Applying the end-end ML steps to a different dataset. ¶

We will apply what we've learnt to another dataset (airbnb dataset). We will predict airbnb price based on other features.

[25 pts] Visualizing Data

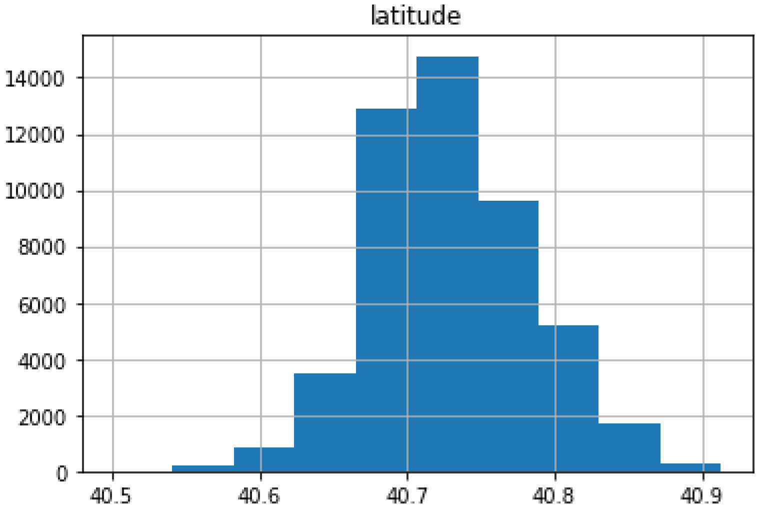
[5 pts] Load the data + statistics

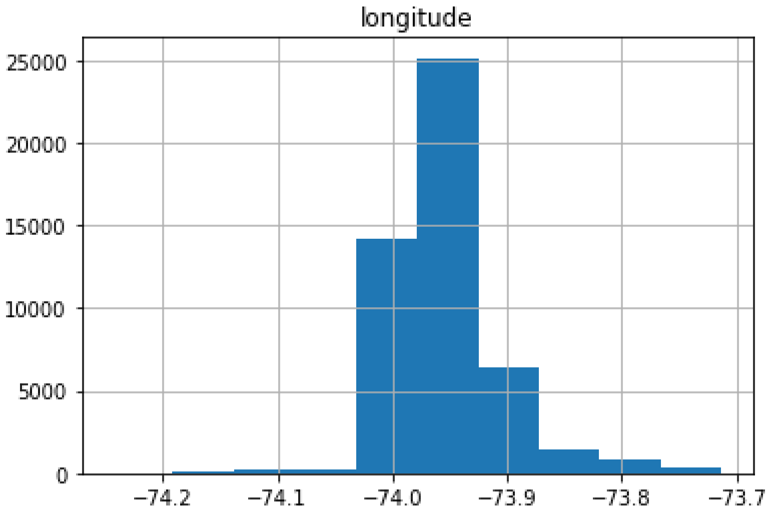
- load the dataset
- display the first few rows of the data
- drop the following columns: name, host_id, host_name, last_review
- display a summary of the statistics of the loaded data
- plot histograms for 3 features of your choice

