# Assignment 3

*Rui Qin 30874157*

## Task A

We first enter the folder which contains the Task A data file.

```
cd C:

cd A3/TaskA
```

### 1)

We using tar -xf to decompress the tar file

```
tar -xf dataset_TIST2015.tar
```

Then we list the document with 'ls'

```
$ ls
dataset_TIST2015.tar              dataset_TIST2015_POIs.txt
dataset_TIST2015_Checkins_v2.txt  dataset_TIST2015_readme_v2.txt
dataset_TIST2015_Cities.txt
```

There are **4 txt files** in the tar file. Now we can check the size of them with -lh, it will print the size and time it created.

```
Qr140@AllEN /cygdrive/c/A3/TaskA
$ ls -lh dataset_TIST2015_POIs.txt
-rwxrwxr-x+ 1 Qr140 Qr140 222M Aug 12  2015 dataset_TIST2015_POIs.txt

Qr140@AllEN /cygdrive/c/A3/TaskA
$ ls -lh dataset_TIST2015_Checkins_v2.txt
-rwxrwxr-x+ 1 Qr140 Qr140 2.1G Oct  6 21:53 dataset_TIST2015_Checkins_v2.txt

Qr140@AllEN /cygdrive/c/A3/TaskA
$ ls -lh dataset_TIST2015_readme_v2.txt
-rwxrwxr-x+ 1 Qr140 Qr140 2.0K Oct  6 21:59 dataset_TIST2015_readme_v2.txt

Qr140@AllEN /cygdrive/c/A3/TaskA
$ ls -lh dataset_TIST2015_Cities.txt
-rwxrwxr-x+ 1 Qr140 Qr140 25K Aug 13  2015 dataset_TIST2015_Cities.txt
```

Based on the code we can know:

- dataset_TIST2015_POIs.txt is **222MB**
- dataset_TIST2015_Checkins_v2.txt is **2.1GB**
- dataset_TIST2015_readme_v2.txt is **2KB**
- dataset_TIST2015_Cities.txt is **25KB**

### 2)

In this part we can use:

```
$ head -1 dataset_TIST2015_Checkins_v2.txt | less
```

In order to check how many columns and what is the delimiter. The output is:

```
user_id venue_id        UTC_time        timezone_offset
```

There are **4 columns** in this data frame. Then we use the search function with tab (**/^I**):

```
user_id venue_id         UTC_time         timezone_offset
50756   4f5e3a72e4b053fd6a4313f6         Tue Apr 03 18:00:06 +0000 2012   240
190571  4b4b87b5f964a5204a9f26e3         Tue Apr 03 18:00:07 +0000 2012   180
221021  4a85b1b3f964a520eefe1fe3         Tue Apr 03 18:00:08 +0000 2012   -240
66981   4b4606f2f964a520751426e3         Tue Apr 03 18:00:08 +0000 2012   -300
```

All the spaces are filled with the highlight, which means the delimiter is **tab.**

If there are so many columns, and we found the delimiter, we can also use awk to get the number of columns.

**NF** represents how many fields there are in a row, and every time we run awk, the number of **NF** will be updated. Due to the delimiter is the tab, so we use **-F '\t'** after awk to let the system know the delimiter is tab.

```
$ awk -F '\t' '{print NF; exit}' dataset_TIST2015_Checkins_v2.txt
4
```

We can verify there are **4 columns** in the file.

### 3)

We can use the part 2 code to list out all columns:

```
$ head -1 dataset_TIST2015_Checkins_v2.txt | less
```

output is:

```
user_id venue_id        UTC_time        timezone_offset
```

We can conclude the name of columns are:

- user_id
- venue_id
- UTC_time
- timezone_offset

### 4)

In this part we can use awk, sort, uniq with word count to calculate how many unique user values are in the file.

```
$ awk -F '\t' '{print $1}' dataset_TIST2015_Checkins_v2.txt | sort | uniq |
wc -l
266910
```

Due to *user_id* can be counted as 1 in that column. So, after subtracting 1, we can know there are **266909** unique users in this file.

Then using the **wc -l** to check how many lines in the file, and get the number of check-in.

```
$ wc -l dataset_TIST2015_Checkins_v2.txt
33263634 dataset_TIST2015_Checkins_v2.txt
```

Due to the title being counted in, so we have to subtract it with 1. We can see there are **33263633** check-in records.

