Warrent Officer	

Pay	Grade	Branch	Sex	Frequency	Rank
W3	Space Force	Male	NA	NA	
W3	Space Force	Female	NA	NA	
W4	Army	Male	1532	Chief Warrant Officer	
W4	Army	Female	149	Chief Warrant Officer	
W4	Navy	Male	416	Chief Warrant Officer	
W4	Navy	Female	42	Chief Warrant Officer	
W4	Marine Corps	Male	265	Chief Warrant Officer	
W4	Marine Corps	Female	11	Chief Warrant Officer	
W4	Air Force	Male	NA	Chief Warrent Officer	
W4	Air Force	Female	NA	Chief Warrent Officer	
W4	Space Force	Male	NA	NA	
W4	Space Force	Female	NA	NA	
W5	Army	Male	514	Chief Warrant Officer	
W5	Army	Female	47	Chief Warrant Officer	
W5	Navy	Male	69	Chief Warrant Officer	
W5	Navy	Female	5	Chief Warrant Officer	
W5	Marine Corps	Male	103	Chief Warrant Officer	
W5	Marine Corps	Female	8	Chief Warrant Officer	
W5	Air Force	Male	NA	Chief Warrent Officer	
W5	Air Force	Female	NA	Chief Warrent Officer	
W5	Space Force	Male	NA	NA	
W5	Space Force	Female	NA	NA	
O1	Army	Male	7153	Second Lieutenant	
O1	Army	Female	2358	Second Lieutenant	
O1	Navy	Male	5012	Ensign	
O1	Navy	Female	1545	Ensign	
O1	Marine Corps	Male	2292	Second Lieutenant	
O1	Marine Corps	Female	370	Second Lieutenant	
O1	Air Force	Male	4867	Second Lieutenant	

Pay	Grade	Branch	Sex	Frequency	Rank
O1	Air Force	Female	1897	Second Lieutenant	
O1	Space Force	Male	387	Second Lieutenant	
O1	Space Force	Female	137	Second Lieutenant	
O2	Army	Male	10013	First Lieutenant	
O2	Army	Female	3093	First Lieutenant	
O2	Navy	Male	5640	Lieutenant Junior Grade	
O2	Navy	Female	1769	Lieutenant Junior Grade	
O2	Marine Corps	Male	3377	First Lieutenant	
O2	Marine Corps	Female	574	First Lieutenant	
O2	Air Force	Male	4993	First Lieutenant	
O2	Air Force	Female	1889	First Lieutenant	
O2	Space Force	Male	409	First Lieutenant	
O2	Space Force	Female	160	First Lieutenant	
O3	Army	Male	20694	Captain	
O3	Army	Female	5739	Captain	
O3	Navy	Male	14825	Lieutenant	
O3	Navy	Female	4825	Lieutenant	
O3	Marine Corps	Male	5298	Captain	
O3	Marine Corps	Female	624	Captain	
O3	Air Force	Male	15532	Captain	
O3	Air Force	Female	5362	Captain	
O3	Space Force	Male	1032	Captain	
O3	Space Force	Female	246	Captain	
O4	Army	Male	12758	Major	
O4	Army	Female	3002	Major	
O4	Navy	Male	8085	Lieutenant Commander	
O4	Navy	Female	2217	Lieutenant Commander	
O4	Marine Corps	Male	3610	Major	
O4	Marine Corps	Female	333	Major	