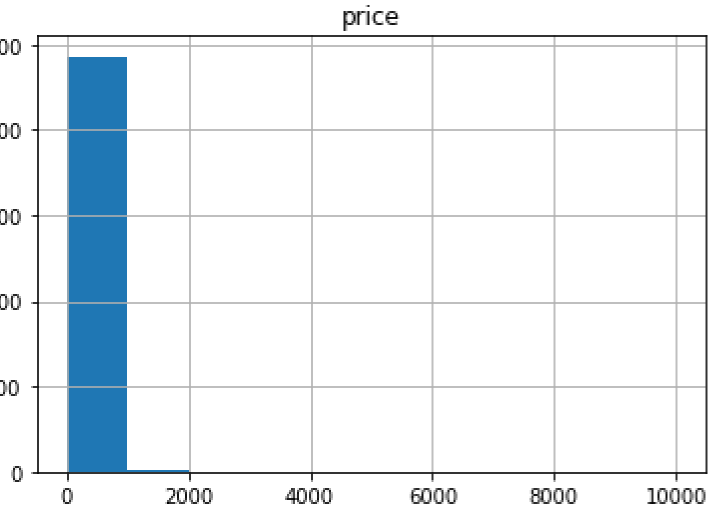
In [34]:

```
%matplotlib inline
import matplotlib # plotting library
import matplotlib.pyplot as plt

import os
import sys
import tarfile
import urllib

DATASET_PATH = os.path.join("datasets", "airbnb")

import pandas as pd

def load_airbnb_data(airbnb_path):
    csv_path = os.path.join(airbnb_path, "AB_NYC_2019.csv")
    return pd.read_csv(csv_path)

airbnb = load_airbnb_data(DATASET_PATH)  #load the dataset
airbnb.head()   #display first few rows of the data

#drop the name, host_id, host_name and last_review columns
airbnb = airbnb.drop(["name", "host_id", "host_name", "last_review"], axis = 1
)

print(airbnb.describe()) #summary of statistics of the data

#plot histograms for any 3 features
airbnb["latitude"].hist()
plt.title("latitude")
plt.show()
airbnb["longitude"].hist()
plt.title("longitude")
plt.show()
airbnb["price"].hist()
plt.title("price")
plt.show()
```

```
                 id      latitude     longitude         price  minimum_nights  \
count  4.889500e+04  48895.000000  48895.000000  48895.000000    48895.000000   
mean   1.901714e+07     40.728949    -73.952170    152.720687        7.029962   
std    1.098311e+07      0.054530      0.046157    240.154170       20.510550   
min    2.539000e+03     40.499790    -74.244420      0.000000        1.000000   
25%    9.471945e+06     40.690100    -73.983070     69.000000        1.000000   
50%    1.967728e+07     40.723070    -73.955680    106.000000        3.000000   
75%    2.915218e+07     40.763115    -73.936275    175.000000        5.000000   
max    3.648724e+07     40.913060    -73.712990  10000.000000     1250.000000   

       number_of_reviews  reviews_per_month  calculated_host_listings_count  \
count       48895.000000       38843.000000                    48895.000000   
mean           23.274466           1.373221                        7.143982   
std            44.550582           1.680442                       32.952519   
min             0.000000           0.010000                        1.000000   
25%             1.000000           0.190000                        1.000000   
50%             5.000000           0.720000                        1.000000   
75%            24.000000           2.020000                        2.000000   
max           629.000000          58.500000                      327.000000   

       availability_365  
count      48895.000000  
mean         112.781327  
std          131.622289  
min            0.000000  
25%            0.000000  
50%           45.000000  
75%          227.000000  
max          365.000000  
```



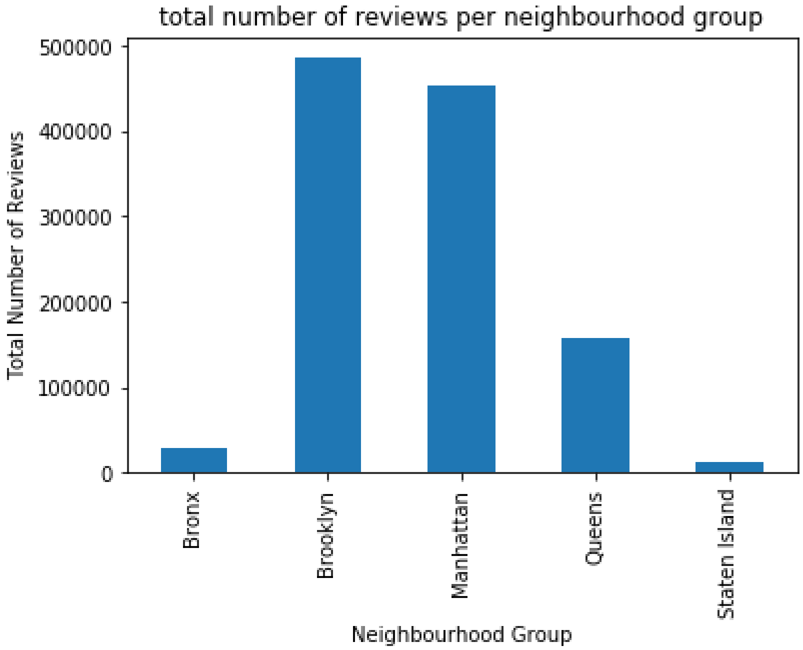




[5 pts] Plot total number_of_reviews per neighbourhood_group

In [35]:
```
groups = airbnb.groupby("neighbourhood_group")["number_of_reviews"].sum().plot
(kind="bar")
plt.ylabel("Total Number of Reviews")
plt.xlabel("Neighbourhood Group")
plt.title("total number of reviews per neighbourhood group")
```