### 5)

We can use **head -n2** to get extract the second line which starts counting from the head (The first line is the title). We want to get the time, so we know the information we want is from column 3 and we use the **print** function to print the time.

```
$ awk -F '\t' '{print $3}' dataset_TIST2015_Checkins_v2.txt | head -n2
UTC_time
Tue Apr 03 18:00:06 +0000 2012
```

We can see the first date is **Tue Apr 03 18:00:06 +0000 2012**
Then we extract the first line from the **tail** to get the last time

```
$ awk -F '\t' '{print $3}' dataset_TIST2015_Checkins_v2.txt | tail -n1
Mon Sep 16 23:24:15 +0000 2013
```

We can know the last date is **Mon Sep 16 23:24:15 +0000 2013**

## 6)

We can use the part 4 method to get the number of unique venue IDs, but this time we print the second column.

```
$ awk -F '\t' '{print $2}' dataset_TIST2015_POIs.txt | sort | uniq | wc -l
2934245
```

We can see that there are **2934245** records, and the first row is not the title so we don't need to subtract one from the total.

## 7)

In this case, we can search the lines in which column 5 only contains FR with the condition **$5== "FR"**, and then we use **cut -f 4** to cut the categories column. In the end, we use **sort** and **uniq** to make sure the lines are unique.

```
$ awk -F '\t' ' $5 == "FR" '  dataset_TIST2015_POIs.txt | cut -f 4 |sort |
uniq | wc -l
384
```

Then we can get there **384** unique venue categories in France.

## 8)

### *a)*

We can know the Europe land area can be defined in the range 34° to 72° latitude and -25° to 45° longitude (European, 2020), and the readme points out that **the second column is latitude and the third column is longitude**. We can base this information to sort the data which contains Europe land.

In this code, we sort columns 2 and 3 by using the conditions, and connect the condition with && which means AND in shell, then output the data in POIeu.txt.

```
$ (awk -F '\t' '$2 >= 34 && $2 <= 72 && $3 >= -25 && $3 <= 45'
dataset_TIST2015_POIs.txt) > POIeu.txt
```

### *b)*

#### The country with the most venues categories

We first let the shell group by two columns: Country and Venue.

- **{array[$5"\t"$4]++}** means we make an array which group by columns 5 and 4, we also add a delimiter tab between them. If the system detects the same combination, our counter will increase by one
- **END** part is we print out the element in the array, and we add a delimiter between the number and the element

```
$ awk -F "\t" '{array[$5"\t"$4]++} END { for (element in array) {print
element "\t"  array[element]}}' POIeu.txt| sort | head -n10
AT      Accessories Store       7
AT      African Restaurant      2
AT      Airport 5
AT      Airport Gate    16
AT      Airport Lounge  1
AT      Airport Terminal        8
AT      Airport Tram    1
AT      American Restaurant     7
AT      Animal Shelter  1
AT      Antique Shop    3
```

After determining that this set of data is what we want, we output it into a document and proceed to the next step.

```
$ awk -F "\t" '{array[$5"\t"$4]++} END { for (element in array) {print
element "\t"  array[element]}}' POIeu.txt| sort >  euvenues.txt
```

Explanation of the third part:

- `{arr[$1]++}`
  increment array with column 1 as the key, and column 1 is the country code
- `END{for (element in arr) print element, arr[element]}`
  The block executed at the end
  - In the block, we create a for loop and go through the elements in the array
  - Print the lines
    - Print the element first
    - Print the count number in the array, with the element as key
- `sort -k2 -n`
  Sort the printout data
  - -k2 means we sort column 2 data
  - -n means we use a numeric sort

```
$ awk -F "\t"  '{arr[$1]++}END{for (element in arr) print element,
arr[element]}' euvenues.txt | sort -k2 -n
LB 37
DK 279
BG 282
TN 283
EE 288
CH 292
PL 317
RO 325
IE 329
SE 329
BY 333
CZ 340
AT 342
FI 343
PT 349
HU 353
LV 355
CY 360
FR 384
GR 387
DE 402
IT 402
NL 404
ES 407
UA 408
BE 410
GB 414
RU 423
TR 428
```

Based on the output list, we can know **TR has the most venues (428) and LB has the least (37).**

