

Bash <3's CSVs

Command line data analysis

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csv,conf 2019



Who am I?

- Database infrastructure @GitHub
- github.com/nickcanz
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Who am I?



@nick_canz

Bash isn't great for **everything**



reddit.com/r/pics/comments/53k48s
by /u/NoUsernamHere

@nick_canz

Why use bash?

“Command-line Tools can be 235x Faster than your Hadoop Cluster”

<https://adamdrake.com/command-line-tools-can-be-235x-faster-than-your-hadoop-cluster.html>

Since the data volume was **only about 1.75GB** containing around 2 million chess games,

for the same amount of data I was able to use my laptop to get the results in about **12 seconds** while the Hadoop processing took about **26 minutes**



When is Bash a good choice?

- New York city, New York, 8537673
- Los Angeles city, California, 3976322
- Chicago city, Illinois, 2704958

When is Bash a good choice?

New York city, New York, 8537673

Los Angeles city, California, 3976322

Chicago city, Illinois, 2704958

First step: peeking at the data

```
$ head -n2 populations.csv
```

```
New York city,New York,8537673
```

```
Los Angeles city,California,3976322
```

...sort of like

```
SELECT * FROM populations  
LIMIT 2
```


First step: peeking at the data

```
$ tail -n2 populations.csv
```

```
Saginaw city,Michigan,48984
```

```
Niagara Falls city,New York,48632
```

...sort of like

```
SELECT * FROM populations  
ORDER BY DESC  
LIMIT 2
```

First step: peeking at the data

```
$ wc -l populations.csv  
    761 populations.csv
```

...sort of like

```
SELECT count(*)  
FROM populations
```

First step: peeking at the data

```
$ wc -l populations.csv      Count lines  
761 populations.csv
```

```
$ wc -m populations.csv      Count characters  
23643 populations.csv
```

```
$ wc -w populations.csv      Count words  
1849 populations.csv
```

First step: peeking at the data

```
$ head -n2 populations.csv
```

```
New York city,New York,8537673
```

```
Los Angeles city,California,3976322
```

```
$ tail -n2 populations.csv
```

```
Saginaw city,Michigan,48984
```

```
Niagara Falls city,New York,48632
```

```
$ wc -l populations.csv
```

```
761 populations.csv
```


Getting the lines you want

```
$ grep Pennsylvania populations.csv  
Philadelphia city,Pennsylvania,1567872  
Pittsburgh city,Pennsylvania,303625  
Allentown city,Pennsylvania,120443
```

...sort of like

```
SELECT * FROM populations  
WHERE row like 'Pennsylvania'
```

Excluding the lines you don't want

```
$ grep -v city populations.csv
```

```
Urban Honolulu CDP,Hawaii,351792
```

```
Lexington-Fayette urban county,Kentucky,318449
```

```
Anchorage municipality,Alaska,298192
```

...sort of like

```
SELECT * FROM populations  
WHERE row not like 'city'
```

Get the fields you want

```
New York city,New York,8537673
```

```
Los Angeles city,California,3976322
```

```
$ cut -d', ' -f1,3 populations.csv
```

```
New York city,8537673
```

```
Los Angeles city,3976322
```

Get the fields you want

```
[17/May/2015:08:05:32 +0000] "GET /downloads/product_1 HTTP/1.1" 304
```

```
$ cut -d' ' -f1 nginx.log
```

```
[17/May/2015:08:05:32
```

```
$ cut -d' ' -f1 nginx.log | cut -d':' -f2-
```

```
08:05:32
```


Organizing your data

```
$ sort populations.csv | head -n 5
```

```
Abilene city,Texas,122225
```

```
Akron city,Ohio,197633
```

```
Alameda city,California,78906
```

```
Albany city,Georgia,73801
```

```
Albany city,New York,98111
```

Organizing your data

```
$ sort -t',' -k2,2 populations.csv
```

```
Auburn city,Alabama,63118
```

```
Birmingham city,Alabama,212157
```

```
Decatur city,Alabama,55072
```

```
Dothan city,Alabama,68468
```

```
Hoover city,Alabama,84978
```

