

MyFirstQMD

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2025-11-16

1 Armed Forces Wrangling and Redux

For our analysis, we want to first bring back our frequency tables from the old activities to see if the frequencies match up between the ranks and genders. The count will be insignificant due to the fact we are using frequencies.

For this, we can make a two-way frequency table to compare.

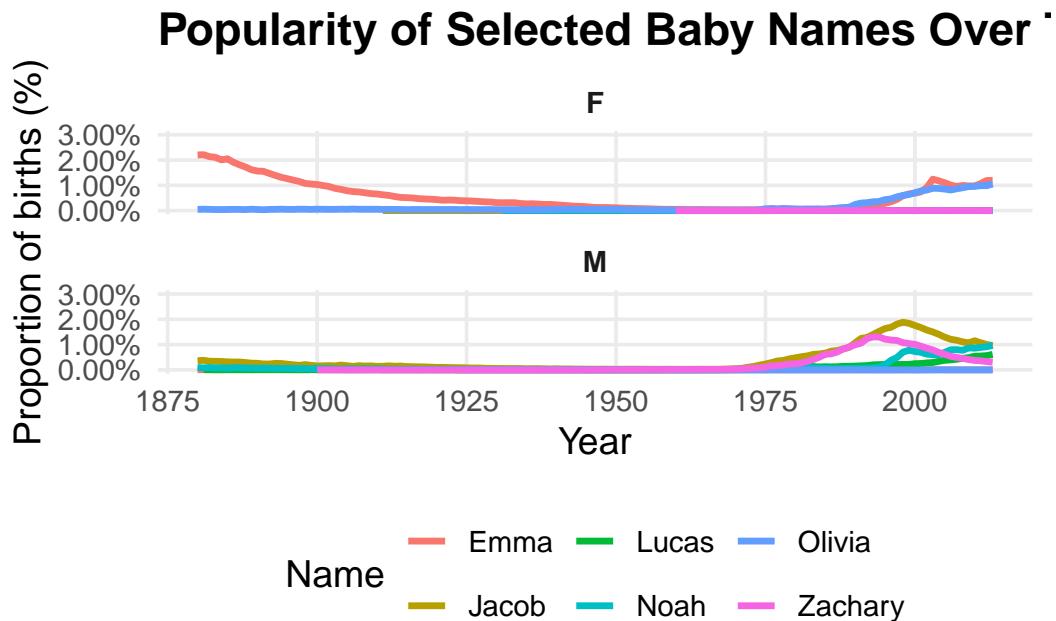
```
# A tibble: 2 x 25
  Sex      E1      E2      E3      E4      E5      E6      E7      E8      E9      O1
  <chr>   <dbl>   <dbl>   <dbl>   <dbl>   <dbl>   <dbl>   <dbl>   <dbl>   <dbl>   <dbl>
1 Male    0.0191  0.0574  0.113   0.204   0.141   0.127   0.0778  0.0244  0.00737 0.0371
2 Female  0.0176  0.0574  0.135   0.201   0.145   0.0975  0.0584  0.0195  0.00522 0.0222
# i 14 more variables: O10 <dbl>, O2 <dbl>, O3 <dbl>, O4 <dbl>, O5 <dbl>,
#   O6 <dbl>, O7 <dbl>, O8 <dbl>, O9 <dbl>, W1 <dbl>, W2 <dbl>, W3 <dbl>,
#   W4 <dbl>, W5 <dbl>
```

Here we can see that the frequencies are quite similar for most of the lower-paying ranks. Most frequencies are close enough to the point that we can assume randomness is what sees them apart. However, we start to see a bit of a trend towards more males as we go higher in the ranks. The frequencies are not too far apart, so there might be other reasons; however for now without exclusive testing, we can say gender may only have a slight effect on paygrade in the higher ranks.

2 Popular Baby Names

For this section, we are going to bring back activity 13's popular baby names data and the visualization we made that tracks the popularity over time.

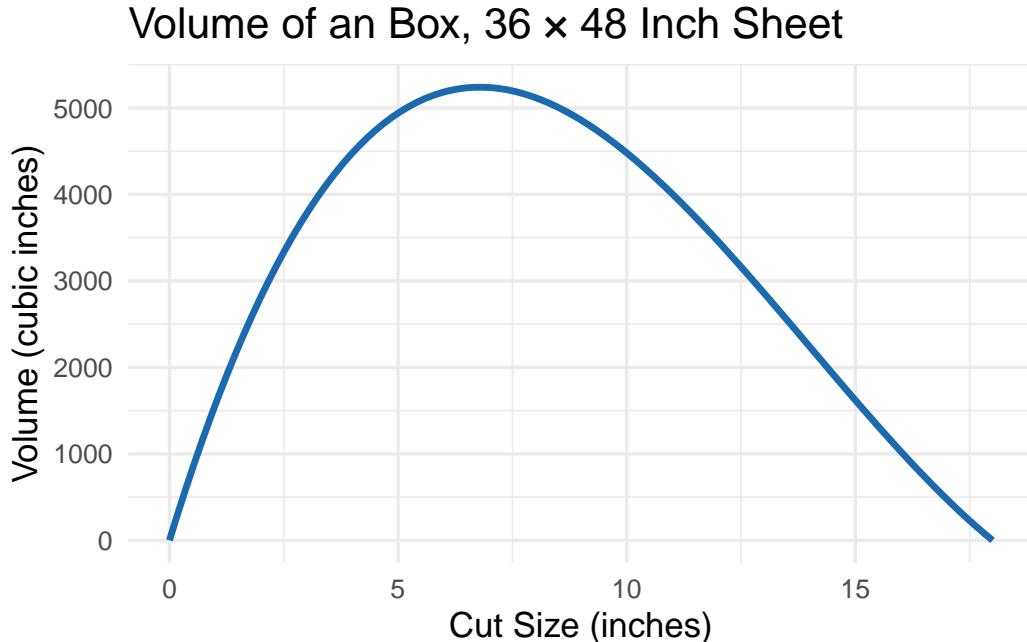
Our chart is a time series line chart of randomly selected names and their popularity over the years in terms of the percentage of babies named that in said year. The chart is also split into male and female to show the proportions on a scale specifically for the popular gender of that name.



Here we see our chart show some very interesting trends. Firstly, a description of the chart. We see each name have its own unique color and line on both chart that helps us to see some interesting things. We also use percentage as it gives a better overall view compared to time, there are more babies now than in the 1800s so a count chart would be heavily skewed towards the present. The actual chart shows us that female names we picked are semi popular now and the name Emma had a stretch of popularity around the late 1800s and early 1900s however faded into obscurity until now where it resurged. The name Olivia had almost no popularity until the recent years where it spiked up to around 1% post 2000. We see the male names we randomly selected had almost no popularity until around the late 1900s where they all slowly started finding their place. One very interesting thing I see in both charts is the female names in the male chart and male names in the female chart have very small bumps throughout that show that there were some one off or two off cases where females were named on of the male names or vice versa.

3 Box Problem

For this section we bring back activity 4 on functions. We are updating our box function that calculates volume of a box based on dimensions we give it. It also includes a plot that optimizes to find the largest volume possible with the dimensions we have.



Here we see that with our new dimensions we get a very large area with a clear optimum cut value to get said largest volume. We can see in the plot there is a peak and decline

```
[1] 5239.819
```

```
[1] 6.789
```

Here we can see our max volume and optimal x from the chart using our function in the appendix. The function used a interval of 0.001 so there might technically be a more optimal answer, however we can generally say its around here.

4 Reflection

I feel like in this course so far I have learned a lot of good techniques, packages, and standards that will help me going forward as a statistician. For my career as an actuary I have heard that we need to use R a lot in the workplace. This class has helped me develop proficiencies and problem solving skills in are due to the difficulty of the activities. I feel as though I have gone from a complete R newbie to being semi-capable in a short time. One thing I feel has been very useful is GGPlot. I see in my stats and data visualization class that GGPlot is widely used and necessary to make pretty and readable visualizations that can portray the data we need to show. One thing I wish to learn is machine learning in R. It is one of my interests and hope with the knowledge learned in this class I will be able to undertake in the near future.