### The country with the most unique venues

If the question only required us to find out the most unique venues, we can group by country id in a simple way.

```
$ awk -F "\t" '{array[$5]++} END { for (element in array) {print element
"\t"  array[element]}}' POIeu.txt| sort -k2 -n
LB      63
EE      2170
BG      2411
DK      2735
CH      2930
TN      3598
PL      3651
RO      3858
IE      3968
AT      5636
FI      5651
CZ      5707
SE      6389
BY      6693
CY      6804
LV      7924
HU      8681
PT      8721
GR      18259
FR      19837
UA      29276
IT      34332
DE      34713
BE      36826
NL      38536
ES      39187
GB      54278
RU      157378
TR      377302
```

Based on the output list, we can know **TR has the most venues (377302) and LB has the least (63).**

*c)*

In this case what we need to do is add condition: **`$4 == "Seafood Restaurant"`** before the **`{arr[$5]++}`**. In this way, we can firstly sort out the seafood restaurant, and then process our rest code.

```
awk -F '\t'  '$4 == "Seafood Restaurant" {arr[$5]++}END{for (element in arr)
print element, arr[element]}' POIeu.txt | sort -k2 -n
PL 1
BY 2
CH 2
EE 2
FI 2
LB 3
LV 5
BG 6
CZ 6
DK 6
HU 6
RO 6
IE 7
TN 11
SE 15
AT 16
CY 25
UA 26
FR 39
PT 57
BE 63
RU 64
DE 76
NL 94
GB 108
GR 110
```

```
ES 123
IT 134
TR 1522
```

Based on the result, we can know **TR has the most seafood restaurants** in their country.

*d)*

We first used the index function to create the condition: string includes 'Restaurant' and put it at the front. In this case, we need to use the old method but with a change. We need to put frequency before the restaurant list because the length of the restaurant name is different.

So **arr[element]** is in front of the **element**, which means we print the frequency first and then print the restaurant name. Then we sort the first column with **-k1**.

```
$ awk -F '\t'  ' index($4, "Restaurant") {arr[$4]++}END{for (element in arr)
print arr[element], element }' POIeu.txt | sort -k1 -n
23 Filipino Restaurant
27 Mongolian Restaurant
37 Peruvian Restaurant
51 Gluten-free Restaurant
53 Malaysian Restaurant
54 New American Restaurant
57 Southern / Soul Food Restaurant
67 Australian Restaurant
67 Indonesian Restaurant
72 Cajun / Creole Restaurant
77 Ethiopian Restaurant
89 South American Restaurant
95 Cuban Restaurant
95 Latin American Restaurant
96 Dim Sum Restaurant
126 Molecular Gastronomy Restaurant
130 Dumpling Restaurant
130 Paella Restaurant
137 Caribbean Restaurant
137 Swiss Restaurant
150 Moroccan Restaurant
179 Afghan Restaurant
181 Arepa Restaurant
185 Brazilian Restaurant
207 Korean Restaurant
313 Argentinian Restaurant
322 African Restaurant
326 Scandinavian Restaurant
338 Vietnamese Restaurant
422 Portuguese Restaurant
522 Vegetarian / Vegan Restaurant
580 Falafel Restaurant
754 Thai Restaurant
759 Mexican Restaurant
1096 German Restaurant
1292 American Restaurant
1371 Indian Restaurant
1456 Tapas Restaurant
1507 Greek Restaurant
1689 Eastern European Restaurant
1755 Japanese Restaurant
1911 Spanish Restaurant
2077 Mediterranean Restaurant
2124 Sushi Restaurant
2219 Chinese Restaurant
2414 Asian Restaurant
2537 Seafood Restaurant
2716 Middle Eastern Restaurant
2863 French Restaurant
7666 Italian Restaurant
8634 Fast Food Restaurant
10093 Turkish Restaurant
15208 Restaurant
```

Based on the result, we can know the most common restaurant is **Restaurant with no categories**, and the most common restaurant with the category is **Turkish restaurant**.