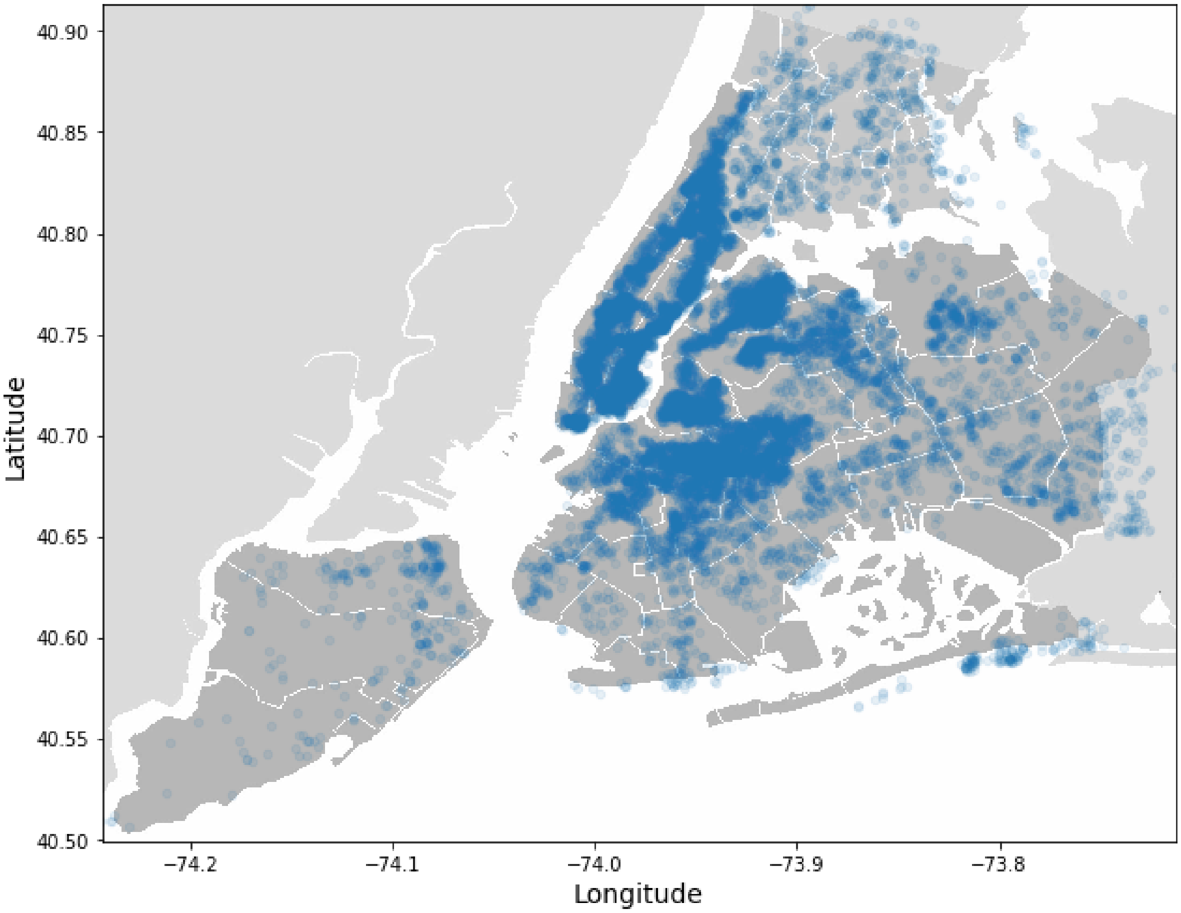
Out[35]:
```
Text(0.5, 1.0, 'total number of reviews per neighbourhood group')
```



[5 pts] Plot map of airbnbs throughout New York (if it gets too crowded take a subset of the data, and try to make it look nice if you can :)).