Pay	Grade	Branch	Sex	Frequency	Rank
O4	Air Force	Male	10045	Major	
O4	Air Force	Female	3395	Major	
O4	Space Force	Male	951	Major	
O4	Space Force	Female	196	Major	
O5	Army	Male	6969	Lieutenant Colonel	
O5	Army	Female	1539	Lieutenant Colonel	
O5	Navy	Male	5478	Commandar	
O5	Navy	Female	1040	Commandar	
O5	Marine Corps	Male	1809	Lieutenant Colonel	
O5	Marine Corps	Female	138	Lieutenant Colonel	
O5	Air Force	Male	7459	Lieutenant Colonel	
O5	Air Force	Female	1804	Lieutenant Colonel	
O5	Space Force	Male	620	Lieutenant Colonel	
O5	Space Force	Female	124	Lieutenant Colonel	
O6	Army	Male	3084	Colonel	
O6	Army	Female	588	Colonel	
O6	Navy	Male	2613	Captain	
O6	Navy	Female	421	Captain	
O6	Marine Corps	Male	660	Colonel	
O6	Marine Corps	Female	49	Colonel	
O6	Air Force	Male	2658	Colonel	
O6	Air Force	Female	544	Colonel	
O6	Space Force	Male	203	Colonel	
O6	Space Force	Female	33	Colonel	
O7	Army	Male	87	Brigadier General	
O7	Army	Female	18	Brigadier General	
O7	Navy	Male	90	Rear Admiral (Lower)	
O7	Navy	Female	7	Rear Admiral (Lower)	
O7	Marine Corps	Male	37	Brigadier General	

Pay	Grade	Branch	Sex	Frequency	Rank
O7	Marine Corps		Female	2	Brigadier General
O7	Air Force		Male	91	Brigadier General
O7	Air Force		Female	14	Brigadier General
O7	Space Force		Male	11	Brigadier General
O7	Space Force		Female	1	Brigadier General
O8	Army		Male	100	Major General
O8	Army		Female	7	Major General
O8	Navy		Male	67	Rear Admiral (Upper)
O8	Navy		Female	3	Rear Admiral (Upper)
O8	Marine Corps		Male	30	Major General
O8	Marine Corps		Female	2	Major General
O8	Air Force		Male	68	Major General
O8	Air Force		Female	8	Major General
O8	Space Force		Male	9	Major General
O8	Space Force		Female	0	Major General
O9	Army		Male	41	Lieutenant General
O9	Army		Female	8	Lieutenant General
O9	Navy		Male	32	Vice Admiral
O9	Navy		Female	4	Vice Admiral
O9	Marine Corps		Male	18	Lieutenant General
O9	Marine Corps		Female	0	Lieutenant General
O9	Air Force		Male	33	Lieutenant General
O9	Air Force		Female	6	Lieutenant General
O9	Space Force		Male	4	Lieutenant General
O9	Space Force		Female	1	Lieutenant General
O10	Army		Male	12	General
O10	Army		Female	1	General
O10	Navy		Male	7	Admiral
O10	Navy		Female	1	Admiral

Pay	Grade	Branch	Sex	Frequency	Rank
O10	Marine Corps		Male	3	General
O10	Marine Corps		Female	0	General
O10	Air Force		Male	12	General
O10	Air Force		Female	1	General
O10	Space Force		Male	3	General
O10	Space Force		Female	0	General

narrative text for armed forces

The visualization presents a table showing military branch, personnel sex, pay grade, and frequency counts. While it includes ratios between men and women, sex and rank are independent variables, so differences between them do not imply causation. Even so, the table highlights several key insights. For example, the Army consistently has the largest number of personnel, while the Air Force and Space Force have the smallest. By illustrating these differences across service branches, the data offers useful context for understanding shifts in overall military composition.

popularity of the baby names

code for pop baby names

```
library(ggplot2) library(dplyr) library(tidyverse)
instructors <- c("Mabel", "Bessie", "Catherine", "Elizabeth")
subsetNames <- BabyNames %>% filter(name %in% instructors) %>% group_by(name, year)
%>% summarize( total = sum(count), .groups = "drop"
```