Organizing your data

```
$ sort -t', ' -k2,2 -k3,3nr populations.csv
```

```
Birmingham city,Alabama,212157  
Montgomery city,Alabama,200022  
Huntsville city,Alabama,193079  
Mobile city,Alabama,192904  
Tuscaloosa city,Alabama,99543
```

What are the biggest cities by state?

```
$ sort -t', ' -k2,2 -k3,3nr populations.csv |  
  sort -u -t', ' -k2,2
```

```
Birmingham city,Alabama,212157  
Anchorage municipality,Alaska,298192  
Phoenix city,Arizona,1615017  
Little Rock city,Arkansas,198541  
Los Angeles city,California,3976322  
Denver city,Colorado,693060
```


How many cities per state?

```
$ cut -d',' -f2 populations.csv | Get only the state field  
sort | Sort it  
uniq -c | Get the unique values and count  
sort -nr Sort by number descending
```

```
178 California  
65 Texas  
57 Florida  
29 Illinois  
25 Michigan
```

Where does Portland rank?

Sort the file by population

```
$ sort -t', ' -k3,3nr populations.csv |  
  grep -n Portland
```

Find Portland and its number in the list

```
26:Portland city,Oregon,639863
```

```
537:Portland city,Maine,66937
```

Working with multiple files

```
$ cat fips_and_city.csv  
06,Los Angeles  
06,San Francisco  
12,Miami  
12,Orlando  
42,Philadelphia  
42,Pittsburgh
```

```
$ cat fips_and_state.csv  
06,California  
12,Florida  
42,Pennsylvania
```

Working with multiple files

```
$ cat fips_and_city.csv
```

```
06,Los Angeles
```

```
06,San Francisco
```

```
12,Miami
```

```
12,Orlando
```

```
42,Philadelphia
```

```
42,Pittsburgh
```

```
$ cat fips_and_state.csv
```

```
06,California
```

```
12,Florida
```

```
42,Pennsylvania
```

```
$ join -t',' fips_and_city.csv fips_and_state.csv
```

```
06,Los Angeles,California
```

```
06,San Francisco,California
```

```
12,Miami,Florida
```

```
12,Orlando,Florida
```

```
42,Philadelphia,Pennsylvania
```

```
42,Pittsburgh,Pennsylvania
```


Working with multiple files

```
$ cat cities.csv
```

```
Philadelphia
```

```
New York
```

```
Austin
```

```
$ cat foods.csv
```

```
Cheesesteak
```

```
Pizza
```

```
Brisket
```

```
$ paste -d',' cities.csv foods.csv
```

```
Philadelphia,Cheesesteak
```

```
New York,Pizza
```

```
Austin,Brisket
```

```
$ paste -s -d',' cities.csv foods.csv
```

```
Philadelphia,New York,Austin
```

```
Cheesesteak,Pizza,Brisket
```

Working with multiple files

```
$ seq 1 5
```

```
1
```

```
2
```

```
3
```

```
4
```

```
5
```

```
$ paste -d, <(seq 1 5) <(head -n5 populations.csv)
```

```
1,New York city,New York,8537673
```

```
2,Los Angeles city,California,3976322
```

```
3,Chicago city,Illinois,2704958
```

```
4,Houston city,Texas,2303482
```

```
5,Phoenix city,Arizona,1615017
```

