Seattle AirBnB Analysis

May 26, 2020

1 Seattle Airbnb Analysis

1.1 Section 1: Business Understanding

What are the tips and tricks for Airbnb beginner hosts?

Below are the questions that I will consider in this analysis: 1. Should the price be the same during every month of the year? 2. Should the price be the same for weekdays and weekends? 3. When should you be worried that the ratings will negatively affect the ability to charge desired prices?

[220]:
```
import pandas as pd
import matplotlib.pyplot as plt
import seaborn as sns
import numpy as np
import calendar
```

1.2 Section 2: Data Understanding

The data for the analysis was obtained from the Kaggle: https://www.kaggle.com/airbnb/seattle/data

The data is broken into 3 datasets: - Listings - includes full descriptions and average review score - Reviews - includes unique id for each reviewer and detailed comments - Calendar - includes listing id and the price and availability for that day

[221]:
```
df_reviews = pd.read_csv ("data/reviews.csv")
df_reviews.head()
```

[221]:
```
   listing_id        id        date  reviewer_id reviewer_name  \
0     7202016  38917982  2015-07-19     28943674        Bianca
1     7202016  39087409  2015-07-20     32440555         Frank
2     7202016  39820030  2015-07-26     37722850           Ian
3     7202016  40813543  2015-08-02     33671805        George
4     7202016  41986501  2015-08-10     34959538          Ming

                                            comments
0  Cute and cozy place. Perfect location to every…
1  Kelly has a great room in a very central locat…
2  Very spacious apartment, and in a great neighb…
```

```
3  Close to Seattle Center and all it has to offe…
4  Kelly was a great host and very accommodating …
```

```
[222]: df_listings = pd.read_csv ("data/listings.csv")
       df_listings.head()
```

```
[222]:        id                           listing_url       scrape_id last_scraped  \
       0   241032   https://www.airbnb.com/rooms/241032  20160104002432   2016-01-04
       1   953595   https://www.airbnb.com/rooms/953595  20160104002432   2016-01-04
       2  3308979  https://www.airbnb.com/rooms/3308979  20160104002432   2016-01-04
       3  7421966  https://www.airbnb.com/rooms/7421966  20160104002432   2016-01-04
       4   278830   https://www.airbnb.com/rooms/278830  20160104002432   2016-01-04

                                         name  \
       0         Stylish Queen Anne Apartment
       1   Bright & Airy Queen Anne Apartment
       2  New Modern House-Amazing water view
       3                   Queen Anne Chateau
       4       Charming craftsman 3 bdm house

                                                    summary  \
       0                                                NaN
       1  Chemically sensitive? We've removed the irrita…
       2  New modern house built in 2013.  Spectacular s…
       3  A charming apartment that sits atop Queen Anne…
       4  Cozy family craftman house in beautiful neighb…

                                                      space  \
       0  Make your self at home in this charming one-be…
       1  Beautiful, hypoallergenic apartment in an extr…
       2  Our house is modern, light and fresh with a wa…
       3                                                NaN
       4  Cozy family craftman house in beautiful neighb…

                                                description experiences_offered  \
       0  Make your self at home in this charming one-be…                none
       1  Chemically sensitive? We've removed the irrita…                none
       2  New modern house built in 2013.  Spectacular s…                none
       3  A charming apartment that sits atop Queen Anne…                none
       4  Cozy family craftman house in beautiful neighb…                none

                                    neighborhood_overview  … review_scores_value  \
       0                                                NaN  …                10.0
       1  Queen Anne is a wonderful, truly functional vi…  …                10.0
       2  Upper Queen Anne is a charming neighborhood fu…  …                10.0
       3                                                NaN  …                 NaN
       4  We are in the beautiful neighborhood of Queen …  …                 9.0
```

```
  requires_license license jurisdiction_names instant_bookable  \
0                f     NaN         WASHINGTON                f
1                f     NaN         WASHINGTON                f
2                f     NaN         WASHINGTON                f
3                f     NaN         WASHINGTON                f
4                f     NaN         WASHINGTON                f

  cancellation_policy  require_guest_profile_picture  \
0            moderate                              f
1              strict                              t
2              strict                              f
3            flexible                              f
4              strict                              f

  require_guest_phone_verification calculated_host_listings_count  \
0                               f                              2
1                               t                              6
2                               f                              2
3                               f                              1
4                               f                              1

  reviews_per_month
0              4.07
1              1.48
2              1.15
3               NaN
4              0.89

[5 rows x 92 columns]
```