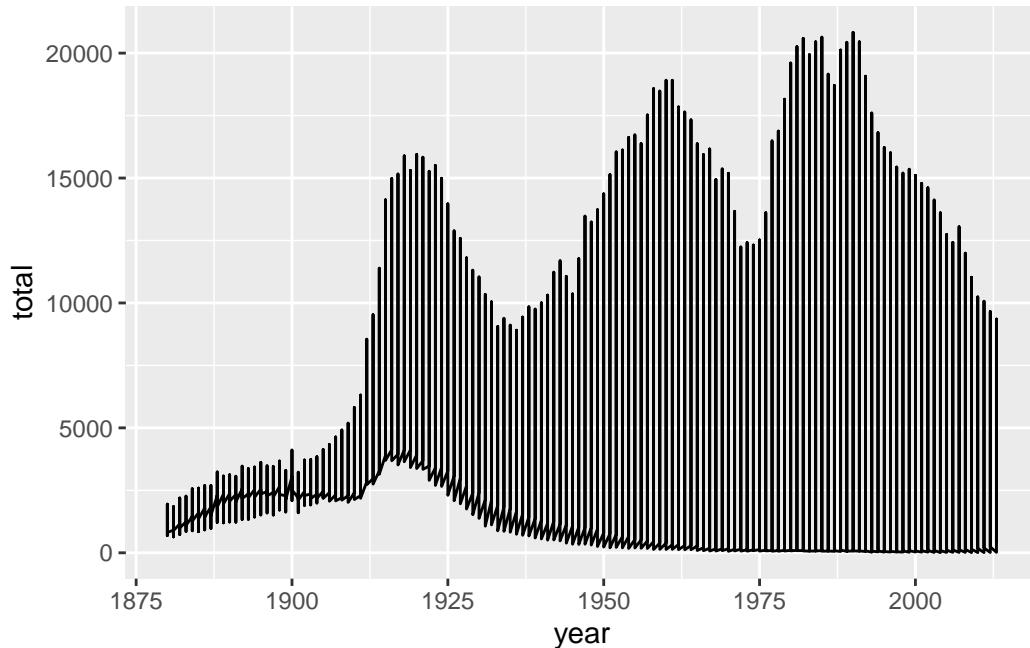
visualization for popular baby names

```
echo=FALSE

library(ggplot2)
library(dplyr)
library(tidyverse)
library(dcData)
data("BabyNames")

instructors <- c("Mabel", "Bessie", "Catherine", "Elizabeth")

subsetNames <- BabyNames %>%
  filter(name %in% instructors) %>%
  group_by(name, year) %>%
  summarize(
    total = sum(count),
    .groups = "drop"
  )
ggplot(subsetNames, mapping = aes(x = year, y = total)
  ) + geom_line()
```



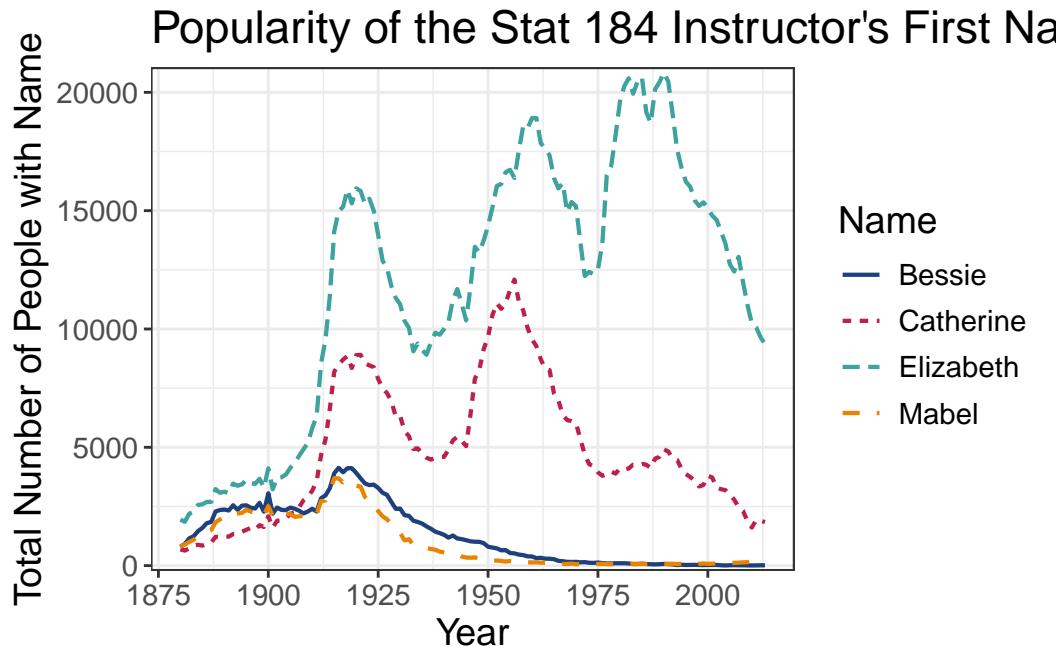
```

psuPalette <- c("#1E407C", "#BC204B", "#3EA39E", "#E98300",
                 "#999999", "#AC8DCE", "#F2665E", "#99CC00")

ggplot(subsetNames, mapping = aes(
  x = year,
  y = total,
  color = name,
  linetype = name
))
  ) + geom_line(linewidth = 0.75) +
  labs(
    title = "Popularity of the Stat 184 Instructor's First Names Over Time",
    x = "Year",
    y = "Total Number of People with Name",
    color = "Name",
    linetype = "Name"
  ) + scale_y_continuous(
    expand = expansion(mult = 0.01)
  ) + scale_color_manual(
    values = psuPalette
  ) +
  theme_bw() +
  theme(
    text = element_text(size = 14),
    legend.key.size = unit(1, "cm")
  )

