

727_assignment4

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GitHub

https://github.com/tzihan/-tzihan-727_assignment4

This is an individual assignment. Turn in this assignment as an HTML or PDF file to ELMS. Make sure to include the R Markdown or Quarto file that was used to generate it. Include the GitHub link for the repository containing these files.

In this notebook we will use Google BigQuery, “Google’s fully managed, petabyte scale, low cost analytics data warehouse”. Some instruction on how to connect to Google BigQuery can be found here: <https://db.rstudio.com/databases/big-query/>.

You will need to set up a Google account with a project to be able to use this service. We will be using a public dataset that comes with 1 TB/mo of free processing on Google BigQuery. As long as you do not repeat the work in this notebook constantly, you should be fine with just the free tier.

Go to <https://console.cloud.google.com> and make sure you are logged in a non-university Google account. **This may not work on a university G Suite account because of restrictions on those accounts.** Create a new project by navigating to the dropdown menu at the top (it might say “Select a project”) and selecting “New Project” in the window that pops up. Name it something useful.

After you have initialized a project, paste your project ID into the following chunk.

```
project <- "134852696833"
```

We will connect to a public database, the Chicago crime database, which has data on crime in Chicago.

```
con <- dbConnect(  
  bigrquery::bigrquery(),  
  project = "bigquery-public-data",  
  dataset = "chicago_crime",  
  billing = project  
)  
con
```

```
<BigQueryConnection>  
Dataset: bigquery-public-data.chicago_crime  
Billing: 134852696833
```

We can look at the available tables in this database using `dbListTables`.

Note: When you run this code, you will be sent to a browser and have to give Google permissions to Tidyverse API Packages. **Make sure you select all to give access or else your code will not run.**

```
dbListTables(con)
```

```
! Using an auto-discovered, cached token.
```

To suppress this message, modify your code or options to clearly consent to the use of a cached token.

See `gargle`'s "Non-interactive auth" vignette for more details:

```
<https://gargle.r-lib.org/articles/non-interactive-auth.html>
```

i The `bigrquery` package is using a cached token for 'totoro.busstop@gmail.com'.

```
[1] "crime"
```

Information on the 'crime' table can be found here:

<https://cloud.google.com/bigquery/public-data/chicago-crime-data>

Write a first query that counts the number of rows of the 'crime' table in the year 2016. Use code chunks with {sql connection = con} in order to write SQL code within the document.

```

SELECT count(primary_type) AS primary_count, count(*) AS overall_count -- counting non-missing
FROM crime
WHERE year = 2016
LIMIT 10;

```

Table 1: 1 records

primary_count	overall_count
269937	269937

Next, count the number of arrests grouped by `primary_type` in 2016. Note that is a somewhat similar task as above, with some adjustments on which rows should be considered. Sort the results, i.e. list the number of arrests in a descending order.

```

SELECT primary_type,
COUNT(*) AS arrest_count
FROM crime
WHERE year = 2016
AND arrest = TRUE
GROUP BY primary_type
ORDER BY arrest_count DESC;

```

Table 2: Displaying records 1 - 10

primary_type	arrest_count
NARCOTICS	13327
BATTERY	10334
THEFT	6522
CRIMINAL TRESPASS	3724
ASSAULT	3494
OTHER OFFENSE	3416
WEAPONS VIOLATION	2510
CRIMINAL DAMAGE	1669
PUBLIC PEACE VIOLATION	1116
MOTOR VEHICLE THEFT	1098

We can also use the `date` for grouping. Count the number of arrests grouped by hour of the day in 2016. You can extract the latter information from `date` via `EXTRACT(HOUR FROM date)`. Which time of the day is associated with the most arrests?

```

SELECT EXTRACT(HOUR FROM date) AS hour_of_day,
COUNT(*) AS arrest_count
FROM crime
WHERE year = 2016
AND arrest = TRUE
GROUP BY hour_of_day
ORDER BY arrest_count DESC;

```

Table 3: Displaying records 1 - 10

hour_of_day	arrest_count
19	3843
18	3482
20	3303
21	2962
16	2933
22	2896
11	2893
17	2821
12	2788
14	2775

- Based on the table, 7 P.M. (19:00) is the hour with the most arrests.

Focus only on HOMICIDE and count the number of arrests for this incident type, grouped by year. List the results in descending order.

```

SELECT year,
COUNT(*) AS arrest_count
FROM crime
WHERE primary_type = 'HOMICIDE'
AND arrest = TRUE
GROUP BY year
ORDER BY arrest_count DESC;

```

Table 4: Displaying records 1 - 10

year	arrest_count
2001	431
2002	428

year	arrest_count
2003	386
2020	356
2022	321
2021	296
2004	294
2016	292
2008	288
2006	284

Find out which districts have the highest numbers of arrests in 2015 and 2016. That is, count the number of arrests in 2015 and 2016, grouped by year and district. List the results in descending order.

```
SELECT year, district,
COUNT(*) AS arrest_count
FROM crime
WHERE year IN (2015, 2016)
AND arrest = TRUE
GROUP BY year, district
ORDER BY arrest_count DESC;
```

Table 5: Displaying records 1 - 10

year	district	arrest_count
2015	11	8975
2016	11	6578
2015	7	5549
2015	15	4514
2015	6	4476
2015	25	4451
2015	4	4326
2015	8	4115
2016	7	3656
2015	10	3628

Lets switch to writing queries from within R via the DBI package. Create a query object that counts the number of arrests grouped by `primary_type` of district 11 in year 2016. The results should be displayed in descending order.