**Reference in case 8:**

European, Environment, Agency. (2020). *Global and European temperatures*. Global and European temperatures — European Environment Agency (europa.eu)

## Task B

To unzip the .gz file we use gunzip.

```
$ gunzip Twitter_Data_1.gz
```

And we get a view of the data

```
head -n1 Twitter_Data_1
433213478539513856      TRY_Sound       Tue Feb 11 12:18:36 +0000 2014  またたび食べると一時的に楽しくなるし、血行良くなるから頭痛も無くなるけど、覚めた後死ぬ。が食べる。うまい
```

This result suggests that:

- The data frame does not have the header
- The data looks like the record of a Twitter post
- We can assume:
    - The first part is ID
    - The second part is the name of the user
    - The third part is time
    - The fourth part is content

Then we find the delimiter, with the search up function **(/^I).**

```
head -1 Twitter_Data_1 | less

433213478539513856      TRY_Sound       Tue Feb 11 12:18:36 +0000 2014  またたび食べると一時的に楽しくなるし、血行良くなるから頭痛も無くなるけど、覚めた後死ぬ。が食べる。うまい
```

The delimiter is the **tab**.

### 1)

Based on the requirement, we can use grep to extract the word 'Donald Trump'. **-oi** means ignore case sensitivity and display only the matched string in the next line.

```
$ awk -F '\t' '{print $4}' Twitter_Data_1 | grep -oi  "Donald Trump" | wc -l
130
```

The word "Donald Trump" appears about **130** times in the data set.

## 2)

The system begins with ignore case setting with **BEGIN{IGNORECASE=1},** then we output the dataset as a txt file.

```
(awk -F '\t'  ' BEGIN{IGNORECASE=1} index($4, "Donald Trump") '
Twitter_Data_1) > Donald.txt
```

After we create a data set, we have to verify our data set has the correct amount of 'Donald Trump'.

```
$ awk -F '\t' '{print $4}' Donald.txt | grep -oi  "Donald Trump" | wc -l
130
```

The number of "Donald Trump" is the same as in part 1. We can start extracting the time column (column 3) and output it as .csv, then add the header to the column with the sed method.

- -i means edit file
- -e means the script in command will be executed
- 1i means insert before line 1

```
awk -F '\t' '{print $3}' Donald.txt > Donald.csv
sed -i -e ' 1i"date"' Donald.csv
```

Now we can start analysing the data with R language.

Initial our R environment and check the data type

- We using ggplot in this assignment
- **rm(list=ls())** is used to clean the R environment
- Set the working directory as TaskB
- Using **read.csv** to read csv file
- **Str()** can display the data type of the column

```
library(ggplot2)

#read data

rm(list = ls())

setwd("C:/A3/TaskB")

df <- read.csv("Donald.csv")

str(df)


output:

'data.frame': 122 obs. of  1 variable:

 $ date: chr  "Tue Feb 11 12:28:36 +0000 2014" "Tue Feb 11 12:47:26 +0000
2014" "Tue Feb 11 12:55:09 +0000 2014" "Tue Feb 11 13:22:29 +0000 2014" ...
```

The data type of date is the character, we have to turn it into date time. In this case, we use striptime with a format based on the time's data, and we set the time zone in GMT then replace data in the column. The format is "%a %b %e %H:%M:%S %z %Y"

- %a-short weekday name
- %b-short month name

- %e-the day of the month in the number
- %H-24-hour clock
- %M-minute
- %S-second
- %z-time-zone offset from GMT
- %Y-the year number includes the century

After using striptime, the data type is POSIXlt, and we need to turn it to POSIXct for making the graph. So we use as.POSIXct() to turn it into the data type we want.

```
#turn date from char to date
df[['date']]<-strptime(df[['date']],
                       format = "%a %b %e %H:%M:%S %z %Y",
                       tz = "GMT")
df[['date']]<-as.POSIXct(df[['date']])
str(df)

output:
'data.frame':122 obs. of  1 variable:
 $ date: POSIXct, format: "2014-02-11 12:28:36" "2014-02-11 12:47:26"
```