5 Code Appendix

```
library(dplyr)
library(tidyr)
library(stringr)
library(janitor)
library(tidyverse)
library(dcData)
library(ggplot2)

# Load tidyverse

#load data
army <- read.csv("Army.csv", header = FALSE)
#view our data
army
```

| | V1 | V2 |
|----|---|-----------|
| 1 | Active-Duty Personnel by Service Branch, Sex, and Pay Grade | |
| 2 | | Army |
| 3 | | Pay Grade |
| 4 | | Male |
| 5 | E1 | 7,429 |
| 6 | E2 | 22,338 |
| 7 | E3 | 43,775 |
| 8 | E4 | 79,234 |
| 9 | E5 | 54,803 |
| 10 | E6 | 49,502 |
| 11 | E7 | 30,264 |
| 12 | E8 | 9,482 |
| 13 | E9 | 2,865 |
| 14 | Total Enlisted | 299,692 |
| 15 | W1 | 3,727 |
| 16 | W2 | 6,024 |
| 17 | W3 | 2,794 |
| 18 | W4 | 1,378 |
| 19 | W5 | 494 |
| 20 | Total Warrant Officers | 14,417 |
| 21 | 01 | 7,122 |
| 22 | 02 | 9,550 |
| 23 | 03 | 20,986 |
| 24 | 04 | 12,350 |
| 25 | 05 | 6,939 |
| 26 | 06 | 3,161 |
| 27 | 07 | 100 |
| 28 | 08 | 80 |
| | 09 | 46 |

| | | | | | | | |
|----|--|--|--|--|--|----------------|---------|
| 29 | | | | | | 010 | 11 |
| 30 | | | | | | Total Officers | 60,345 |
| 31 | | | | | | Total | 374,454 |

32 Source: DMDC Active-Duty Military Personnel Master File (June 2025)

| | V3 | V4 | V5 | V6 | V7 | V8 | V9 | V10 | V11 |
|----|--------|---------|---------|--------|---------|--------------|--------|---------|-----------|
| 1 | | | | | | | | | |
| 2 | | | Navy | | | Marine Corps | | | Air Force |
| 3 | Female | Total | Male | Female | Total | Male | Female | Total | Male |
| 4 | 1,326 | 8,755 | 8,903 | 3,434 | 12,337 | 7,849 | 655 | 8,504 | 8,537 |
| 5 | 4,336 | 26,674 | 17,504 | 5,833 | 23,337 | 15,034 | 1,684 | 16,718 | 7,343 |
| 6 | 10,229 | 54,004 | 25,436 | 9,103 | 34,539 | 35,239 | 4,174 | 39,413 | 37,324 |
| 7 | 15,143 | 94,377 | 33,859 | 9,959 | 43,818 | 28,519 | 2,961 | 31,480 | 53,185 |
| 8 | 10,954 | 65,757 | 58,142 | 16,169 | 74,311 | 22,262 | 2,670 | 24,932 | 40,614 |
| 9 | 7,363 | 56,865 | 45,833 | 9,950 | 55,783 | 12,225 | 1,529 | 13,754 | 31,400 |
| 10 | 4,410 | 34,674 | 19,046 | 3,434 | 22,480 | 7,720 | 747 | 8,467 | 18,309 |
| 11 | 1,472 | 10,954 | 6,007 | 850 | 6,857 | 3,495 | 293 | 3,788 | 3,876 |
| 12 | 394 | 3,259 | 2,574 | 368 | 2,942 | 1,515 | 82 | 1,597 | 1,903 |
| 13 | 55,627 | 355,319 | 217,304 | 59,100 | 276,404 | 133,858 | 14,795 | 148,653 | 202,491 |
| 14 | 460 | 4,187 | 44 | 4 | 48 | 494 | 44 | 538 | 27 |
| 15 | 692 | 6,716 | 641 | 91 | 732 | 725 | 53 | 778 | 33 |
| 16 | 346 | 3,140 | 744 | 115 | 859 | 518 | 32 | 550 | 0 |
| 17 | 137 | 1,515 | 432 | 41 | 473 | 265 | 12 | 277 | 0 |
| 18 | 43 | 537 | 69 | 6 | 75 | 104 | 3 | 107 | 0 |
| 19 | 1,678 | 16,095 | 1,930 | 257 | 2,187 | 2,106 | 144 | 2,250 | 60 |
| 20 | 2,400 | 9,522 | 5,497 | 1,766 | 7,263 | 2,412 | 366 | 2,778 | 5,048 |
| 21 | 3,006 | 12,556 | 5,544 | 1,716 | 7,260 | 3,162 | 525 | 3,687 | 5,045 |
| 22 | 6,053 | 27,039 | 14,480 | 4,830 | 19,310 | 5,385 | 707 | 6,092 | 15,715 |
| 23 | 3,044 | 15,394 | 7,983 | 2,306 | 10,289 | 3,637 | 338 | 3,975 | 9,682 |
| 24 | 1,531 | 8,470 | 5,525 | 1,151 | 6,676 | 1,830 | 137 | 1,967 | 7,373 |
| 25 | 452 | 3,613 | 2,644 | 452 | 3,096 | 656 | 54 | 710 | 2,663 |
| 26 | 18 | 118 | 101 | 5 | 106 | 36 | 2 | 38 | 99 |
| 27 | 8 | 88 | 62 | 6 | 68 | 28 | 2 | 30 | 63 |
| 28 | 5 | 51 | 32 | 2 | 34 | 17 | 1 | 18 | 30 |
| 29 | 0 | 11 | 8 | 0 | 8 | 3 | 0 | 3 | 11 |
| 30 | 16,517 | 76,862 | 41,876 | 12,234 | 54,110 | 17,166 | 2,132 | 19,298 | 45,729 |
| 31 | 73,822 | 448,276 | 261,110 | 71,591 | 332,701 | 153,130 | 17,071 | 170,201 | 248,280 |

| 32 | | | | | | | | | |
|----|--------|--------|-------------|--------|-------|---------|--------|---------|--|
| | V12 | V13 | V14 | V15 | V16 | V17 | V18 | V19 | |
| 1 | | | | | | | | | |
| 2 | | | Space Force | | | Total | | | |
| 3 | Female | Total | Male | Female | Total | Male | Female | Total | |
| 4 | 1,933 | 10,470 | 179 | 38 | 217 | 32,897 | 7,386 | 40,283 | |
| 5 | 2,019 | 9,362 | 186 | 41 | 227 | 62,405 | 13,913 | 76,318 | |
| 6 | 10,369 | 47,693 | 1,015 | 194 | 1,209 | 142,789 | 34,069 | 176,858 | |
| 7 | 15,055 | 68,240 | 541 | 179 | 720 | 195,338 | 43,297 | 238,635 | |
| 8 | 10,762 | 51,376 | 859 | 173 | 1,032 | 176,680 | 40,728 | 217,408 | |
| 9 | 6,679 | 38,079 | 853 | 147 | 1,000 | 139,813 | 25,668 | 165,481 | |
| 10 | 4,807 | 23,116 | 535 | 114 | 649 | 75,874 | 13,512 | 89,386 | |

