

Programming with R – Experiential Learning Component

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SECTION: AIML A (SEM-3)

CODE:

```
library(dplyr)

library(ggplot2)

file_path <- "C:\\Users\\chinm\\Downloads\\listings.csv" # Replace with the actual path to your CSV
file

data <- read.csv(file_path)


head(data)

tail(data)

print(filter(data, is.na(data$price)))


# summary statistics
summary(data)


# checking for missing values
sum(is.na(data))


# checking for missing values in ratings and price
sum(is.na(data$review_scores_rating))
sum(is.na(data$price))


head(data$price)

# removing the "$" sign and converting to numeric
data$price <- as.numeric(gsub("\\$", "", data$price))

mean(data$price)
```

```

# removing rows with missing values in ratings and price
data <- subset(data, !(is.na(data$review_scores_rating) & is.na(data$price)))

# outlier detection for price which are less than Q1 - 1.5 IQR and above Q3 + 1.5 IQR
s_price <- summary(data$price)

data <- filter(data, data$price >= (s_price[2] - 1.5 * IQR(data$price, na.rm = TRUE)) &
  data$price <= (s_price[5] + 1.5 * IQR(data$price, na.rm = TRUE)))

# outlier detection for review_scores_rating which are below 0 and above 5
data <- filter(data, data$review_scores_rating >= 0 & data$review_scores_rating <= 5)

# visualization of review scores
ggplot(data, aes(x = review_scores_rating)) +
  geom_histogram(bins = 20, fill = "pink", color = "black") +
  labs(title = "Distribution of Review Scores", x = "Review Scores", y = "Frequency")

# calculating avg price by neighbourhood group
avg_price_ng <- data %>%
  group_by(neighbourhood_group_cleansed) %>%
  summarise(avg_price = mean(price, na.rm = TRUE)) %>%
  arrange(desc(avg_price))

avg_price_ng

# we see that Bronx has the lowest average price and Manhattan has the highest average price

# finding the most common property types
most_common_property_type <- data %>%
  group_by(property_type) %>%
  summarise(listing_count = n()) %>%
  arrange(desc(listing_count)) %>%

```

```
head(5)
```

```
print(most_common_property_type)
```

```
# we see that the most common property type is an entire rental unit
```

```
# finding the neighbourhoods with most number of listings
```

```
pop_neighborhoods <- data %>%
```

```
group_by(neighbourhood_cleansed) %>%
```

```
summarise(listing_count = n()) %>%
```

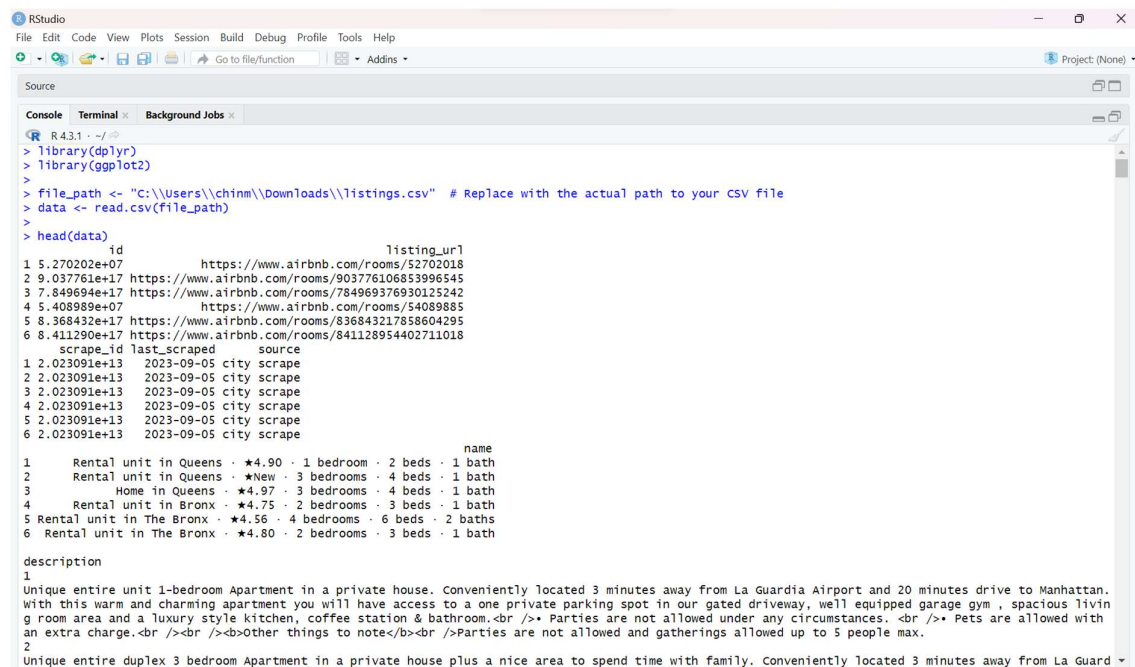
```
arrange(desc(listing_count)) %>%
```

```
head(5)
```

```
print(pop_neighborhoods)
```

```
# we see that Bedford-Stuyvesant has the most number of listings
```