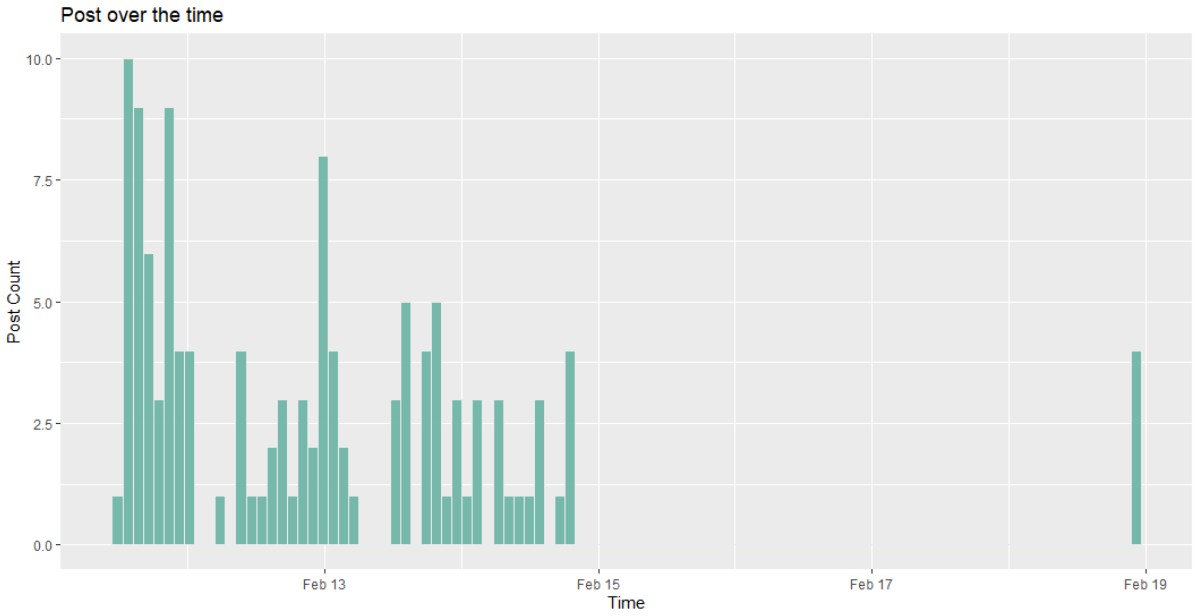
After the process, we can get the date data in POSIXct format.

### 3)

Plot the data with ggplot2, and set the plot title, x-axis and y -axis title with labs. Using geom_histogram to let ggplot plot a histogram and set the bins as 100.

```
ggplot(df,
       aes(x=date)) +
  labs(
    title = "Post over the time",
    x = "Time",
    y = "Post Count")+
  geom_histogram(bins = 100,
                 fill="#69b3a2",
                 color="#e9ecef",
                 alpha=0.9)
```

Then we can get the histogram of posts over the time




## 4)

Based on the graph we can know:

- The data shows the **positive skewed bimodal distribution**
    - The number of posts reaches its highest point (10 posts) at midnight of Feb 11 and then drops to the bottom at day time of Feb 12. But on Feb 13, the number of posts goes up and then slowly goes down to 0.
    - After Feb 15, there is a little post (around 4 posts) on the night of Feb 18
    - User activity is higher during the daytime to midnight of the next day, with activity highest in the middle of the night.
    - The trend of Trump has been hot for about 3 days.

## 5)

Before we start our analysis, we have to prepare our dataset. We use the method in Task A case 8, but we add a comma between the element and count, then output as CSV. And then we add a header in our CSV file.

```
$ awk -F '\t'  ' {arr[$2]++}END{for (element in arr) print arr[element],
"," ,element }' Twitter_Data_1 | sort -k1 -n > user.csv

$ sed -i -e ' 1i"count","user"' user.csv
```

Then we can input the CSV file in R and check the datatype of the column.