Execute the query.

```

query <-
" SELECT primary_type,
      COUNT(*) AS arrest_count
  FROM `bigquery-public-data.chicago_crime.crime`
 WHERE year = 2016
   AND district = 11
   AND arrest = TRUE
 GROUP BY primary_type
 ORDER BY arrest_count DESC
"
results <- dbGetQuery(con, query)

head(results, 10)

```

```

# A tibble: 10 x 2
  primary_type              arrest_count
  <chr>                      <int>
1 NARCOTICS                  3634
2 BATTERY                     635
3 PROSTITUTION                 511
4 WEAPONS VIOLATION            303
5 OTHER OFFENSE                  255
6 ASSAULT                      207
7 CRIMINAL TRESPASS                205
8 PUBLIC PEACE VIOLATION             135
9 INTERFERENCE WITH PUBLIC OFFICER        119
10 CRIMINAL DAMAGE                   106

```

Try to write the very same query, now using the `dplyr` package. For this, you need to first map the `crime` table to a tibble object in R.

```
crime_tbl <- tbl(con, "crime")
```

Again, count the number of arrests grouped by `primary_type` of district 11 in year 2016, now using `dplyr` syntax.

```

crime_tbl %>%
  filter(year == 2016, district == 11, arrest == TRUE) %>%
  group_by(primary_type) %>%
  summarize(arrest_count = n()) %>%
  arrange(desc(arrest_count)) %>%

```

```
collect() %>%
head(10)
```

```
# A tibble: 10 x 2
  primary_type              arrest_count
  <chr>                      <int>
1 NARCOTICS                  3634
2 BATTERY                     635
3 PROSTITUTION                 511
4 WEAPONS VIOLATION            303
5 OTHER OFFENSE                   255
6 ASSAULT                      207
7 CRIMINAL TRESPASS                205
8 PUBLIC PEACE VIOLATION             135
9 INTERFERENCE WITH PUBLIC OFFICER      119
10 CRIMINAL DAMAGE                  106
```

Count the number of arrests grouped by `primary_type` and `year`, still only for district 11. Arrange the result by `year`.

```
crime_tbl %>%
  filter(district == 11, arrest == TRUE) %>%
  group_by(year, primary_type) %>%
  summarise(arrest_count = n()) %>%
  arrange(year) %>%
  collect() %>%
  head(10)
```

``summarise()` has grouped output by "year". You can override using the
.groups` argument.`

```
# A tibble: 10 x 3
# Groups:   year [1]
  year primary_type              arrest_count
  <int> <chr>                      <int>
1 2001 GAMBLING                  71
2 2001 BURGLARY                   42
3 2001 KIDNAPPING                   4
4 2001 STALKING                     1
5 2001 ROBBERY                     97
```

6	2001 NARCOTICS	7979
7	2001 MOTOR VEHICLE THEFT	179
8	2001 INTERFERENCE WITH PUBLIC OFFICER	14
9	2001 LIQUOR LAW VIOLATION	49
10	2001 CRIM SEXUAL ASSAULT	17

Assign the results of the query above to a local R object.

```
district11_2016_arrests_type <- crime_tbl %>%
  filter(year == 2016, district == 11, arrest == TRUE) %>%
  group_by(primary_type) %>%
  summarize(arrest_count = n()) %>%
  arrange(desc(arrest_count)) %>%
  collect()
```

```
district11_arrests_type_year <- crime_tbl %>%
  filter(district == 11, arrest == TRUE) %>%
  group_by(year, primary_type) %>%
  summarize(arrest_count = n()) %>%
  arrange(year) %>%
  collect()
```

`summarise()` has grouped output by "year". You can override using the `.`groups` argument.

Confirm that you pulled the data to the local environment by displaying the first ten rows of the saved data set.

```
head(district11_2016_arrests_type, 10)
```

```
# A tibble: 10 x 2
  primary_type          arrest_count
  <chr>                  <int>
1 NARCOTICS                3634
2 BATTERY                   635
3 PROSTITUTION                 511
4 WEAPONS VIOLATION            303
5 OTHER OFFENSE                  255
6 ASSAULT                      207
7 CRIMINAL TRESPASS                 205
```

8 PUBLIC PEACE VIOLATION	135
9 INTERFERENCE WITH PUBLIC OFFICER	119
10 CRIMINAL DAMAGE	106

```
head(district11_arrests_type_year, 10)
```

```
# A tibble: 10 x 3
# Groups:   year [1]
  year primary_type      arrest_count
  <int> <chr>            <int>
1 2001 GAMBLING           71
2 2001 BURGLARY           42
3 2001 KIDNAPPING          4
4 2001 STALKING             1
5 2001 ROBBERY            97
6 2001 NARCOTICS          7979
7 2001 MOTOR VEHICLE THEFT 179
8 2001 INTERFERENCE WITH PUBLIC OFFICER 14
9 2001 LIQUOR LAW VIOLATION 49
10 2001 CRIM SEXUAL ASSAULT 17
```

Close the connection.

```
dbDisconnect(con)
```