[223]:
```
df_calendar= pd.read_csv ("data/calendar.csv")
df_calendar.head()
```

[223]:
```
   listing_id        date available   price
0      241032  2016-01-04         t  $85.00
1      241032  2016-01-05         t  $85.00
2      241032  2016-01-06         f     NaN
3      241032  2016-01-07         f     NaN
4      241032  2016-01-08         f     NaN
```

[224]:
```
df_calendar.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 1393570 entries, 0 to 1393569
Data columns (total 4 columns):
 #   Column      Non-Null Count    Dtype
```

```
---  ------      --------------    -----
 0   listing_id  1393570 non-null  int64
 1   date        1393570 non-null  object
 2   available   1393570 non-null  object
 3   price       934542 non-null   object
dtypes: int64(1), object(3)
memory usage: 42.5+ MB
```

1.3 Section 3: Prepare the data

[225]:
```
# Convert date from string to datetime to match the natural format of the data
df_calendar.date = pd.to_datetime(df_calendar.date)
# Break out the month into a separate column for easier analysis
df_calendar ["month"] = pd.DatetimeIndex(df_calendar.date).month
```

1.3.1 Explore Date Ranges

- Examine the earliest date in the dataset
- Examine the latest date in the dataset
- Calculate the number of days in the dataset

[226]:
```
df_calendar.date.min()
```

[226]:
```
Timestamp('2016-01-04 00:00:00')
```

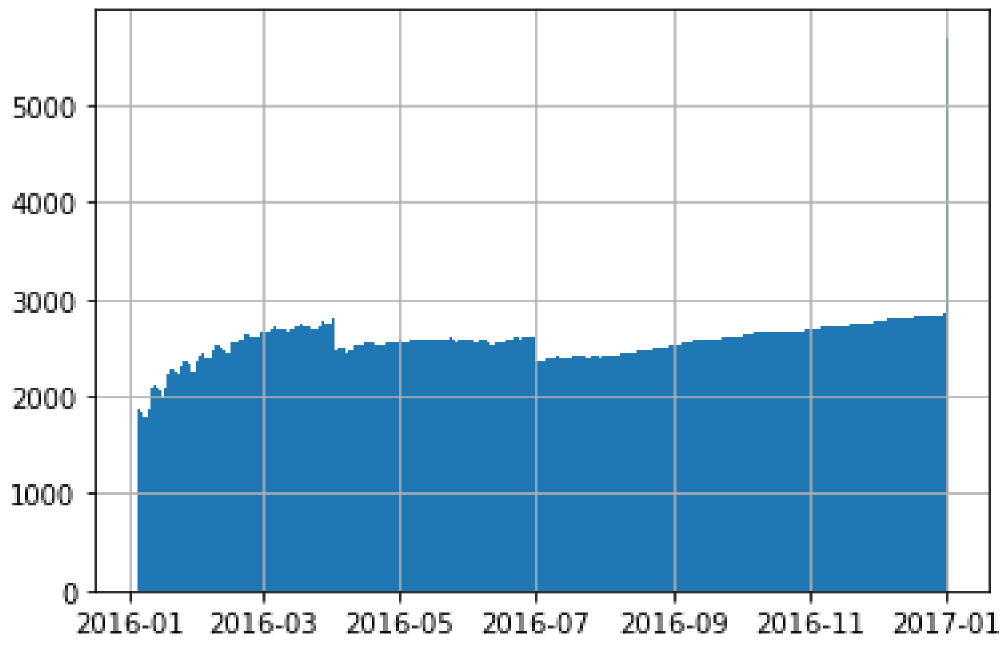
[227]:
```
df_calendar.date.max()
```

[227]:
```
Timestamp('2017-01-02 00:00:00')
```

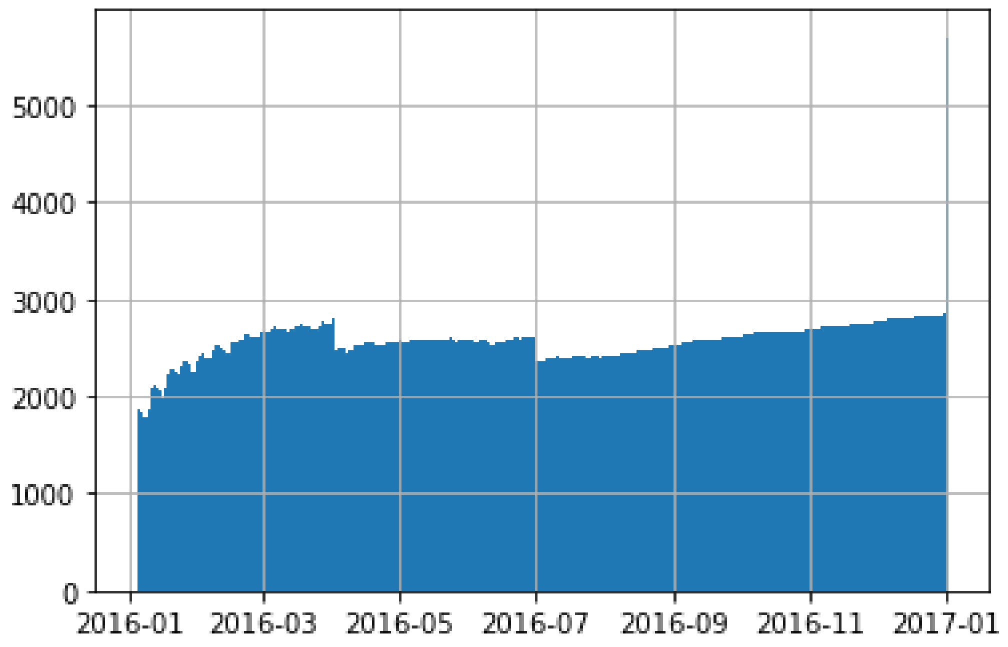
[228]:
```
num_days_in_dataset = (df_calendar.date.max()-df_calendar.date.min()).days
num_days_in_dataset
```