OUTPUT:



```
R 4.3.1 ~ />
> library(dplyr)
> library(ggplot2)
>
> file_path <- "C:\\Users\\chinm\\Downloads\\listings.csv" # Replace with the actual path to your CSV file
> data <- read.csv(file_path)
>
> head(data)
      id                               listing_url
1 5.270202e+07 https://www.airbnb.com/rooms/52702018
2 9.037761e+17 https://www.airbnb.com/rooms/903776106853996545
3 7.849694e+17 https://www.airbnb.com/rooms/784969376930125242
4 5.408989e+07 https://www.airbnb.com/rooms/54089885
5 8.368432e+17 https://www.airbnb.com/rooms/836843217858604295
6 8.411290e+17 https://www.airbnb.com/rooms/841128954402711018

  scrape_id last_scraped source
1 2.023091e+13 2023-09-05 city scrape
2 2.023091e+13 2023-09-05 city scrape
3 2.023091e+13 2023-09-05 city scrape
4 2.023091e+13 2023-09-05 city scrape
5 2.023091e+13 2023-09-05 city scrape
6 2.023091e+13 2023-09-05 city scrape

      name
1 Rental unit in Queens · ★4.90 · 1 bedroom · 2 beds · 1 bath
2 Rental unit in Queens · ★New · 3 bedrooms · 4 beds · 1 bath
3 Home in Queens · ★4.97 · 3 bedrooms · 4 beds · 1 bath
4 Rental unit in Bronx · ★4.75 · 2 bedrooms · 3 beds · 1 bath
5 Rental unit in The Bronx · ★4.56 · 4 bedrooms · 6 beds · 2 baths
6 Rental unit in The Bronx · ★4.80 · 2 bedrooms · 3 beds · 1 bath

description
1
Unique entire unit 1-bedroom Apartment in a private house. Conveniently located 3 minutes away from La Guardia Airport and 20 minutes drive to Manhattan.
with this warm and charming apartment you will have access to a one private parking spot in our gated driveway, well equipped garage gym , spacious living
room area and a luxury style kitchen, coffee station & bathroom.<br />• Parties are not allowed under any circumstances. <br />• Pets are allowed with
an extra charge.<br /><br /><b>Other things to note</b><br /><b>Parties are not allowed and gatherings allowed up to 5 people max.</b>
2
Unique entire duplex 3 bedroom Apartment in a private house plus a nice area to spend time with family. Conveniently located 3 minutes away from La Guard
```

..... remaining of the first six rows of each column.....

```
RStudio
File Edit Code View Plots Session Build Debug Profile Tools Help
Go to file/function Addins Project: (None)

Source
Console Terminal Background Jobs
R 4.3.1 ~ / ~
4 0
5 0
6 0
calculated_host_listings_count shared_rooms reviews_per_month
1 0 8.53
2 0 NA
3 0 4.47
4 0 1.43
5 0 2.50
6 0 2.11
> tail(data)
      id listing_url
39448 2.378194e+07 https://www.airbnb.com/rooms/23781939
39449 3.390812e+07 https://www.airbnb.com/rooms/33908121
39450 6.499054e+17 https://www.airbnb.com/rooms/649905426134989324
39451 8.123634e+17 https://www.airbnb.com/rooms/812363361679077941
39452 1.244649e+07 https://www.airbnb.com/rooms/12446494
39453 4.929029e+07 https://www.airbnb.com/rooms/49290285
      scrape_id last_scraped source
39448 2.023091e+13 2023-09-06 previous scrape
39449 2.023091e+13 2023-09-06 previous scrape
39450 2.023091e+13 2023-09-06 previous scrape
39451 2.023091e+13 2023-09-06 city scrape
39452 2.023091e+13 2023-09-05 previous scrape
39453 2.023091e+13 2023-09-06 previous scrape
      name
39448 Rental unit in New York · 2 bedrooms · 2 beds · 1 bath
39449 Rental unit in Brooklyn · 1 bedroom · 2 beds · 1 shared bath
39450 Rental unit in Brooklyn · ★5.0 · 2 bedrooms · 2 beds · 1 private bath
39451 Rental unit in New York · ★5.0 · 1 bedroom · 2 beds · 1.5 baths
39452 Rental unit in New York · 2 bedrooms · 2 beds · 1 bath
39453 Rental unit in Queens · ★5.0 · 1 bedroom · 1 shared bath
description
39448
Steps away from Central Park, 123 & BC subway lines. <10 min walk to Lincoln Center & Columbus Circle.
39449
```