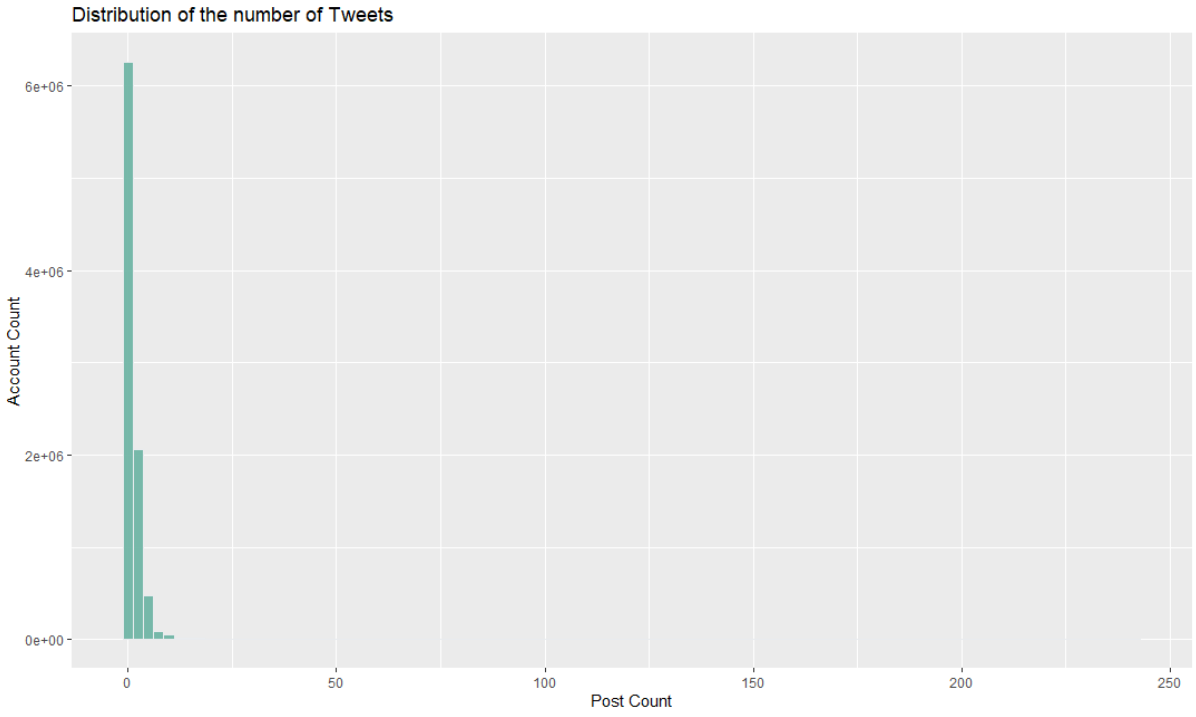
```
df2 <- read.csv("user.csv")
str(df2)


output:
'data.frame': 8977904 obs. of  2 variables:
 $ count: num  1 1 1 1 1 1 1 1 1 ...
```

```
 $ user : chr  " " " 000000000003737" " 0000000000_24" "
0000000000yours" ...
```

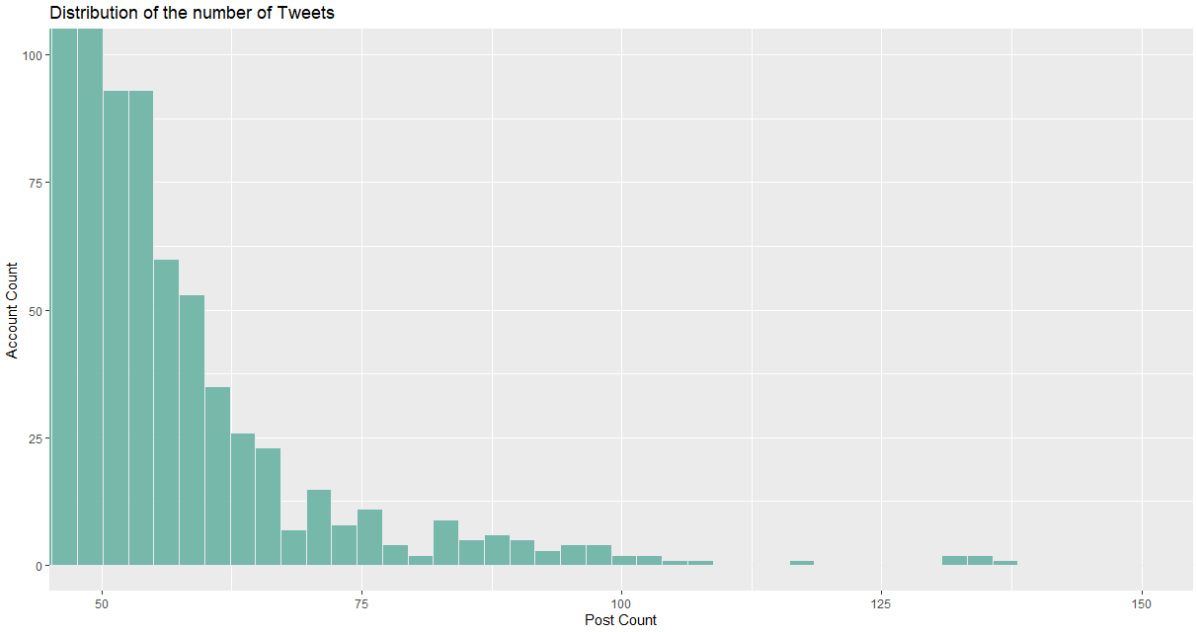
We can see the column ‘count’ is number data type and the ‘user’ is character data type. Then we plot the histogram of the distribution of tweets.

```
p = ggplot(df2,
       aes(x=count)) +
  labs(
    title = "Distribution of the number of Tweets",
    x = "Post Count",
    y = "Account Count")+
  geom_histogram(bins = 100,
                 fill="#69b3a2",
                 color="#e9ecef",
                 alpha=0.9)
p
```