[228]:
```
364
```

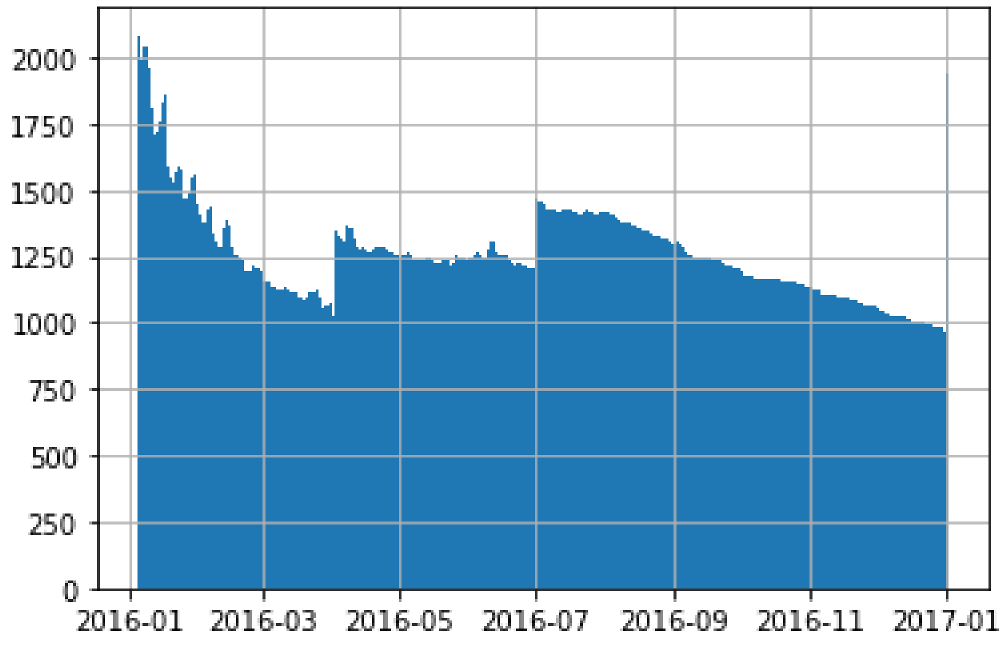
[252]:
```
#View the number of listings -> the number of listings is the same across the␣
 ↪entire range, this is not useful, let's dive deeper
df_calendar.date.hist(bins=num_days_in_dataset);
```



```
[230]: #View the number of listings that are available
       df_calendar.query("available=='t'").date.hist(bins=num_days_in_dataset);
```



[231]:
```
#View number of listings that are not available
df_calendar.query("available=='f'").date.hist(bins=num_days_in_dataset);
```



[232]:
```
#Calculate percentage of data with no price
df_calendar.price.count()/(df_calendar.price.isna().sum() + df_calendar.price.
 ↪count()) * 100
```

[232]:
```
67.06100160020667
```

[233]:
```
# Check the number of entries where price is missing
df_calendar.price.isna().sum()
```

[233]:
```
459028
```

[234]:
```
# Check if the number of missing prices corresponds to when the unit was not␣
 ↪available for rent