| | | | | | | | | | | |
|----|--------|---------|------|-------|-------|--------|---------|-----------|-----------|-----------|
| 11 | 1,221 | 5,097 | 112 | 25 | 137 | 22,972 | 3,861 | 26,833 | | |
| 12 | 523 | 2,426 | | 47 | 16 | 63 | 8,904 | 1,383 | 10,287 | |
| 13 | 53,368 | 255,859 | | 4,327 | 927 | 5,254 | 857,672 | 183,817 | 1,041,489 | |
| 14 | 1 | 28 | N/A* | N/A* | N/A* | 4,292 | 509 | 4,801 | | |
| 15 | 1 | 34 | N/A* | N/A* | N/A* | 7,423 | 837 | 8,260 | | |
| 16 | 0 | 0 | N/A* | N/A* | N/A* | 4,056 | 493 | 4,549 | | |
| 17 | 0 | 0 | N/A* | N/A* | N/A* | 2,075 | 190 | 2,265 | | |
| 18 | 0 | 0 | N/A* | N/A* | N/A* | 667 | 52 | 719 | | |
| 19 | 2 | 62 | N/A* | N/A* | N/A* | 18,513 | 2,081 | 20,594 | | |
| 20 | 1,985 | 7,033 | | 412 | 152 | 564 | 20,491 | 6,669 | 27,160 | |
| 21 | 2,037 | 7,082 | | 437 | 155 | 592 | 23,738 | 7,439 | 31,177 | |
| 22 | 5,485 | 21,200 | | 997 | 280 | 1,277 | 57,563 | 17,355 | 74,918 | |
| 23 | 3,440 | 13,122 | | 941 | 209 | 1,150 | 34,593 | 9,337 | 43,930 | |
| 24 | 1,890 | 9,263 | | 657 | 124 | 781 | 22,324 | 4,833 | 27,157 | |
| 25 | 569 | 3,232 | | 206 | 42 | 248 | 9,330 | 1,569 | 10,899 | |
| 26 | 18 | 117 | | 11 | 2 | 13 | 347 | 45 | 392 | |
| 27 | 6 | 69 | | 10 | 0 | 10 | 243 | 22 | 265 | |
| 28 | 7 | 37 | | 4 | 1 | 5 | 129 | 16 | 145 | |
| 29 | 0 | 11 | | 3 | 0 | 3 | 36 | 0 | 36 | |
| 30 | 15,437 | 61,166 | | 3,678 | 965 | 4,643 | 168,794 | 47,285 | 216,079 | |
| 31 | 68,807 | 317,087 | | | 8,005 | 1,892 | 9,897 | 1,044,979 | 233,183 | 1,278,162 |

32

```
#remove the header
army1 <- army[-1,]

paygrades <- army$V1
valid_paygrades <- paygrades[grep("^[EWO] \\d+$", paygrades)]

# Clean result
valid_paygrades <- trimws(valid_paygrades)

# Check result
valid_paygrades
```

```
[1] "E1"   "E2"   "E3"   "E4"   "E5"   "E6"   "E7"   "E8"   "E9"   "W1"   "W2"   "W3"
[13] "W4"   "W5"   "01"   "02"   "03"   "04"   "05"   "06"   "07"   "08"   "09"   "010"
```

```
army1
```

| | V1 | V2 |
|---|-------|--------|
| 2 | | Army |
| 3 | Pay | Male |
| 4 | Grade | |
| 5 | E1 | 7,429 |
| 6 | E2 | 22,338 |
| | E3 | 43,775 |

| | | | | | | | | |
|----|--|--|--|--|--|------------------------|---------|--------|
| 7 | | | | | | | E4 | 79,234 |
| 8 | | | | | | | E5 | 54,803 |
| 9 | | | | | | | E6 | 49,502 |
| 10 | | | | | | | E7 | 30,264 |
| 11 | | | | | | | E8 | 9,482 |
| 12 | | | | | | | E9 | 2,865 |
| 13 | | | | | | Total Enlisted | 299,692 | |
| 14 | | | | | | W1 | 3,727 | |
| 15 | | | | | | W2 | 6,024 | |
| 16 | | | | | | W3 | 2,794 | |
| 17 | | | | | | W4 | 1,378 | |
| 18 | | | | | | W5 | 494 | |
| 19 | | | | | | Total Warrant Officers | 14,417 | |
| 20 | | | | | | 01 | 7,122 | |
| 21 | | | | | | 02 | 9,550 | |
| 22 | | | | | | 03 | 20,986 | |
| 23 | | | | | | 04 | 12,350 | |
| 24 | | | | | | 05 | 6,939 | |
| 25 | | | | | | 06 | 3,161 | |
| 26 | | | | | | 07 | 100 | |
| 27 | | | | | | 08 | 80 | |
| 28 | | | | | | 09 | 46 | |
| 29 | | | | | | 010 | 11 | |
| 30 | | | | | | Total Officers | 60,345 | |
| 31 | | | | | | Total | 374,454 | |

32 Source: DMDC Active-Duty Military Personnel Master File (June 2025)

| | V3 | V4 | V5 | V6 | V7 | V8 | V9 | V10 | V11 |
|----|--------|---------|---------|--------|---------|--------------|--------|---------|-----------|
| 2 | | | Navy | | | Marine Corps | | | Air Force |
| 3 | Female | Total | Male | Female | Total | Male | Female | Total | Male |
| 4 | 1,326 | 8,755 | 8,903 | 3,434 | 12,337 | 7,849 | 655 | 8,504 | 8,537 |
| 5 | 4,336 | 26,674 | 17,504 | 5,833 | 23,337 | 15,034 | 1,684 | 16,718 | 7,343 |
| 6 | 10,229 | 54,004 | 25,436 | 9,103 | 34,539 | 35,239 | 4,174 | 39,413 | 37,324 |
| 7 | 15,143 | 94,377 | 33,859 | 9,959 | 43,818 | 28,519 | 2,961 | 31,480 | 53,185 |
| 8 | 10,954 | 65,757 | 58,142 | 16,169 | 74,311 | 22,262 | 2,670 | 24,932 | 40,614 |
| 9 | 7,363 | 56,865 | 45,833 | 9,950 | 55,783 | 12,225 | 1,529 | 13,754 | 31,400 |
| 10 | 4,410 | 34,674 | 19,046 | 3,434 | 22,480 | 7,720 | 747 | 8,467 | 18,309 |
| 11 | 1,472 | 10,954 | 6,007 | 850 | 6,857 | 3,495 | 293 | 3,788 | 3,876 |
| 12 | 394 | 3,259 | 2,574 | 368 | 2,942 | 1,515 | 82 | 1,597 | 1,903 |
| 13 | 55,627 | 355,319 | 217,304 | 59,100 | 276,404 | 133,858 | 14,795 | 148,653 | 202,491 |
| 14 | 460 | 4,187 | 44 | 4 | 48 | 494 | 44 | 538 | 27 |
| 15 | 692 | 6,716 | 641 | 91 | 732 | 725 | 53 | 778 | 33 |
| 16 | 346 | 3,140 | 744 | 115 | 859 | 518 | 32 | 550 | 0 |
| 17 | 137 | 1,515 | 432 | 41 | 473 | 265 | 12 | 277 | 0 |
| 18 | 43 | 537 | 69 | 6 | 75 | 104 | 3 | 107 | 0 |
| 19 | 1,678 | 16,095 | 1,930 | 257 | 2,187 | 2,106 | 144 | 2,250 | 60 |
| 20 | 2,400 | 9,522 | 5,497 | 1,766 | 7,263 | 2,412 | 366 | 2,778 | 5,048 |
| 21 | 3,006 | 12,556 | 5,544 | 1,716 | 7,260 | 3,162 | 525 | 3,687 | 5,045 |
| 22 | 6,053 | 27,039 | 14,480 | 4,830 | 19,310 | 5,385 | 707 | 6,092 | 15,715 |