..... remaining of the last six rows of each column.....

RStudio

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Go to file/function Addins Project: (None)

Source

Console Terminal Background Jobs

```
R 4.3.1 ~ />
39451
39452
39453
calculated_host_listings_count shared_rooms reviews_per_month
39448 0 0 0.03
39449 0 NA
39450 0 0.20
39451 0 2.06
39452 0 NA
39453 0 0.14
> print(filter(data, is.na(data$price)))
[1] id
[2] listing_url
[3] scrape_id
[4] last_scraped
[5] source
[6] name
[7] description
[8] neighborhood_overview
[9] picture_url
[10] host_id
[11] host_url
[12] host_name
[13] host_since
[14] host_location
[15] host_about
[16] host_response_time
[17] host_response_rate
[18] host_acceptance_rate
[19] host_is_superhost
[20] host_thumbnail_url
[21] host_picture_url
[22] host_neighbourhood
[23] host_listings_count
[24] host_total_listings_count
[25] host_verifications
[26] host_has_profile_pic
[27] host_identity_verified
[28] neighbourhood
[29] neighbourhood_cleansed
[30] neighbourhood_group_cleansed
[31] latitude
[32] longitude
[33] property_type
[34] room_type
[35] accommodates
[36] bathrooms
[37] bathrooms_text
[38] bedrooms
[39] beds
[40] amenities
[41] price
[42] minimum_nights
[43] maximum_nights
[44] minimum_minimum_nights
[45] maximum_minimum_nights
[46] minimum_maximum_nights
[47] maximum_maximum_nights
[48] minimum_nights_avg_ntm
[49] maximum_nights_avg_ntm
[50] calendar_updated
[51] has_availability
[52] availability_30
[53] availability_60
[54] availability_90
[55] availability_365
[56] calendar_last_scraped
[57] number_of_reviews
```

RStudio

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Go to file/function Addins Project: (None)

Source

Console Terminal Background Jobs

```
R 4.3.1 ~ />
[21] host_picture_url
[22] host_neighbourhood
[23] host_listings_count
[24] host_total_listings_count
[25] host_verifications
[26] host_has_profile_pic
[27] host_identity_verified
[28] neighbourhood
[29] neighbourhood_cleansed
[30] neighbourhood_group_cleansed
[31] latitude
[32] longitude
[33] property_type
[34] room_type
[35] accommodates
[36] bathrooms
[37] bathrooms_text
[38] bedrooms
[39] beds
[40] amenities
[41] price
[42] minimum_nights
[43] maximum_nights
[44] minimum_minimum_nights
[45] maximum_minimum_nights
[46] minimum_maximum_nights
[47] maximum_maximum_nights
[48] minimum_nights_avg_ntm
[49] maximum_nights_avg_ntm
[50] calendar_updated
[51] has_availability
[52] availability_30
[53] availability_60
[54] availability_90
[55] availability_365
[56] calendar_last_scraped
[57] number_of_reviews
```

RStudio

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Go to file/function Addins Project: (None)