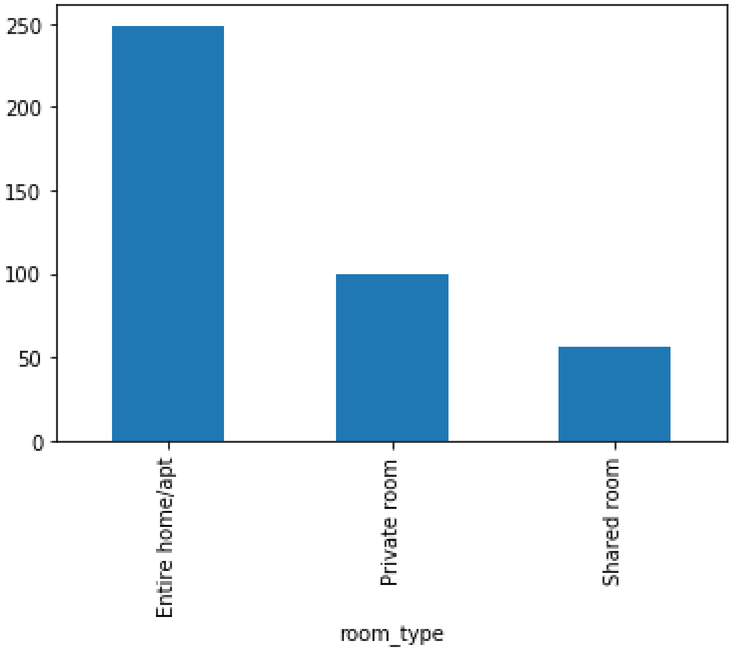
```
In [36]: images_path = os.path.join('./', "images/")
         os.makedirs(images_path, exist_ok=True)
         filename = "NYC.png"

         #take a subset of the dataset so that the plot looks pretty
         sample = airbnb.dropna() #drop rows that contain null values
         #to take a sample of the subset I drop values from Brooklyn and Manhattan sinc
         e they are overcrowded and make the map look ugly
         airbnb_subset = sample.drop(sample[((sample["neighbourhood_group"] == "Brookly
         n") |
                                             (sample["neighbourhood_group"] == "Manhatt
         an")) &
                                            ((sample["number_of_reviews"] < 60) & (samp
         le["availability_365"] < 180))].index)
         print("Airbnb original set size: " + str(airbnb.size))
         print("Airbnb_subset size: " + str(airbnb_subset.size))

         import matplotlib.image as mpimg
         nyc_img = mpimg.imread(os.path.join(images_path, filename),0)
         ax = airbnb_subset.plot(kind="scatter", x="longitude", y="latitude", figsize=(
         10,7),alpha=0.1)

         # overlay the NYC map on the plotted scatter plot
         # note: plt.imshow still refers to the most recent figure
         # that hasn't been plotted yet.
         plt.imshow(nyc_img, extent=[-74.244, -73.713, 40.499, 40.913], alpha=0.5,
                    cmap=plt.get_cmap("jet"))
         plt.ylabel("Latitude", fontsize=14)
         plt.xlabel("Longitude", fontsize=14)

         save_fig("better_NYC_airbnb_plot")
         plt.show()
```

```
Airbnb original set size: 586740
Airbnb_subset size: 213744
Saving figure better_NYC_airbnb_plot
```



[5 pts] Plot average price of room types who have availability greater than 180 days.

```
In [37]: rooms_avail_180 = airbnb.drop(airbnb[(airbnb["availability_365"] <= 180)].inde
x)

room_price = rooms_avail_180.groupby("room_type")["price"].sum()
room_count = rooms_avail_180.groupby("room_type")["price"].count()

av_room_price = (room_price/room_count).plot(kind="bar")
```