| | | | | | | | | | | |
|----|--------|---------|---------|--------|---------|--|---------|--------|---------|---------|
| 23 | 3,044 | 15,394 | 7,983 | 2,306 | 10,289 | | 3,637 | 338 | 3,975 | 9,682 |
| 24 | 1,531 | 8,470 | 5,525 | 1,151 | 6,676 | | 1,830 | 137 | 1,967 | 7,373 |
| 25 | 452 | 3,613 | 2,644 | 452 | 3,096 | | 656 | 54 | 710 | 2,663 |
| 26 | 18 | 118 | 101 | 5 | 106 | | 36 | 2 | 38 | 99 |
| 27 | 8 | 88 | 62 | 6 | 68 | | 28 | 2 | 30 | 63 |
| 28 | 5 | 51 | 32 | 2 | 34 | | 17 | 1 | 18 | 30 |
| 29 | 0 | 11 | 8 | 0 | 8 | | 3 | 0 | 3 | 11 |
| 30 | 16,517 | 76,862 | 41,876 | 12,234 | 54,110 | | 17,166 | 2,132 | 19,298 | 45,729 |
| 31 | 73,822 | 448,276 | 261,110 | 71,591 | 332,701 | | 153,130 | 17,071 | 170,201 | 248,280 |
| 32 | | | | | | | | | | |

| | V12 | V13 | V14 | V15 | V16 | V17 | V18 | V19 | |
|----|--------|-------------|-------|--------|-------|-----------|---------|-----------|--|
| 2 | | Space Force | | | | Total | | | |
| 3 | Female | Total | Male | Female | Total | Male | Female | Total | |
| 4 | 1,933 | 10,470 | 179 | 38 | 217 | 32,897 | 7,386 | 40,283 | |
| 5 | 2,019 | 9,362 | 186 | 41 | 227 | 62,405 | 13,913 | 76,318 | |
| 6 | 10,369 | 47,693 | 1,015 | 194 | 1,209 | 142,789 | 34,069 | 176,858 | |
| 7 | 15,055 | 68,240 | 541 | 179 | 720 | 195,338 | 43,297 | 238,635 | |
| 8 | 10,762 | 51,376 | 859 | 173 | 1,032 | 176,680 | 40,728 | 217,408 | |
| 9 | 6,679 | 38,079 | 853 | 147 | 1,000 | 139,813 | 25,668 | 165,481 | |
| 10 | 4,807 | 23,116 | 535 | 114 | 649 | 75,874 | 13,512 | 89,386 | |
| 11 | 1,221 | 5,097 | 112 | 25 | 137 | 22,972 | 3,861 | 26,833 | |
| 12 | 523 | 2,426 | 47 | 16 | 63 | 8,904 | 1,383 | 10,287 | |
| 13 | 53,368 | 255,859 | 4,327 | 927 | 5,254 | 857,672 | 183,817 | 1,041,489 | |
| 14 | 1 | 28 | N/A* | N/A* | N/A* | 4,292 | 509 | 4,801 | |
| 15 | 1 | 34 | N/A* | N/A* | N/A* | 7,423 | 837 | 8,260 | |
| 16 | 0 | 0 | N/A* | N/A* | N/A* | 4,056 | 493 | 4,549 | |
| 17 | 0 | 0 | N/A* | N/A* | N/A* | 2,075 | 190 | 2,265 | |
| 18 | 0 | 0 | N/A* | N/A* | N/A* | 667 | 52 | 719 | |
| 19 | 2 | 62 | N/A* | N/A* | N/A* | 18,513 | 2,081 | 20,594 | |
| 20 | 1,985 | 7,033 | 412 | 152 | 564 | 20,491 | 6,669 | 27,160 | |
| 21 | 2,037 | 7,082 | 437 | 155 | 592 | 23,738 | 7,439 | 31,177 | |
| 22 | 5,485 | 21,200 | 997 | 280 | 1,277 | 57,563 | 17,355 | 74,918 | |
| 23 | 3,440 | 13,122 | 941 | 209 | 1,150 | 34,593 | 9,337 | 43,930 | |
| 24 | 1,890 | 9,263 | 657 | 124 | 781 | 22,324 | 4,833 | 27,157 | |
| 25 | 569 | 3,232 | 206 | 42 | 248 | 9,330 | 1,569 | 10,899 | |
| 26 | 18 | 117 | 11 | 2 | 13 | 347 | 45 | 392 | |
| 27 | 6 | 69 | 10 | 0 | 10 | 243 | 22 | 265 | |
| 28 | 7 | 37 | 4 | 1 | 5 | 129 | 16 | 145 | |
| 29 | 0 | 11 | 3 | 0 | 3 | 36 | 0 | 36 | |
| 30 | 15,437 | 61,166 | 3,678 | 965 | 4,643 | 168,794 | 47,285 | 216,079 | |
| 31 | 68,807 | 317,087 | 8,005 | 1,892 | 9,897 | 1,044,979 | 233,183 | 1,278,162 | |
| 32 | | | | | | | | | |

```
#remove total columns
army2 <- army1[, -seq(1, ncol(army1), 3)]
army2
```

| | V2 | V3 | V5 | V6 | V8 | V9 | V11 | V12 |
|----|---------|--------|---------|--------|--------------|--------|-----------|--------|
| 2 | Army | | Navy | | Marine Corps | | Air Force | |
| 3 | Male | Female | Male | Female | Male | Female | Male | Female |
| 4 | 7,429 | 1,326 | 8,903 | 3,434 | 7,849 | 655 | 8,537 | 1,933 |
| 5 | 22,338 | 4,336 | 17,504 | 5,833 | 15,034 | 1,684 | 7,343 | 2,019 |
| 6 | 43,775 | 10,229 | 25,436 | 9,103 | 35,239 | 4,174 | 37,324 | 10,369 |
| 7 | 79,234 | 15,143 | 33,859 | 9,959 | 28,519 | 2,961 | 53,185 | 15,055 |
| 8 | 54,803 | 10,954 | 58,142 | 16,169 | 22,262 | 2,670 | 40,614 | 10,762 |
| 9 | 49,502 | 7,363 | 45,833 | 9,950 | 12,225 | 1,529 | 31,400 | 6,679 |
| 10 | 30,264 | 4,410 | 19,046 | 3,434 | 7,720 | 747 | 18,309 | 4,807 |
| 11 | 9,482 | 1,472 | 6,007 | 850 | 3,495 | 293 | 3,876 | 1,221 |
| 12 | 2,865 | 394 | 2,574 | 368 | 1,515 | 82 | 1,903 | 523 |
| 13 | 299,692 | 55,627 | 217,304 | 59,100 | 133,858 | 14,795 | 202,491 | 53,368 |
| 14 | 3,727 | 460 | 44 | 4 | 494 | 44 | 27 | 1 |
| 15 | 6,024 | 692 | 641 | 91 | 725 | 53 | 33 | 1 |
| 16 | 2,794 | 346 | 744 | 115 | 518 | 32 | 0 | 0 |
| 17 | 1,378 | 137 | 432 | 41 | 265 | 12 | 0 | 0 |
| 18 | 494 | 43 | 69 | 6 | 104 | 3 | 0 | 0 |
| 19 | 14,417 | 1,678 | 1,930 | 257 | 2,106 | 144 | 60 | 2 |
| 20 | 7,122 | 2,400 | 5,497 | 1,766 | 2,412 | 366 | 5,048 | 1,985 |
| 21 | 9,550 | 3,006 | 5,544 | 1,716 | 3,162 | 525 | 5,045 | 2,037 |
| 22 | 20,986 | 6,053 | 14,480 | 4,830 | 5,385 | 707 | 15,715 | 5,485 |
| 23 | 12,350 | 3,044 | 7,983 | 2,306 | 3,637 | 338 | 9,682 | 3,440 |
| 24 | 6,939 | 1,531 | 5,525 | 1,151 | 1,830 | 137 | 7,373 | 1,890 |
| 25 | 3,161 | 452 | 2,644 | 452 | 656 | 54 | 2,663 | 569 |
| 26 | 100 | 18 | 101 | 5 | 36 | 2 | 99 | 18 |
| 27 | 80 | 8 | 62 | 6 | 28 | 2 | 63 | 6 |
| 28 | 46 | 5 | 32 | 2 | 17 | 1 | 30 | 7 |
| 29 | 11 | 0 | 8 | 0 | 3 | 0 | 11 | 0 |
| 30 | 60,345 | 16,517 | 41,876 | 12,234 | 17,166 | 2,132 | 45,729 | 15,437 |
| 31 | 374,454 | 73,822 | 261,110 | 71,591 | 153,130 | 17,071 | 248,280 | 68,807 |
| 32 | | | | | | | | |