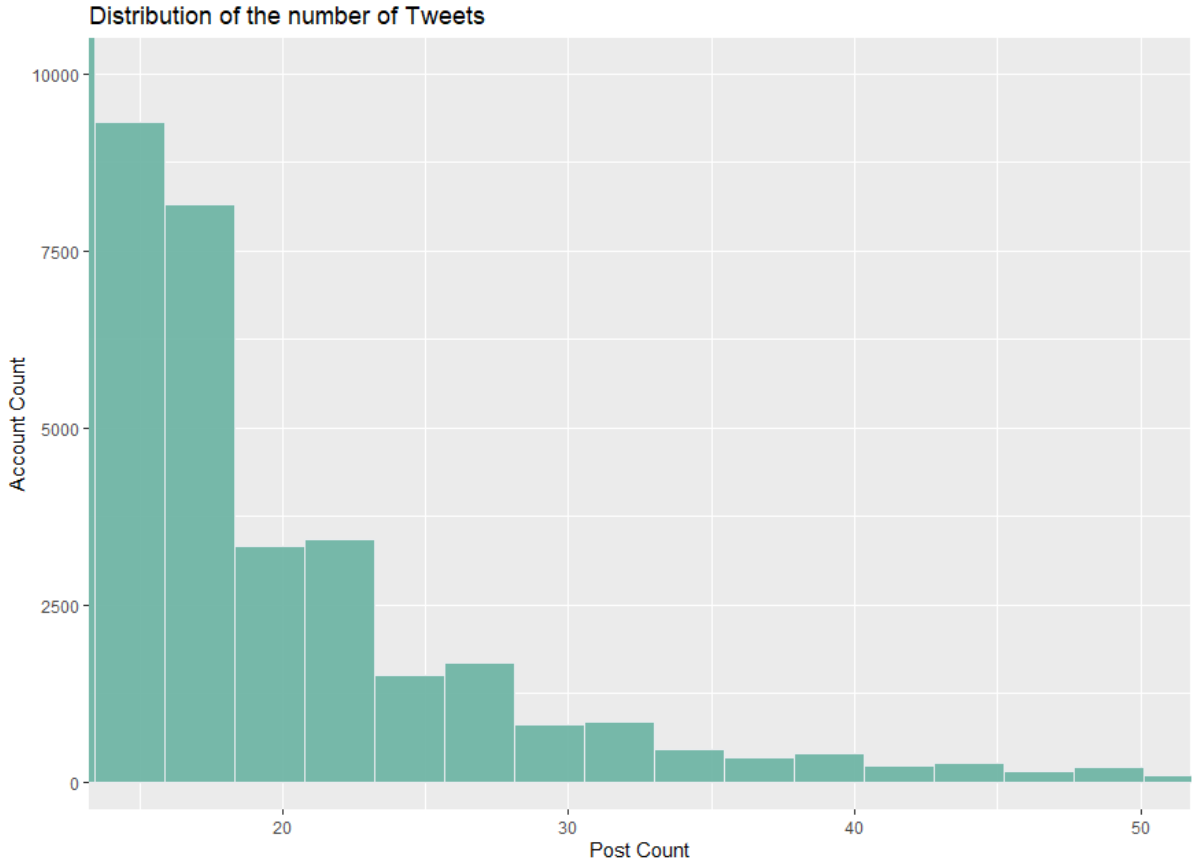

We can see most of the users (Around 6,000,000 users) only post one time. But we also want to see more details of the post count at the right of the graph. We can limit the x and y-axis.

```
p + coord_cartesian( xlim = c(50,150),ylim = c(0,100))
```




The number of accounts with more than 50 posts is all within 100.

```
p + coord_cartesian( xlim = c(15,50),ylim = c(100,10000))
```




The number of accounts within the range of 15-50 posts is all within 10000.