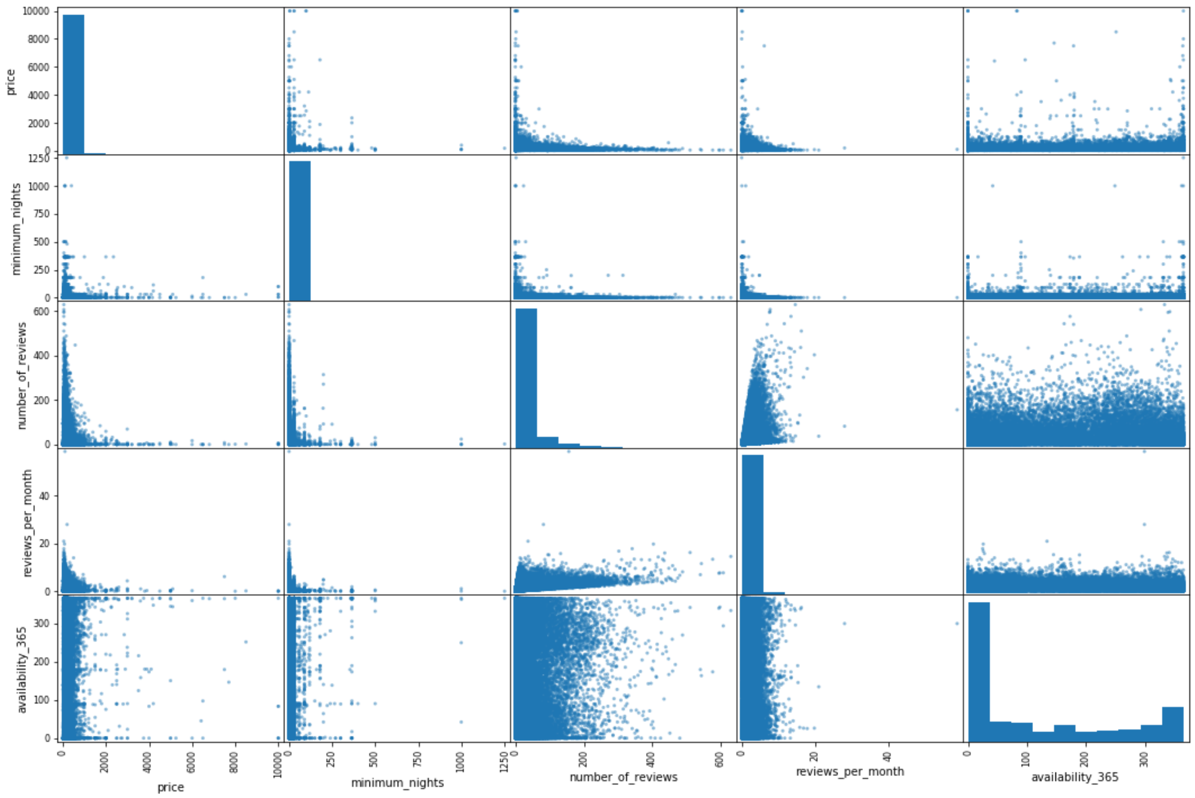
[5 pts] Plot correlation matrix

- which features have positive correlation?
- which features have negative correlation?

In [38]:

```
#airbnb_corr_matrix = airbnb.corr()
#print(airbnb_corr_matrix)
airbnb_attributes = ["price","minimum_nights","number_of_reviews","reviews_per_month","availability_365"]
scatter_matrix(airbnb[airbnb_attributes], figsize=(18,12))
```

```
Out[38]: array([[<matplotlib.axes._subplots.AxesSubplot object at 0x00000141737701C8>,
                 <matplotlib.axes._subplots.AxesSubplot object at 0x0000014173795D08>,
                 <matplotlib.axes._subplots.AxesSubplot object at 0x00000141737D2508>,
                 <matplotlib.axes._subplots.AxesSubplot object at 0x00000141741CB308>,
                 <matplotlib.axes._subplots.AxesSubplot object at 0x00000141744A3408
         >],
                [<matplotlib.axes._subplots.AxesSubplot object at 0x00000141744DB508>,
                 <matplotlib.axes._subplots.AxesSubplot object at 0x0000014174514608>,
                 <matplotlib.axes._subplots.AxesSubplot object at 0x000001417454DC88>,
                 <matplotlib.axes._subplots.AxesSubplot object at 0x0000014174557848>,
                 <matplotlib.axes._subplots.AxesSubplot object at 0x0000014174591A08
         >],
                [<matplotlib.axes._subplots.AxesSubplot object at 0x0000014174677A48>,
                 <matplotlib.axes._subplots.AxesSubplot object at 0x00000141749CFB08>,
                 <matplotlib.axes._subplots.AxesSubplot object at 0x0000014174A79C48>,
                 <matplotlib.axes._subplots.AxesSubplot object at 0x0000014174AAFD88>,
                 <matplotlib.axes._subplots.AxesSubplot object at 0x0000014174AE8E88
         >],
                [<matplotlib.axes._subplots.AxesSubplot object at 0x0000014174B21F88>,
                 <matplotlib.axes._subplots.AxesSubplot object at 0x0000014176C32048>,
                 <matplotlib.axes._subplots.AxesSubplot object at 0x0000014176C6A148>,
                 <matplotlib.axes._subplots.AxesSubplot object at 0x0000014176CA2248>,
                 <matplotlib.axes._subplots.AxesSubplot object at 0x0000014176CDA388
         >],
                [<matplotlib.axes._subplots.AxesSubplot object at 0x0000014176D13488>,
                 <matplotlib.axes._subplots.AxesSubplot object at 0x0000014176D4A548>,
                 <matplotlib.axes._subplots.AxesSubplot object at 0x0000014176D85688>,
                 <matplotlib.axes._subplots.AxesSubplot object at 0x0000014176DBD788>,
                 <matplotlib.axes._subplots.AxesSubplot object at 0x0000014176DF4888
         >]],
               dtype=object)
```