| | V14 | V15 | V17 | V18 |
|----|-------------|--------|---------|---------|
| 2 | Space Force | | Total | |
| 3 | Male | Female | Male | Female |
| 4 | 179 | 38 | 32,897 | 7,386 |
| 5 | 186 | 41 | 62,405 | 13,913 |
| 6 | 1,015 | 194 | 142,789 | 34,069 |
| 7 | 541 | 179 | 195,338 | 43,297 |
| 8 | 859 | 173 | 176,680 | 40,728 |
| 9 | 853 | 147 | 139,813 | 25,668 |
| 10 | 535 | 114 | 75,874 | 13,512 |
| 11 | 112 | 25 | 22,972 | 3,861 |
| 12 | 47 | 16 | 8,904 | 1,383 |
| 13 | 4,327 | 927 | 857,672 | 183,817 |
| 14 | N/A* | N/A* | 4,292 | 509 |
| 15 | N/A* | N/A* | 7,423 | 837 |
| 16 | N/A* | N/A* | 4,056 | 493 |

| | | | | |
|----|-------|-------|-----------|---------|
| 17 | N/A* | N/A* | 2,075 | 190 |
| 18 | N/A* | N/A* | 667 | 52 |
| 19 | N/A* | N/A* | 18,513 | 2,081 |
| 20 | 412 | 152 | 20,491 | 6,669 |
| 21 | 437 | 155 | 23,738 | 7,439 |
| 22 | 997 | 280 | 57,563 | 17,355 |
| 23 | 941 | 209 | 34,593 | 9,337 |
| 24 | 657 | 124 | 22,324 | 4,833 |
| 25 | 206 | 42 | 9,330 | 1,569 |
| 26 | 11 | 2 | 347 | 45 |
| 27 | 10 | 0 | 243 | 22 |
| 28 | 4 | 1 | 129 | 16 |
| 29 | 3 | 0 | 36 | 0 |
| 30 | 3,678 | 965 | 168,794 | 47,285 |
| 31 | 8,005 | 1,892 | 1,044,979 | 233,183 |
| 32 | | | | |

```
#remove total section at end
army3 <- army2[,-( (ncol(army2)-1):ncol(army2) )]
army3
```

| | V2 | V3 | V5 | V6 | V8 | V9 | V11 | V12 |
|----|---------|--------|---------|--------|--------------|--------|-----------|--------|
| 2 | Army | | Navy | | Marine Corps | | Air Force | |
| 3 | Male | Female | Male | Female | Male | Female | Male | Female |
| 4 | 7,429 | 1,326 | 8,903 | 3,434 | 7,849 | 655 | 8,537 | 1,933 |
| 5 | 22,338 | 4,336 | 17,504 | 5,833 | 15,034 | 1,684 | 7,343 | 2,019 |
| 6 | 43,775 | 10,229 | 25,436 | 9,103 | 35,239 | 4,174 | 37,324 | 10,369 |
| 7 | 79,234 | 15,143 | 33,859 | 9,959 | 28,519 | 2,961 | 53,185 | 15,055 |
| 8 | 54,803 | 10,954 | 58,142 | 16,169 | 22,262 | 2,670 | 40,614 | 10,762 |
| 9 | 49,502 | 7,363 | 45,833 | 9,950 | 12,225 | 1,529 | 31,400 | 6,679 |
| 10 | 30,264 | 4,410 | 19,046 | 3,434 | 7,720 | 747 | 18,309 | 4,807 |
| 11 | 9,482 | 1,472 | 6,007 | 850 | 3,495 | 293 | 3,876 | 1,221 |
| 12 | 2,865 | 394 | 2,574 | 368 | 1,515 | 82 | 1,903 | 523 |
| 13 | 299,692 | 55,627 | 217,304 | 59,100 | 133,858 | 14,795 | 202,491 | 53,368 |
| 14 | 3,727 | 460 | 44 | 4 | 494 | 44 | 27 | 1 |
| 15 | 6,024 | 692 | 641 | 91 | 725 | 53 | 33 | 1 |
| 16 | 2,794 | 346 | 744 | 115 | 518 | 32 | 0 | 0 |
| 17 | 1,378 | 137 | 432 | 41 | 265 | 12 | 0 | 0 |
| 18 | 494 | 43 | 69 | 6 | 104 | 3 | 0 | 0 |
| 19 | 14,417 | 1,678 | 1,930 | 257 | 2,106 | 144 | 60 | 2 |
| 20 | 7,122 | 2,400 | 5,497 | 1,766 | 2,412 | 366 | 5,048 | 1,985 |
| 21 | 9,550 | 3,006 | 5,544 | 1,716 | 3,162 | 525 | 5,045 | 2,037 |
| 22 | 20,986 | 6,053 | 14,480 | 4,830 | 5,385 | 707 | 15,715 | 5,485 |
| 23 | 12,350 | 3,044 | 7,983 | 2,306 | 3,637 | 338 | 9,682 | 3,440 |
| 24 | 6,939 | 1,531 | 5,525 | 1,151 | 1,830 | 137 | 7,373 | 1,890 |
| 25 | 3,161 | 452 | 2,644 | 452 | 656 | 54 | 2,663 | 569 |
| 26 | 100 | 18 | 101 | 5 | 36 | 2 | 99 | 18 |

| | | | | | | | | |
|----|-------------|--------|---------|--------|---------|--------|---------|--------|
| 27 | 80 | 8 | 62 | 6 | 28 | 2 | 63 | 6 |
| 28 | 46 | 5 | 32 | 2 | 17 | 1 | 30 | 7 |
| 29 | 11 | 0 | 8 | 0 | 3 | 0 | 11 | 0 |
| 30 | 60,345 | 16,517 | 41,876 | 12,234 | 17,166 | 2,132 | 45,729 | 15,437 |
| 31 | 374,454 | 73,822 | 261,110 | 71,591 | 153,130 | 17,071 | 248,280 | 68,807 |
| 32 | | | | | | | | |
| | V14 | V15 | | | | | | |
| 2 | Space Force | | | | | | | |
| 3 | | Male | Female | | | | | |
| 4 | | 179 | 38 | | | | | |
| 5 | | 186 | 41 | | | | | |
| 6 | | 1,015 | 194 | | | | | |
| 7 | | 541 | 179 | | | | | |
| 8 | | 859 | 173 | | | | | |
| 9 | | 853 | 147 | | | | | |
| 10 | | 535 | 114 | | | | | |
| 11 | | 112 | 25 | | | | | |
| 12 | | 47 | 16 | | | | | |
| 13 | | 4,327 | 927 | | | | | |
| 14 | | N/A* | N/A* | | | | | |
| 15 | | N/A* | N/A* | | | | | |
| 16 | | N/A* | N/A* | | | | | |
| 17 | | N/A* | N/A* | | | | | |
| 18 | | N/A* | N/A* | | | | | |
| 19 | | N/A* | N/A* | | | | | |
| 20 | | 412 | 152 | | | | | |
| 21 | | 437 | 155 | | | | | |
| 22 | | 997 | 280 | | | | | |
| 23 | | 941 | 209 | | | | | |
| 24 | | 657 | 124 | | | | | |
| 25 | | 206 | 42 | | | | | |
| 26 | | 11 | 2 | | | | | |
| 27 | | 10 | 0 | | | | | |
| 28 | | 4 | 1 | | | | | |
| 29 | | 3 | 0 | | | | | |
| 30 | | 3,678 | 965 | | | | | |
| 31 | | 8,005 | 1,892 | | | | | |
| 32 | | | | | | | | |

```
print(colnames(army))
```

```
[1] "V1"   "V2"   "V3"   "V4"   "V5"   "V6"   "V7"   "V8"   "V9"   "V10"  "V11"  "V12"
[13] "V13"  "V14"  "V15"  "V16"  "V17"  "V18"  "V19"
```

```
army3_col <- colnames(army3) <- c(
  "Army_Male", "Army_Female",
  "Navy_Male", "Navy_Female",
```

```

    "Marines_Male", "Marines_Female",
    "AirForce_Male", "AirForce_Female",
    "SpaceForce_Male", "SpaceForce_Female")
army3_col
```

```

[1] "Army_Male"           "Army_Female"        "Navy_Male"
[4] "Navy_Female"         "Marines_Male"       "Marines_Female"
[7] "AirForce_Male"        "AirForce_Female"     "SpaceForce_Male"
[10] "SpaceForce_Female"
```

```
print(head(army3, 5))
```