Comparing files

```
$ comm ohio_cities.csv missouri_cities.csv
```

Akron city

Cincinnati city

Cleveland city

Columbus city

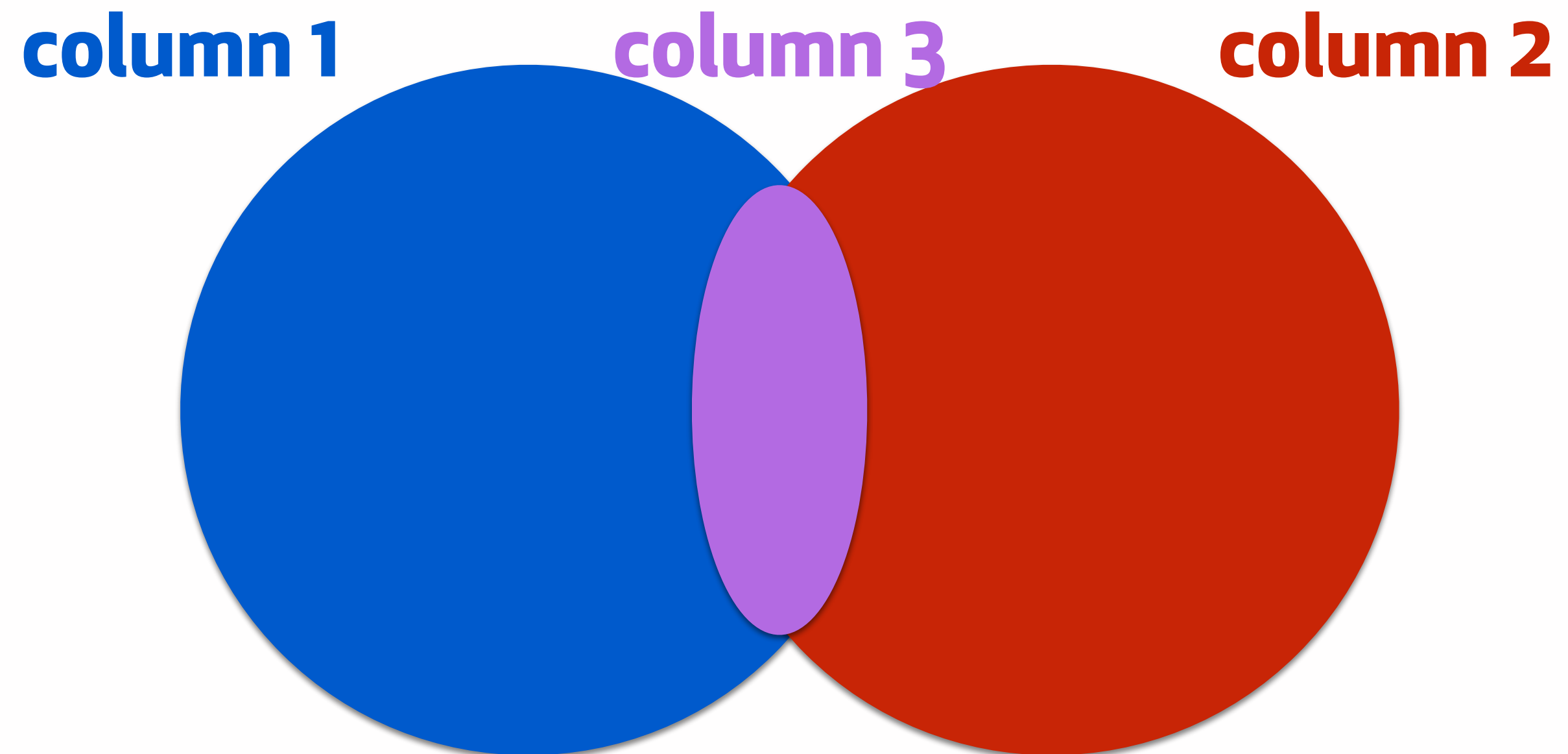
Joplin city

Kansas City city

O'Fallon city

Springfield city

St. Louis city

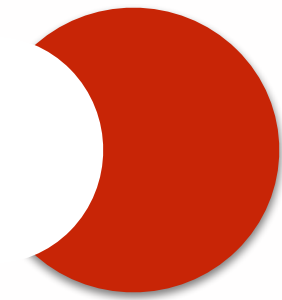


Comparing files

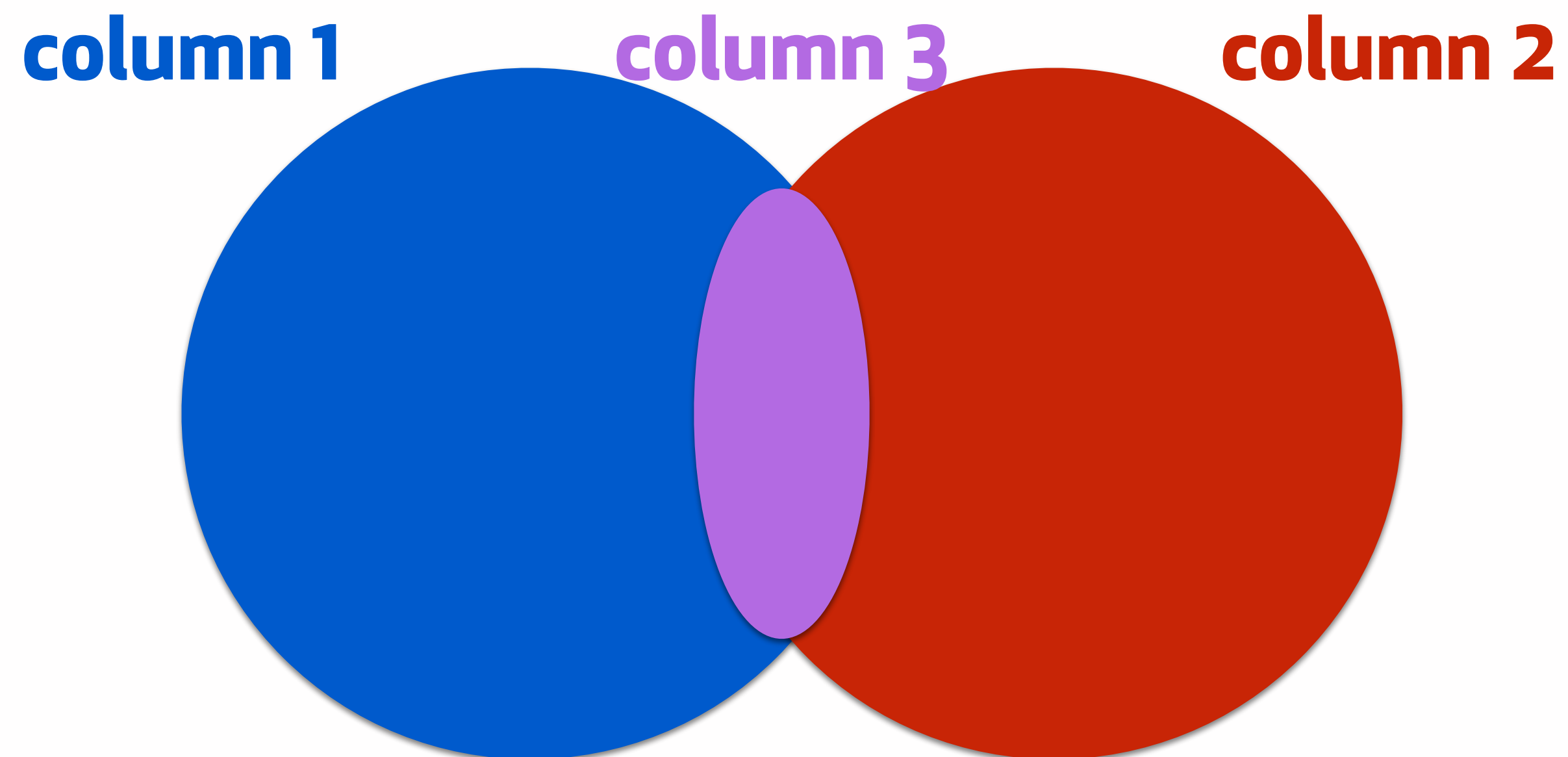
\$ comm -23 ohio_cities.csv missouri_cities.csv



\$ comm -13 ohio_cities.csv missouri_cities.csv



\$ comm -12 ohio_cities.csv missouri_cities.csv



Dealing with cleanup

Brookhaven city,Georgia,52444

Minnetonka city,Minnesota,52369

Palm Desert city,California,52231

```
$ sed 's/ city//' populations.csv
```

Brookhaven,Georgia,52444

Minnetonka,Minnesota,52369

Palm Desert,California,52231

Dealing with cleanup

```
$ echo 'A B C' | tr ' ' '\n'
```

A

B

C

```
$ echo 'APPLE PEAR' | tr '[:upper:]' '[:lower:]'
```

apple pear

```
$ echo '0 1 2' | tr '[0-8]' '[1-9]'
```

1 2 3

Practical example time



A nice dataset

```
$ head populations.csv
```

```
New York city,New York,8537673
```

```
Los Angeles city,California,3976322
```

```
Chicago city,Illinois,2704958
```

```
Houston city,Texas,2303482
```

```
Phoenix city,Arizona,1615017
```

```
Philadelphia city,Pennsylvania,1567872
```

```
San Antonio city,Texas,1492510
```

```
San Diego city,California,1406630
```