Source

Console Terminal Background Jobs

```
R 4.3.1 ~ />
[56] calendar_last_scraped
[57] number_of_reviews
[58] number_of_reviews_ltm
[59] number_of_reviews_130d
[60] first_review
[61] last_review
[62] review_scores_rating
[63] review_scores_accuracy
[64] review_scores_cleanliness
[65] review_scores_checkin
[66] review_scores_communication
[67] review_scores_location
[68] review_scores_value
[69] license
[70] instant_bookable
[71] calculated_host_listings_count
[72] calculated_host_listings_count_entire_homes
[73] calculated_host_listings_count_private_rooms
[74] calculated_host_listings_count_shared_rooms
[75] reviews_per_month
<0 rows> (or 0-length row.names)
>
>
> # summary statistics
> summary(data)
      id          listing_url      scrape_id
Min.   :2.595e+03  Length:39453    Min.   :2.023e+13
1st Qu.:1.986e+07  Class :character  1st Qu.:2.023e+13
Median :4.543e+07  Mode  :character  Median :2.023e+13
Mean   :2.778e+17  Mean   :2.023e+13
3rd Qu.:7.135e+17  3rd Qu.:2.023e+13
Max.   :9.733e+17  Max.   :2.023e+13

last_scraped      source          name
Length:39453     Length:39453    Length:39453
Class :character  Class :character Class :character
Mode  :character  Mode  :character Mode  :character

description      neighborhood_overview picture_url
Length:39453     Length:39453    Length:39453
Class :character  Class :character Class :character
Mode  :character  Mode  :character Mode  :character

      host_id      host_url      host_name
Min.   :    2234  Length:39453  Length:39453
1st Qu.:16542425  Class :character Class :character
Median : 77725998  Mode  :character Mode  :character
Mean   :155835829
3rd Qu.:276831272
Max.   :535531720

      host_since      host_location      host_about
Length:39453     Length:39453    Length:39453
Class :character  Class :character Class :character
Mode  :character  Mode  :character Mode  :character

host_response_time host_response_rate host_acceptance_rate
Length:39453     Length:39453    Length:39453
Class :character  Class :character Class :character
Mode  :character  Mode  :character Mode  :character
```

```
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Go to file/function Addins Project: (None)

Source
Console Terminal Background Jobs
R 4.3.1 ~ / ~

host_is_superhost host_thumbnail_url host_picture_url
Length:39453 Length:39453 Length:39453
Class :character Class :character Class :character
Mode :character Mode :character Mode :character

host_neighbourhood host_listings_count host_total_listings_count
Length:39453 Min. : 0.0 Min. : 1.0
Class :character 1st Qu.: 1.0 1st Qu.: 1.0
Mode :character Median : 2.0 Median : 3.0
Mean : 138.5 Mean : 225.3
3rd Qu.: 7.0 3rd Qu.: 10.0
Max. : 4577.0 Max. : 9176.0
NA's :5 NA's :5

host_verifications host_has_profile_pic host_identity_verified
Length:39453 Length:39453 Length:39453
Class :character Class :character Class :character
Mode :character Mode :character Mode :character

neighbourhood neighbourhood_cleansed neighbourhood_group_cleansed
Length:39453 Length:39453 Length:39453