df_calendar.query("available=='f'").available.count()
```

[234]:
```
459028
```

[235]:
```
# Drop rows with no price data, as missing values indicate that a property was␣
 ↪not listed to be rented on those dates
# and thus is not interesting for our analysis
df_calendar = df_calendar.dropna()
```

[236]:
```
df_calendar.info()
```

```
<class 'pandas.core.frame.DataFrame'>
Int64Index: 934542 entries, 0 to 1393213
Data columns (total 5 columns):
 #   Column      Non-Null Count   Dtype
---  ------      --------------   -----
 0   listing_id  934542 non-null  int64
 1   date        934542 non-null  datetime64[ns]
 2   available   934542 non-null  object
 3   price       934542 non-null  object
 4   month       934542 non-null  int64
dtypes: datetime64[ns](1), int64(2), object(2)
memory usage: 42.8+ MB
```

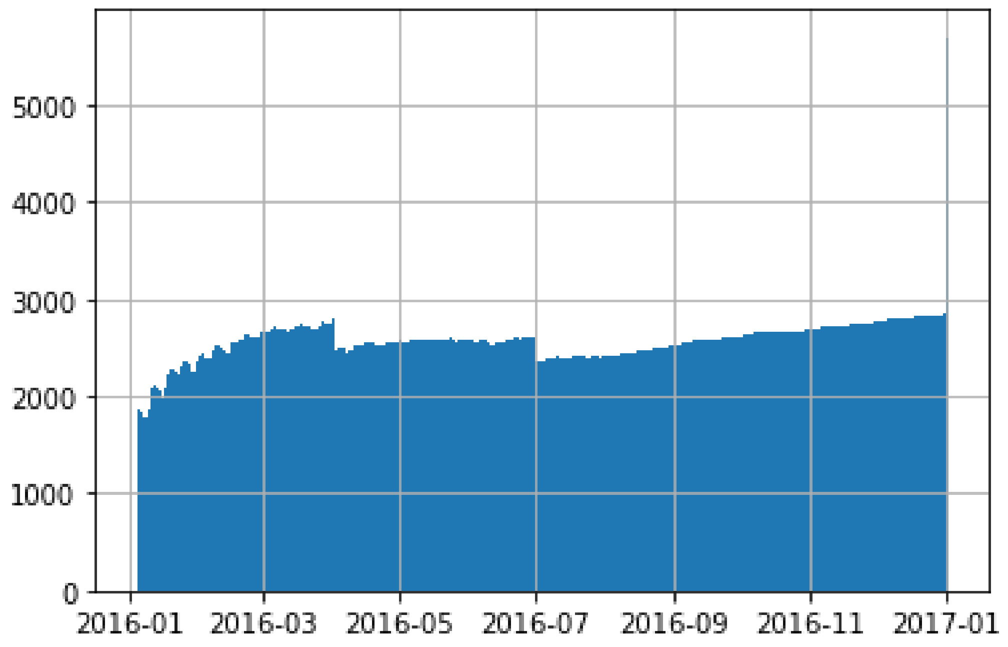
[237]:
```
# Convert price to an int instead of a string
df_calendar["price_numerical"] = df_calendar.price.str[1:].str.replace (",","").
↪astype(float)
```