| | Army_Male | Army_Female | Navy_Male | Navy_Female | Marines_Male | Marines_Female |
|---|---------------|-----------------|-----------------|-------------------|--------------|----------------|
| 2 | Army | | Navy | | Marine Corps | |
| 3 | Male | Female | Male | Female | Male | Female |
| 4 | 7,429 | 1,326 | 8,903 | 3,434 | 7,849 | 655 |
| 5 | 22,338 | 4,336 | 17,504 | 5,833 | 15,034 | 1,684 |
| 6 | 43,775 | 10,229 | 25,436 | 9,103 | 35,239 | 4,174 |
| | AirForce_Male | AirForce_Female | SpaceForce_Male | SpaceForce_Female | | |
| 2 | Air Force | | Space Force | | | |
| 3 | Male | Female | | Male | | Female |
| 4 | 8,537 | 1,933 | | 179 | | 38 |
| 5 | 7,343 | 2,019 | | 186 | | 41 |
| 6 | 37,324 | 10,369 | | 1,015 | | 194 |

```

army4 <- army3[-c(1,2),]
army4
```

| | Army_Male | Army_Female | Navy_Male | Navy_Female | Marines_Male | Marines_Female |
|----|-----------|-------------|-----------|-------------|--------------|----------------|
| 4 | 7,429 | 1,326 | 8,903 | 3,434 | 7,849 | 655 |
| 5 | 22,338 | 4,336 | 17,504 | 5,833 | 15,034 | 1,684 |
| 6 | 43,775 | 10,229 | 25,436 | 9,103 | 35,239 | 4,174 |
| 7 | 79,234 | 15,143 | 33,859 | 9,959 | 28,519 | 2,961 |
| 8 | 54,803 | 10,954 | 58,142 | 16,169 | 22,262 | 2,670 |
| 9 | 49,502 | 7,363 | 45,833 | 9,950 | 12,225 | 1,529 |
| 10 | 30,264 | 4,410 | 19,046 | 3,434 | 7,720 | 747 |
| 11 | 9,482 | 1,472 | 6,007 | 850 | 3,495 | 293 |
| 12 | 2,865 | 394 | 2,574 | 368 | 1,515 | 82 |
| 13 | 299,692 | 55,627 | 217,304 | 59,100 | 133,858 | 14,795 |
| 14 | 3,727 | 460 | 44 | 4 | 494 | 44 |
| 15 | 6,024 | 692 | 641 | 91 | 725 | 53 |
| 16 | 2,794 | 346 | 744 | 115 | 518 | 32 |
| 17 | 1,378 | 137 | 432 | 41 | 265 | 12 |
| 18 | 494 | 43 | 69 | 6 | 104 | 3 |
| 19 | 14,417 | 1,678 | 1,930 | 257 | 2,106 | 144 |

| | | | | | | |
|----|---------|--------|---------|--------|---------|--------|
| 20 | 7,122 | 2,400 | 5,497 | 1,766 | 2,412 | 366 |
| 21 | 9,550 | 3,006 | 5,544 | 1,716 | 3,162 | 525 |
| 22 | 20,986 | 6,053 | 14,480 | 4,830 | 5,385 | 707 |
| 23 | 12,350 | 3,044 | 7,983 | 2,306 | 3,637 | 338 |
| 24 | 6,939 | 1,531 | 5,525 | 1,151 | 1,830 | 137 |
| 25 | 3,161 | 452 | 2,644 | 452 | 656 | 54 |
| 26 | 100 | 18 | 101 | 5 | 36 | 2 |
| 27 | 80 | 8 | 62 | 6 | 28 | 2 |
| 28 | 46 | 5 | 32 | 2 | 17 | 1 |
| 29 | 11 | 0 | 8 | 0 | 3 | 0 |
| 30 | 60,345 | 16,517 | 41,876 | 12,234 | 17,166 | 2,132 |
| 31 | 374,454 | 73,822 | 261,110 | 71,591 | 153,130 | 17,071 |
| 32 | | | | | | |

| | AirForce_Male | AirForce_Female | SpaceForce_Male | SpaceForce_Female |
|----|---------------|-----------------|-----------------|-------------------|
| 4 | 8,537 | 1,933 | 179 | 38 |
| 5 | 7,343 | 2,019 | 186 | 41 |
| 6 | 37,324 | 10,369 | 1,015 | 194 |
| 7 | 53,185 | 15,055 | 541 | 179 |
| 8 | 40,614 | 10,762 | 859 | 173 |
| 9 | 31,400 | 6,679 | 853 | 147 |
| 10 | 18,309 | 4,807 | 535 | 114 |
| 11 | 3,876 | 1,221 | 112 | 25 |
| 12 | 1,903 | 523 | 47 | 16 |
| 13 | 202,491 | 53,368 | 4,327 | 927 |
| 14 | 27 | 1 | N/A* | N/A* |
| 15 | 33 | 1 | N/A* | N/A* |
| 16 | 0 | 0 | N/A* | N/A* |
| 17 | 0 | 0 | N/A* | N/A* |
| 18 | 0 | 0 | N/A* | N/A* |
| 19 | 60 | 2 | N/A* | N/A* |
| 20 | 5,048 | 1,985 | 412 | 152 |
| 21 | 5,045 | 2,037 | 437 | 155 |
| 22 | 15,715 | 5,485 | 997 | 280 |
| 23 | 9,682 | 3,440 | 941 | 209 |
| 24 | 7,373 | 1,890 | 657 | 124 |
| 25 | 2,663 | 569 | 206 | 42 |
| 26 | 99 | 18 | 11 | 2 |
| 27 | 63 | 6 | 10 | 0 |
| 28 | 30 | 7 | 4 | 1 |
| 29 | 11 | 0 | 3 | 0 |
| 30 | 45,729 | 15,437 | 3,678 | 965 |
| 31 | 248,280 | 68,807 | 8,005 | 1,892 |
| 32 | | | | |

```
army4rows <- army4[-c(10,27,28,29),]
army4rows
```