Class :character Class :character Class :character
Mode :character Mode :character Mode :character

latitude longitude property_type room_type
Min. :40.50 Min. : -74.25 Length:39453 Length:39453
1st Qu.:40.69 1st Qu.: -73.98 Class :character Class :character
Median :40.73 Median : -73.95 Mode :character Mode :character
Mean :40.73 Mean : -73.95
3rd Qu.:40.76 3rd Qu.: -73.93
Max. :40.91 Max. : -73.71

accommodates bathrooms bathrooms_text bedrooms
Min. : 1.000 Mode:logical Length:39453 Min. : 1.000
1st Qu.: 2.000 NA's:39453 Class :character 1st Qu.: 1.000
Median : 2.000 Mode :character Median : 1.000
Mean : 2.934 Mean : 1.597
3rd Qu.: 4.000 3rd Qu.: 2.000
Max. :16.000 Max. :50.000
NA's :16893

beds amenities price
Min. : 1.000 Length:39453 Length:39453
1st Qu.: 1.000 Class :character Class :character
Median : 1.000 Mode :character Mode :character
Mean : 1.658
3rd Qu.: 2.000
Max. :42.000
NA's :605

minimum_nights maximum_nights minimum_minimum_nights
Min. : 1.00 Min. :1.000e+00 Min. : 1.00
1st Qu.: 30.00 1st Qu.:1.200e+02 1st Qu.: 30.00
Median : 30.00 Median :3.650e+02 Median : 30.00
Mean : 28.05 Mean :5.606e+04 Mean : 29.63
3rd Qu.: 30.00 3rd Qu.:1.125e+03 3rd Qu.: 30.00
Max. :1250.00 Max. :2.147e+09 Max. :1250.00

maximum_minimum_nights minimum_maximum_nights maximum_maximum_nights
Min. : 1.00 Min. :1.000e+00 Min. :1.000e+00
1st Qu.: 30.00 1st Qu.:3.650e+02 1st Qu.:3.650e+02
Median : 30.00 Median :1.125e+03 Median :1.125e+03
Mean : 34.95 Mean :6.549e+05 Mean :1.199e+06
```

```
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Go to file/function Addins Project: (None)

Source
Console Terminal Background Jobs

R 4.3.1 ~ /
minimum_nights_avg_ntm maximum_nights_avg_ntm calendar_updated
Min. : 1.00 Min. :1.000e+00 Mode:logical
1st Qu.: 30.00 1st Qu.:3.650e+02 NA's:39453
Median : 30.00 Median :1.125e+03
Mean : 34.33 Mean :1.036e+06
3rd Qu.: 30.00 3rd Qu.:1.125e+03
Max. :1250.00 Max. :2.147e+09

has_availability availability_30 availability_60 availability_90
Length:39453 Min. : 0.000 Min. : 0.00 Min. : 0.0
Class :character 1st Qu.: 0.000 1st Qu.: 0.00 1st Qu.: 0.0
Mode :character Median : 0.000 Median : 4.00 Median :16.0
Mean : 6.923 Mean :17.22 Mean :30.3
3rd Qu.:11.000 3rd Qu.:34.00 3rd Qu.:61.0
Max. :30.000 Max. :60.00 Max. :90.0

availability_365 calendar_last_scraped number_of_reviews
Min. : 0.0 Length:39453 Min. : 0.00
1st Qu.: 0.0 Class :character 1st Qu.: 0.00
Median :107.0 Mode :character Median : 5.00
Mean :144.8 Mean : 25.84
3rd Qu.:291.0 3rd Qu.: 24.00
Max. :365.0 Max. :1834.00

number_of_reviews_1tm number_of_reviews_130d first_review
Min. : 0.00 Min. : 0.0000 Length:39453
1st Qu.: 0.00 1st Qu.: 0.0000 Class :character
Median : 0.00 Median : 0.0000 Mode :character
Mean : 7.36 Mean : 0.6207
3rd Qu.: 6.00 3rd Qu.: 0.0000
Max. :686.00 Max. :97.0000

last_review review_scores_rating review_scores_accuracy
Length:39453 Min. :0.000 Min. :0.000
Class :character 1st Qu.:4.600 1st Qu.:4.700
Mode :character Median :4.830 Median :4.890
Mean :4.631 Mean :4.744
3rd Qu.:5.000 3rd Qu.:5.000
Max. :5.000 Max. :5.000