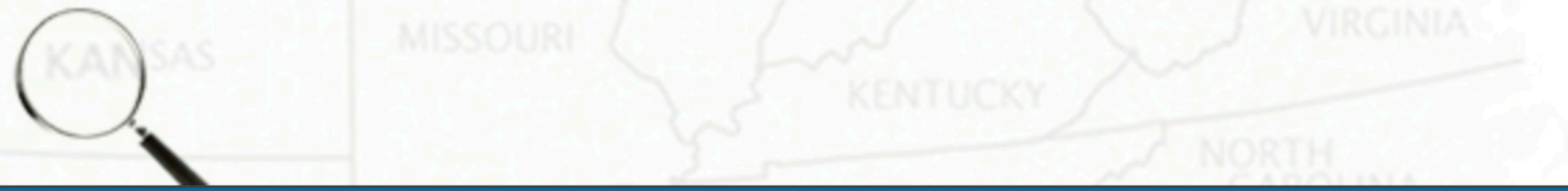
```
Dallas city,Texas,1317929
```

```
San Jose city,California,1025350
```

Where to get the data?

United States™
Census
Bureau

AMERICAN
FactFinder



MAIN

COMMUNITY FACTS

GUIDED SEARCH

ADVANCED SEARCH

DOWNLOAD CENTER

Advanced Search - Search all data in American FactFinder

1 Advanced Search


2 Table Viewer

Result 1 of 1







PEPANRSIP

Annual Estimates of the Resident Population for Incorporated Places of 50,000 or More, Ranked by July 1, 2016 Population: April 1, 2010 to July 1, 2016 - United States -- Places of 50,000+ Population ⓘ


2016 Population Estimates

Table View 

◀ B

Actions:  [Modify Table](#) |  [Add/Remove Geographies](#) |  [Bookmark/Save](#) |  [Print](#) |  [Download](#) |  [Create a Map](#)

This table is displayed with default geographies. ⓘ
Click Back to Search to select other geographies using the search options on the left.

 [View Geography](#)

Versions of this table are available for the following years:

2017

2016 ▶

2015

2014

2013

2012

Geography: United States ⌵

Rank	Geography	April 1, 2010		Population Estimate (as of July 1)						
		Census	Estimates Base	2010	2011	2012	2013	2014	2015	2016
1	United States									
1	New York city, New York	8,175,133	8,174,962	8,192,026	8,284,098	8,361,179	8,422,460	8,471,990	8,516,502	8,537,673
2	Los Angeles city, California	3,792,621	3,792,584	3,796,292	3,825,393	3,858,137	3,890,436	3,920,173	3,949,149	3,976,322
3	Chicago city, Illinois	2,695,598	2,695,620	2,697,736	2,705,404	2,714,120	2,718,887	2,718,530	2,713,596	2,704,958
4	Houston city, Texas	2,099,451	2,100,277	2,105,625	2,132,157	2,166,458	2,204,406	2,243,999	2,284,816	2,303,482
5	Phoenix city, Arizona	1,445,632	1,447,624	1,450,629	1,469,353	1,499,007	1,525,562	1,554,179	1,582,904	1,615,017
6	Philadelphia city, Pennsylvania	1,526,006	1,526,006	1,528,427	1,539,022	1,550,379	1,555,868	1,560,609	1,564,964	1,567,872
7	San Antonio city, Texas	1,327,407	1,327,538	1,333,952	1,359,002	1,385,250	1,411,652	1,439,150	1,468,037	1,492,510
8	San Diego city, California	1,307,402	1,301,722	1,306,153	1,320,686	1,338,983	1,358,242	1,379,299	1,390,915	1,406,630
9	Dallas city, Texas	1,197,816	1,197,824	1,200,711	1,218,664	1,241,624	1,258,016	1,277,376	1,297,327	1,317,929