| | Army_Male | Army_Female | Navy_Male | Navy_Female | Marines_Male | Marines_Female |
|----|-----------|-------------|-----------|-------------|--------------|----------------|
| 4 | 7,429 | 1,326 | 8,903 | 3,434 | 7,849 | 655 |
| 5 | 22,338 | 4,336 | 17,504 | 5,833 | 15,034 | 1,684 |
| 6 | 43,775 | 10,229 | 25,436 | 9,103 | 35,239 | 4,174 |
| 7 | 79,234 | 15,143 | 33,859 | 9,959 | 28,519 | 2,961 |
| 8 | 54,803 | 10,954 | 58,142 | 16,169 | 22,262 | 2,670 |
| 9 | 49,502 | 7,363 | 45,833 | 9,950 | 12,225 | 1,529 |
| 10 | 30,264 | 4,410 | 19,046 | 3,434 | 7,720 | 747 |
| 11 | 9,482 | 1,472 | 6,007 | 850 | 3,495 | 293 |
| 12 | 2,865 | 394 | 2,574 | 368 | 1,515 | 82 |
| 14 | 3,727 | 460 | 44 | 4 | 494 | 44 |
| 15 | 6,024 | 692 | 641 | 91 | 725 | 53 |
| 16 | 2,794 | 346 | 744 | 115 | 518 | 32 |
| 17 | 1,378 | 137 | 432 | 41 | 265 | 12 |
| 18 | 494 | 43 | 69 | 6 | 104 | 3 |
| 19 | 14,417 | 1,678 | 1,930 | 257 | 2,106 | 144 |
| 20 | 7,122 | 2,400 | 5,497 | 1,766 | 2,412 | 366 |
| 21 | 9,550 | 3,006 | 5,544 | 1,716 | 3,162 | 525 |
| 22 | 20,986 | 6,053 | 14,480 | 4,830 | 5,385 | 707 |
| 23 | 12,350 | 3,044 | 7,983 | 2,306 | 3,637 | 338 |
| 24 | 6,939 | 1,531 | 5,525 | 1,151 | 1,830 | 137 |
| 25 | 3,161 | 452 | 2,644 | 452 | 656 | 54 |
| 26 | 100 | 18 | 101 | 5 | 36 | 2 |
| 27 | 80 | 8 | 62 | 6 | 28 | 2 |
| 28 | 46 | 5 | 32 | 2 | 17 | 1 |
| 29 | 11 | 0 | 8 | 0 | 3 | 0 |

| | AirForce_Male | AirForce_Female | SpaceForce_Male | SpaceForce_Female |
|----|---------------|-----------------|-----------------|-------------------|
| 4 | 8,537 | 1,933 | 179 | 38 |
| 5 | 7,343 | 2,019 | 186 | 41 |
| 6 | 37,324 | 10,369 | 1,015 | 194 |
| 7 | 53,185 | 15,055 | 541 | 179 |
| 8 | 40,614 | 10,762 | 859 | 173 |
| 9 | 31,400 | 6,679 | 853 | 147 |
| 10 | 18,309 | 4,807 | 535 | 114 |
| 11 | 3,876 | 1,221 | 112 | 25 |
| 12 | 1,903 | 523 | 47 | 16 |
| 14 | 27 | 1 | N/A* | N/A* |
| 15 | 33 | 1 | N/A* | N/A* |
| 16 | 0 | 0 | N/A* | N/A* |
| 17 | 0 | 0 | N/A* | N/A* |
| 18 | 0 | 0 | N/A* | N/A* |
| 19 | 60 | 2 | N/A* | N/A* |
| 20 | 5,048 | 1,985 | 412 | 152 |
| 21 | 5,045 | 2,037 | 437 | 155 |
| 22 | 15,715 | 5,485 | 997 | 280 |
| 23 | 9,682 | 3,440 | 941 | 209 |
| 24 | 7,373 | 1,890 | 657 | 124 |
| 25 | 2,663 | 569 | 206 | 42 |

| | | | | |
|----|----|----|----|---|
| 26 | 99 | 18 | 11 | 2 |
| 27 | 63 | 6 | 10 | 0 |
| 28 | 30 | 7 | 4 | 1 |
| 29 | 11 | 0 | 3 | 0 |

```
army4_clean <- army4rows[1:length(valid_paygrades), ]
army4_clean
```

| | Army_Male | Army_Female | Navy_Male | Navy_Female | Marines_Male | Marines_Female |
|----|---------------|-----------------|-----------------|-------------------|--------------|----------------|
| 4 | 7,429 | 1,326 | 8,903 | 3,434 | 7,849 | 655 |
| 5 | 22,338 | 4,336 | 17,504 | 5,833 | 15,034 | 1,684 |
| 6 | 43,775 | 10,229 | 25,436 | 9,103 | 35,239 | 4,174 |
| 7 | 79,234 | 15,143 | 33,859 | 9,959 | 28,519 | 2,961 |
| 8 | 54,803 | 10,954 | 58,142 | 16,169 | 22,262 | 2,670 |
| 9 | 49,502 | 7,363 | 45,833 | 9,950 | 12,225 | 1,529 |
| 10 | 30,264 | 4,410 | 19,046 | 3,434 | 7,720 | 747 |
| 11 | 9,482 | 1,472 | 6,007 | 850 | 3,495 | 293 |
| 12 | 2,865 | 394 | 2,574 | 368 | 1,515 | 82 |
| 14 | 3,727 | 460 | 44 | 4 | 494 | 44 |
| 15 | 6,024 | 692 | 641 | 91 | 725 | 53 |
| 16 | 2,794 | 346 | 744 | 115 | 518 | 32 |
| 17 | 1,378 | 137 | 432 | 41 | 265 | 12 |
| 18 | 494 | 43 | 69 | 6 | 104 | 3 |
| 19 | 14,417 | 1,678 | 1,930 | 257 | 2,106 | 144 |
| 20 | 7,122 | 2,400 | 5,497 | 1,766 | 2,412 | 366 |
| 21 | 9,550 | 3,006 | 5,544 | 1,716 | 3,162 | 525 |
| 22 | 20,986 | 6,053 | 14,480 | 4,830 | 5,385 | 707 |
| 23 | 12,350 | 3,044 | 7,983 | 2,306 | 3,637 | 338 |
| 24 | 6,939 | 1,531 | 5,525 | 1,151 | 1,830 | 137 |
| 25 | 3,161 | 452 | 2,644 | 452 | 656 | 54 |
| 26 | 100 | 18 | 101 | 5 | 36 | 2 |
| 27 | 80 | 8 | 62 | 6 | 28 | 2 |
| 28 | 46 | 5 | 32 | 2 | 17 | 1 |
| | AirForce_Male | AirForce_Female | SpaceForce_Male | SpaceForce_Female | | |
| 4 | 8,537 | 1,933 | 179 | 38 | | |
| 5 | 7,343 | 2,019 | 186 | 41 | | |
| 6 | 37,324 | 10,369 | 1,015 | 194 | | |
| 7 | 53,185 | 15,055 | 541 | 179 | | |
| 8 | 40,614 | 10,762 | 859 | 173 | | |
| 9 | 31,400 | 6,679 | 853 | 147 | | |
| 10 | 18,309 | 4,807 | 535 | 114 | | |
| 11 | 3,876 | 1,221 | 112 | 25 | | |
| 12 | 1,903 | 523 | 47 | 16 | | |
| 14 | 27 | 1 | N/A* | N/A* | | |
| 15 | 33 | 1 | N/A* | N/A* | | |
| 16 | 0 | 0 | N/A* | N/A* | | |
| 17 | 0 | 0 | N/A* | N/A* | | |

| | | | | |
|----|--------|-------|------|------|
| 18 | 0 | 0 | N/A* | N/A* |
| 19 | 60 | 2 | N/A* | N/A* |
| 20 | 5,048 | 1,985 | 412 | 152 |
| 21 | 5,045 | 2,037 | 437 | 155 |
| 22 | 15,715 | 5,485 | 997 | 280 |
| 23 | 9,682 | 3,440 | 941 | 209 |
| 24 | 7,373 | 1,890 | 657 | 124 |
| 25 | 2,663 | 569 | 206 | 42 |
| 26 | 99 | 18 | 11 | 2 |
| 27 | 63 | 6 | 10 | 0 |
| 28 | 30 | 7 | 4 | 1 |

```

army4_clean$PayGrade <- valid_paygrades

#add paygrades into fit
army4_clean3 <- army4_clean %>%
  mutate(across(-PayGrade, ~ as.numeric(gsub(", ", "", .x)))))

#Make long
army4_long <- army4_clean3 %>%
  pivot_longer(
    cols = -PayGrade,
    names_to = c("Branch", "Gender"),
    names_sep = "_",
    values_to = "Count"
  )
army4_long