NA's :10241 NA's :10654

review_scores_cleanliness review_scores_checkin
Min. :0.000 Min. :0.000
1st Qu.:4.500 1st Qu.:4.800
Median :4.800 Median :4.940
Mean :4.627 Mean :4.813
3rd Qu.:5.000 3rd Qu.:5.000
Max. :5.000 Max. :5.000
NA's :10644 NA's :10658

review_scores_communication review_scores_location review_scores_value
Min. :0.000 Min. :0.000 Min. :0.000
1st Qu.:4.800 1st Qu.:4.620 1st Qu.:4.520
Median :4.960 Median :4.830 Median :4.750
Mean :4.809 Mean :4.725 Mean :4.627
3rd Qu.:5.000 3rd Qu.:5.000 3rd Qu.:4.930
Max. :5.000 Max. :5.000 Max. :5.000
NA's :10650 NA's :10661 NA's :10660

license instant_bookable calculated_host_listings_count
Mode:logical Length:39453 Min. : 1.00
NA's:39453 Class :character 1st Qu.: 1.00
Mode :character Median : 1.00
Mean : 37.45
3rd Qu.: 5.00
Max. :597.00

calculated_host_listings_count_entire_homes
Min. : 0.00
1st Qu.: 0.00
Median : 1.00
```



```
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Go to file/function Addins Project: (None)

Source
Console Terminal Background Jobs
R 4.3.1 ~ / ~
calculated_host_listings_count_entire_homes
Min. : 0.00
1st Qu.: 0.00
Median : 1.00
Mean : 17.37
3rd Qu.: 2.00
Max. : 597.00

calculated_host_listings_count_private_rooms
Min. : 0.00
1st Qu.: 0.00
Median : 0.00
Mean : 19.98
3rd Qu.: 2.00
Max. : 519.00

calculated_host_listings_count_shared_rooms reviews_per_month
Min. : 0.00000 Min. : 0.010
1st Qu.: 0.00000 1st Qu.: 0.120
Median : 0.00000 Median : 0.450
Mean : 0.04111 Mean : 1.138
3rd Qu.: 0.00000 3rd Qu.: 1.620
Max. : 11.00000 Max. : 79.820
NA's :10241

>
> # checking for missing values
> sum(is.na(data))
[1] 220276
>
> # checking for missing values in ratings and price
> sum(is.na(data$review_scores_rating))
[1] 10241
> sum(is.na(data$price))
[1] 0
>
> head(data$price)
[1] "$171.00" "$137.00" "$311.00" "$116.00" "$255.00" "$141.00"

RStudio
File Edit Code View Plots Session Build Debug Profile Tools Help
Go to file/function Addins Project: (None)

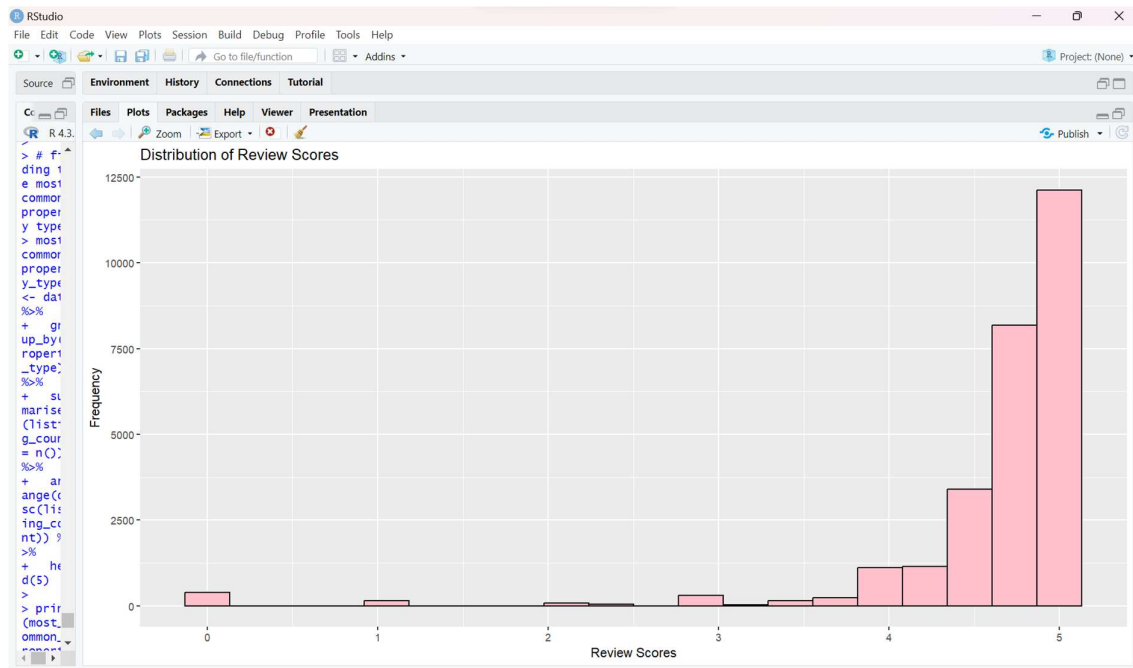
Source
Console Terminal Background Jobs
R 4.3.1 ~ / ~
>
> head(data$price)
[1] "$171.00" "$137.00" "$311.00" "$116.00" "$255.00" "$141.00"
> # removing the "$" sign and converting to numeric
> data$price <- as.numeric(gsub("\\$", "", data$price))
Warning message:
NA's introduced by coercion
> mean(data$price)
[1] NA
>
> # removing rows with missing values in ratings and price
> data <- subset(data, !(is.na(data$review_scores_rating) & is.na(data$price)))
> # outlier detection for price which are less than Q1 - 1.5 IQR and above Q3 + 1.5 IQR
> s_price <- summary(data$price)
>
> data <- filter(data, data$price >= (s_price[2] - 1.5 * IQR(data$price, na.rm = TRUE)) &
+ data$price <= (s_price[5] + 1.5 * IQR(data$price, na.rm = TRUE)))
>
> # outlier detection for review_scores_rating which are below 0 and above 5
> data <- filter(data, data$review_scores_rating >= 0 & data$review_scores_rating <= 5)
>
> # visualization of review scores
> ggplot(data, aes(x = review_scores_rating)) +
+ geom_histogram(bins = 20, fill = "pink", color = "black") +