A not nice dataset

```
$ head PEP_2016_PEPANNRSIP.US12A_with_ann.csv
GEO.id,GEO.id2,GEO.display-label,GC_RANK.target-geo-id,GC_RANK.target-geo-id2,GC_RANK.rank-label,GC_RANK
label,rescensus42010,resbase42010,resp72010,resp72011,resp72012,resp72013,resp72014,resp72015
Id,Id2,Geography,Target Geo Id,Target Geo Id2,Rank,Geography,Geography,"April 1, 2010 - Census","April 1
2011,Population Estimate (as of July 1) - 2012,Population Estimate (as of July 1) - 2013,Population Estim
010000US,,United States,1620000US3651000,3651000,1,"United States - New York city, New York","New York
010000US,,United States,1620000US0644000,0644000,2,"United States - Los Angeles city, California","Los
010000US,,United States,1620000US1714000,1714000,3,"United States - Chicago city, Illinois","Chicago ci
```


Making our nice dataset

```
$ cat PEP_2016_PEPANNRSIP.US12A_with_ann.csv |  
    tail -n +3
```

Remove the two(?) header lines

```
0100000US,,United States,1620000US3651000,3651000,1,"United States - New York city, New York","Ne  
0100000US,,United States,1620000US0644000,0644000,2,"United States - Los Angeles city, California  
0100000US,,United States,1620000US1714000,1714000,3,"United States - Chicago city, Illinois","Chi  
0100000US,,United States,1620000US4835000,4835000,4,"United States - Houston city, Texas","Housto
```


Making our nice dataset

```
$ cat PEP_2016_PEPANNRSIP.US12A_with_ann.csv |  
    tail -n +3 |  
    cut -d',' -f9,10,19
```

Get the fields we want

```
"New York city, New York",8537673  
"Los Angeles city, California",3976322  
"Chicago city, Illinois",2704958  
"Houston city, Texas",2303482  
"Phoenix city, Arizona",1615017
```

Making our nice dataset

```
$ cat PEP_2016_PEPANNRSIP.US12A_with_ann.csv |  
    tail -n +3 |  
    cut -d',' -f9,10,19 |  
    sed 's/"//g'    Clean up the quotes
```

```
New York city, New York,8537673  
Los Angeles city, California,3976322  
Chicago city, Illinois,2704958  
Houston city, Texas,2303482  
Phoenix city, Arizona,1615017
```

Making our nice dataset

```
$ cat PEP_2016_PEPANNRSIP.US12A_with_ann.csv |  
  tail -n +3 |  
  cut -d',' -f9,10,19 |  
  sed 's/"/"/g' |  
  sed 's/, /,/ ' Remove leading space in state column
```

```
New York city,New York,8537673  
Los Angeles city,California,3976322  
Chicago city,Illinois,2704958  
Houston city,Texas,2303482  
Phoenix city,Arizona,1615017
```

Making our nice dataset

```
$ cat PEP_2016_PEPANNRSIP.US12A_with_ann.csv |  
  tail -n +3 |  
  cut -d',' -f9,10,19 |  
  sed 's/"/"/g' |  
  sed 's/, //' > populations.csv
```

Save it all to a file!

Shakespeare word count

```
$ cat shakespeare.txt |  
tr -d -c '[:alpha:][:space:]' |  
tr -s '[:space:]' ' ' |  
tr ' ' '\n' |  
tr '[:upper:]' '[:lower:]' |  
sort | uniq -c |  
sort -nr
```

```
27825 the  
26791 and  
20681 i  
19261 to  
18289 of  
14668 a  
13716 you  
12481 my  
11135 that  
11027 in  
9621 is  
...  
1 foiled  
1 foemens  
1 foemans  
1 foeman  
1 fodder
```



Thanks!

Talk materials
github.com/nickcanz/csvconf2019

@nick_canz on twitter