```

Warning in plot_theme(plot): The `legend.key.size` theme element is not defined in the element hierarchy.



narrative text for popular baby names

alt text: Displaying multiple line graphs on a single plot to show the total number of people with each name across different years.

long description: This visualization presents data for various given names over time. It includes four names and the specific years in which each was recorded. The line graph illustrates how often each name was used in those years. Each line corresponds to a different name, as shown in the legend. The lines reflect different patterns of change—some names rise again in popularity, others show steady declines, and some display fluctuating trends throughout the timeline.

brief paragraph: This data visualization shows how many individuals were given a particular name in each year. It plots a separate line for every name, allowing viewers to see how the popularity of each name changes and grows over time.

plotting the mathematical function

code for the box problem

```
volume_box <- function(x){ vol <- (48-2x)(32-2x)(x) return(vol) }
```

visualization for box problem

```
library(ggplot2)

volume_box <- function(x){
  vol <- (48-2*x)*(32-2*x)*(x)
  return(vol)
}

#if we want to see max volume at what x
x_vals <- seq(0, 18, 0.01)
volumes <- volume_box(x_vals)
max_volume <- max(volumes)
best_x <- x_vals[which.max(volumes)]

max_volume
```

```
[1] 4326.629
```

```
best_x
```

```
[1] 6.28
```

```
# create the plot
ggplot(data = data.frame(x = c(0, 18)), aes(x = x)) + # x ranges from 0 to half the smallest side
  stat_function(fun = volume_box, color = "#0072B2", linewidth = 1) +
  labs(
    x = "Side Length of Square Cut (inches)",
    y = "Volume (cubic inches)"
  ) +
  theme_minimal()
```



narrative text for box problem

The plot shows how the volume of a box with an open top changes as the side length x of the square cut from each corner increases. At first, as x increases from 0, the volume increases because the box gets taller, but beyond a certain point, the volume decreases because the base becomes too small.

For a 36×48 inch piece of paper, the maximum volume occurs when $x = 6.28$ inches, which gives a maximum volume of 4326.629 cubic inches. This visualization helps us see that the optimal side length balances the height of the box with the area of the base to maximize volume.

What You've Learned So Far

So far in this activity, I've learned how to use R more, especially when it comes to working with real datasets. I got practice pulling data from the web, cleaning it up, and reshaping it into something usable. I also learned how to make clearer visualizations with ggplot2 and how to explain them using alt text and short descriptions. On top of that, writing a custom function for the box problem helped me see how R can be used to explore a mathematical idea and graph it. Overall, I've definitely gotten more comfortable using R to wrangle data, make plots, and communicate what the visuals show.