[25 pts] Prepare the Data

[5 pts] Augment the dataframe with two other features which you think would be useful

In [39]:

```
airbnb["minimum_cost"] = airbnb["price"]*airbnb["minimum_nights"]
airbnb["minimum_earnings_per_year"] = airbnb["reviews_per_month"]*airbnb["minimum_cost"]*12
```

[5 pts] Impute any missing feature with a method of your choice, and briefly discuss why you chose this imputation method

In [40]:

```
from sklearn.impute import SimpleImputer

imputer = SimpleImputer(strategy="median")
```

[10 pts] Code complete data pipeline using sklearn mixins

In [41]:

```
from sklearn.pipeline import Pipeline
from sklearn.preprocessing import StandardScaler
from sklearn.preprocessing import OneHotEncoder
from sklearn.compose import ColumnTransformer

airbnb_num = airbnb.drop(columns=["neighbourhood","neighbourhood_group","room_type","id"])

airbnb_num_pipeline = Pipeline([
    ('imputer', SimpleImputer(strategy="median")),
    ('std_scaler', StandardScaler()),
])

airbnb_num_tr = airbnb_num_pipeline.fit_transform(airbnb_num)
airbnb_num_features = list(airbnb_num)
airbnb_cat_features = ["neighbourhood","neighbourhood_group","room_type"]

airbnb_full_pipeline = ColumnTransformer([
    ("num", airbnb_num_pipeline, airbnb_num_features),
    ("cat", OneHotEncoder(sparse=False, handle_unknown='ignore'), airbnb_cat_features),
])

airbnb_prepared = airbnb_full_pipeline.fit_transform(airbnb)
airbnb_prepared = pd.DataFrame(airbnb_prepared)
```

[5 pts] Set aside 20% of the data as test test (80% train, 20% test).

In [42]:

```
from sklearn.model_selection import train_test_split

X_train, X_test, y_train, y_test = train_test_split(airbnb_prepared.drop(airbn
b_prepared.columns[2], axis=1), airbnb_prepared[2], test_size=0.2, random_stat
e=0)
```

[15 pts] Fit a model of your choice

The task is to predict the price, you could refer to the housing example on how to train and evaluate your model using MSE. Provide both test and train set MSE values.

In [43]:

```
from sklearn.linear_model import LinearRegression

airbnb_lin_reg = LinearRegression()
airbnb_lin_reg.fit(X_train, y_train)

from sklearn.metrics import mean_squared_error

airbnb_preds = airbnb_lin_reg.predict(X_test)
mse = mean_squared_error(y_test, airbnb_preds)
print("Test mse value: ", mse)

airbnb_preds = airbnb_lin_reg.predict(X_train)
mse = mean_squared_error(y_train, airbnb_preds)
print("Train mse value: ", mse)
```

```
Test mse value:  0.6153495963161475
Train mse value:  0.6806895547681125
```