```

```

# A tibble: 240 x 4
  PayGrade Branch      Gender Count
  <chr>     <chr>      <chr>   <dbl>
1 E1        Army       Male    7429
2 E1        Army       Female  1326
3 E1        Navy       Male    8903
4 E1        Navy       Female  3434
5 E1        Marines    Male    7849
6 E1        Marines    Female  655
7 E1        AirForce   Male    8537
8 E1        AirForce   Female  1933
9 E1        SpaceForce Male     179
10 E1       SpaceForce Female    38
# i 230 more rows

```

```

# drop na
army4_na <- army4_long %>%
  filter(!is.na(Count))

```

```
#uncount
army_soldiers <- army4_na %>%
  tidyverse::uncount(weights = Count)
army_soldiers
```

```
# A tibble: 1,298,720 x 3
  PayGrade Branch Gender
  <chr>     <chr>   <chr>
1 E1        Army    Male
2 E1        Army    Male
3 E1        Army    Male
4 E1        Army    Male
5 E1        Army    Male
6 E1        Army    Male
7 E1        Army    Male
8 E1        Army    Male
9 E1        Army    Male
10 E1       Army    Male
# i 1,298,710 more rows
```

```
#male frequency
male_freq <- army_soldiers %>%
  filter(Gender == "Male") %>%
  count/Branch, PayGrade) %>%
  group_by/Branch) %>%
  mutate(Relative_Frequency = n / sum(n)) %>%
  ungroup()
male_freq
```

```
# A tibble: 111 x 4
  Branch  PayGrade      n Relative_Frequency
  <chr>    <chr>    <int>          <dbl>
1 AirForce E1      8537      0.0344
2 AirForce E2      7343      0.0296
3 AirForce E3     37324      0.150
4 AirForce E4     53185      0.214
5 AirForce E5     40614      0.164
6 AirForce E6     31400      0.126
7 AirForce E7     18309      0.0737
8 AirForce E8      3876      0.0156
9 AirForce E9      1903      0.00766
10 AirForce O1      60      0.000242
# i 101 more rows
```

```
#female frequency
female_freq <- army_soldiers %>%
  filter(Gender == "Female") %>%
  count/Branch, PayGrade) %>%
  group_by/Branch) %>%
  mutate(Relative_Frequency = n / sum(n)) %>%
  ungroup()
female_freq
```

```
# A tibble: 110 x 4
  Branch   PayGrade     n Relative_Frequency
  <chr>    <chr>    <int>          <dbl>
1 AirForce E1        1933      0.0281
2 AirForce E2        2019      0.0293
3 AirForce E3       10369      0.151
4 AirForce E4       15055      0.219
5 AirForce E5       10762      0.156
6 AirForce E6        6679      0.0971
7 AirForce E7        4807      0.0699
8 AirForce E8        1221      0.0177
9 AirForce E9         523      0.00760
10 AirForce O1        2        0.0000291
# i 100 more rows
```

```
chosen_branch <- "Army"

branch_freq <- bind_rows(
  male_freq %>% mutate(Sex = "Male"),
  female_freq %>% mutate(Sex = "Female")
) %>%
  filter/Branch == chosen_branch)

freq_table_output <- branch_freq %>%
  select(Sex, PayGrade, Relative_Frequency) %>%
  tidyrr::pivot_wider(
    names_from = PayGrade,
    values_from = Relative_Frequency,
    values_fill = 0
)
```

```
data("BabyNames")

selected_names <- c("Emma", "Olivia", "Jacob", "Noah", "Lucas", "Zachary")
```

```

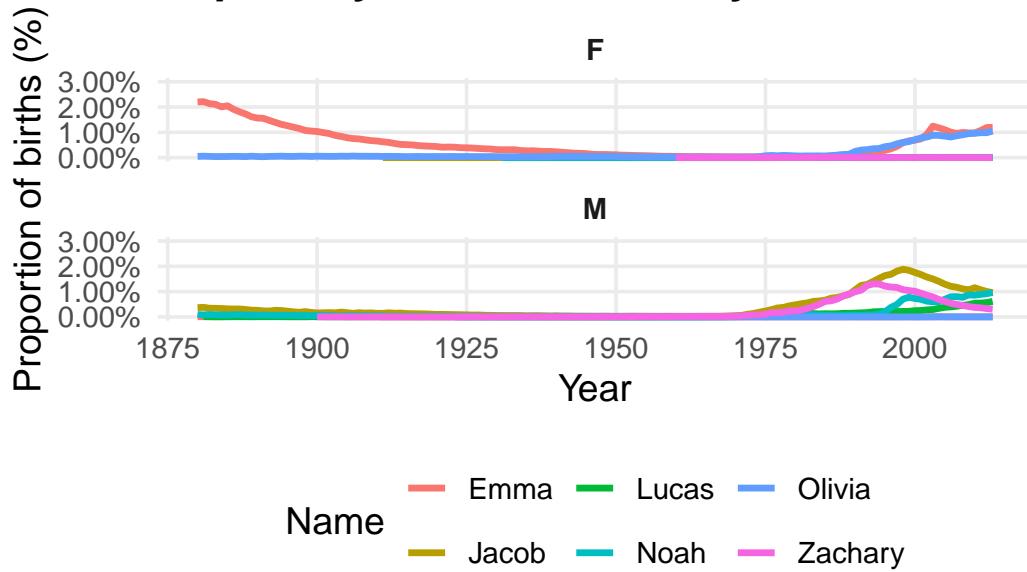
totals <- BabyNames %>%
  group_by(year, sex) %>%
  summarise(total_births = sum(count), .groups = "drop")

name_trends <- BabyNames %>%
  filter(name %in% selected_names) %>%
  group_by(year, sex, name) %>%
  summarise(name_count = sum(count), .groups = "drop") %>%
  left_join(totals, by = c("year", "sex")) %>%
  mutate(prop = name_count / total_births)

baby_chart <- ggplot(name_trends, aes(x = year, y = prop, color = name)) +
  geom_line(linewidth = 1.2) +
  facet_wrap(~ sex, ncol = 1) +
  scale_y_continuous(
    labels = scales::percent_format(accuracy = 0.01),
    limits = c(0, 0.03)
  ) +
  labs(
    title = "Popularity of Selected Baby Names Over Time",
    x = "Year",
    y = "Proportion of births (%)",
    color = "Name"
  ) +
  theme_minimal(base_size = 14) +
  theme(
    plot.title = element_text(face = "bold"),
    legend.position = "bottom",
    panel.grid.minor = element_blank(),
    strip.text = element_text(face = "bold")
  )
baby_chart

```

Popularity of Selected Baby Names Over Time



```

box_prob <- function(x,len,wid){
  new_len = len - 2*x
  new_wid = wid - 2*x
  volume = new_len * new_wid * x
  return(volume)
}

x_range <- data.frame(x = seq(from = 0, to = 18, by = 0.1))
# update to ggplot
box_plot <- ggplot(
  data = x_range,
  mapping = aes(x = x)
) +
  stat_function(
    fun = box_prob,
    args = list(len = 36, wid = 48),
    linewidth = 1.2,
    color = "#1B69AF"
) +
  labs(
    title = "Volume of an Box, 36 x 48 Inch Sheet",
    x = "Cut Size (inches)",
    y = "Volume (cubic inches)",
    alt = "A smooth curve showing the volume of an open-top box as a function of cut-out size"
) +
  theme_minimal(base_size = 13)
  
```

```
x_vol_vals <- seq(0,18,.001)
volume_interval <- box_prob(x_vol_vals, 36, 48)
max_volume <- max(volume_interval)
optimal_x <- x_vol_vals[which.max(volume_interval)]
max_volume
```

[1] 5239.819

```
optimal_x
```

[1] 6.789