

MyFirstQMD

Zach Thomas

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.

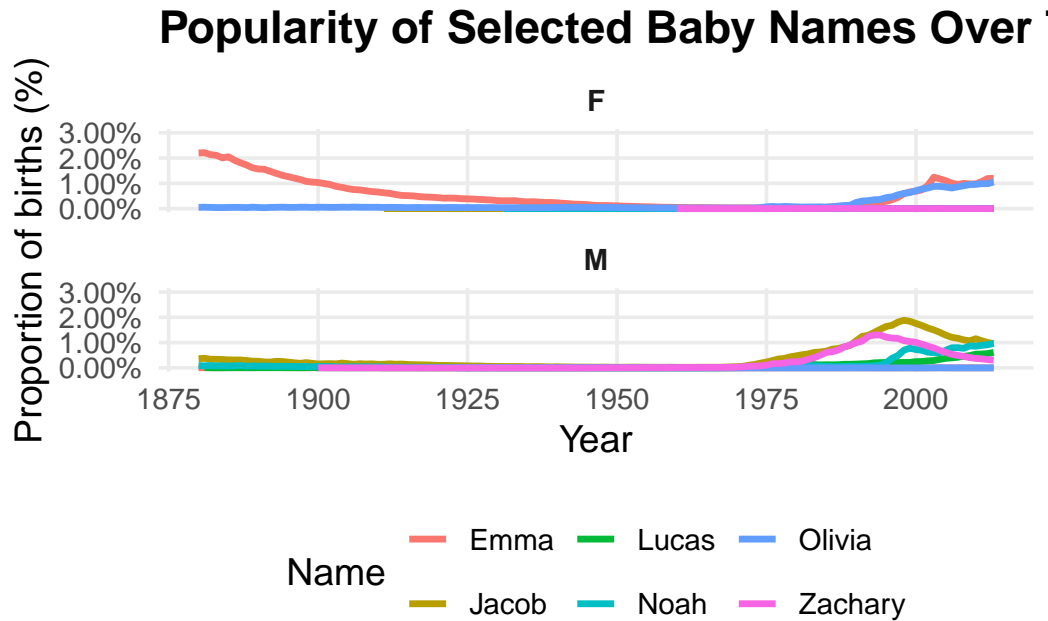
```
# A tibble: 2 x 25
  Sex      E1      E2      E3      E4      E5      E6      E7      E8      E9      O1
<chr> <dbl> <dbl> <dbl> <dbl> <dbl> <dbl> <dbl> <dbl> <dbl> <dbl>
1 Male  0.0191 0.0574 0.113 0.204 0.141 0.127 0.0778 0.0244 0.00737 0.0371
2 Female 0.0176 0.0574 0.135 0.201 0.145 0.0975 0.0584 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.

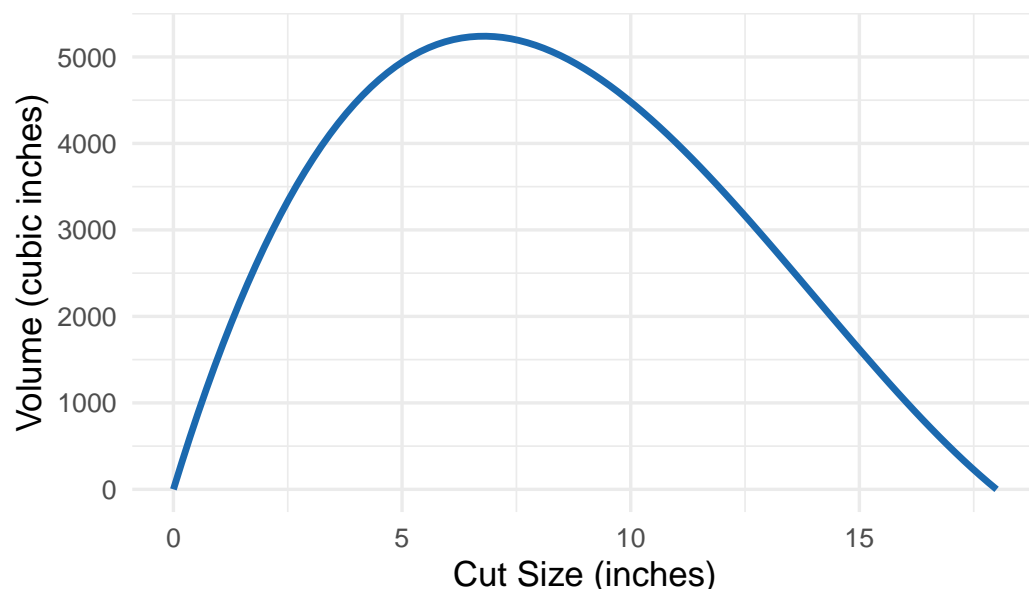


Here we see our chart show some very interesting trends. Firstly, a description of the chart. We see each name have its own unique color and line on both chart that helps us to see some interesting things. We also use percentage as it gives a better overall view compared to time, there are more babies 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.

Volume of an Box, 36 × 48 Inch Sheet



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	Male
4	E1	7,429
5	E2	22,338
6	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
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

	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$V1
valid_paygrades <- paygrades[grepl("^[EW0]\\d+$", 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 Grade	Male
4	E1	7,429
5	E2	22,338
6	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 %>%
  tidyr::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) %>%
  tidyr::pivot_wider(
    names_from = PayGrade,
    values_from = Relative_Frequency,
    values_fill = 0
  )
```

```
data("BabyNames")
```

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

```

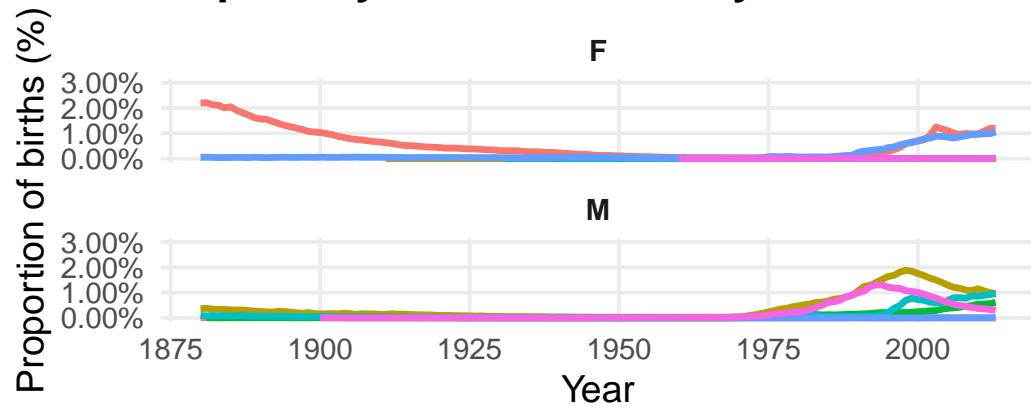
totals <- BabyNames %>%
  group_by(year, sex) %>%
  summarise(total_births = sum(count), .groups = "drop")

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



Name

Emma Lucas Olivia

Jacob Noah Zachary

```
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 × 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
```