+ labs(title = "Distribution of Review Scores", x = "Review Scores", y = "Frequency")
>
> # calculating avg price by neighbourhood group
> avg_price_ng <- data %>%
+ group_by(neighbourhood_group_cleansed) %>%
+ summarise(avg_price = mean(price, na.rm = TRUE))%>%
+ arrange(desc(avg_price))
>
> avg_price_ng
# A tibble: 5 x 2
  neighbourhood_group_cleansed avg_price
  <chr> <dbl>
1 Manhattan 171.
```

```
RStudio
File Edit Code View Plots Session Build Debug Profile Tools Help
Go to file/function Addins Project: (None)

Source
Console Terminal Background Jobs

R 4.3.1 ~ /
neighbourhood_group_cleansed avg_price
<chr> <dbl>
1 Manhattan 171.
2 Brooklyn 139.
3 Staten Island 124.
4 Queens 119.
5 Bronx 111.
> # we see that Bronx has the lowest avg price and Manhattan has the highest avg price
>
> # finding the most common property types
> most_common_property_type <- data %>%
+ group_by(property_type) %>%
+ summarise(listing_count = n()) %>%
+ arrange(desc(listing_count)) %>%
+ head(5)
>
> print(most_common_property_type)
# A tibble: 5 x 2
  property_type listing_count
<chr> <int>
1 Entire rental unit 11809
2 Private room in rental unit 2420
3 Private room in home 1923
4 Entire home 1170
5 Entire condo 901
> # we see that the most common property type is an entire rental unit
>
> # finding the neighbourhoods with most number of listings
> pop_neighborhoods <- data %>%
+ group_by(neighbourhood_cleansed) %>%
+ summarise(listing_count = n()) %>%
+ arrange(desc(listing_count)) %>%
+ head(5)
>
> print(pop_neighborhoods)
# A tibble: 5 x 2
  neighbourhood_cleansed listing_count
<chr> <int>
1 Bedford-Stuyvesant 2076
2 Williamsburg 1730
3 Harlem 1384
4 Bushwick 1196
5 Upper East Side 948
> # we see that Bedford-Stuyvesant has the most number of listings
>

R 4.3.1 ~ /
> # finding the most common property types
> most_common_property_type <- data %>%
+ group_by(property_type) %>%
+ summarise(listing_count = n()) %>%
+ arrange(desc(listing_count)) %>%
+ head(5)
>
> print(most_common_property_type)
# A tibble: 5 x 2
  property_type listing_count
<chr> <int>
1 Entire rental unit 11809
2 Private room in rental unit 2420
3 Private room in home 1923
4 Entire home 1170
5 Entire condo 901
> # we see that the most common property type is an entire rental unit
>
> # finding the neighbourhoods with most number of listings
> pop_neighborhoods <- data %>%
+ group_by(neighbourhood_cleansed) %>%
+ summarise(listing_count = n()) %>%
+ arrange(desc(listing_count)) %>%
+ head(5)
>
> print(pop_neighborhoods)
# A tibble: 5 x 2
  neighbourhood_cleansed listing_count
<chr> <int>
1 Bedford-Stuyvesant 2076
2 Williamsburg 1730
3 Harlem 1384
4 Bushwick 1196
5 Upper East Side 948
> # we see that Bedford-Stuyvesant has the most number of listings
>
|
```



Three interesting pieces of information from this analysis:

- 1) Bronx has the lowest average price and Manhattan has the highest average price
- 2) The most common property type is an entire rental unit
- 3) Bedford-Stuyvesant has the most number of listings