[238]:
```
df_calendar.describe()
```

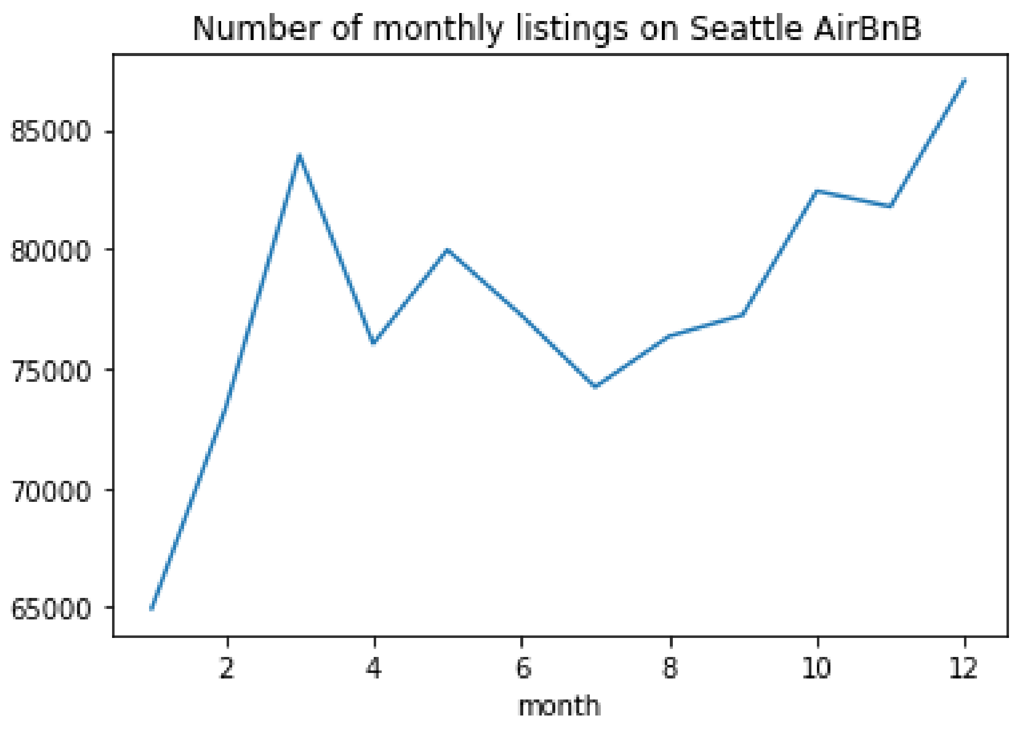
[238]:
```
         listing_id          month  price_numerical
count  9.345420e+05  934542.000000    934542.000000
mean   5.305517e+06       6.661120       137.944859
std    2.974821e+06       3.446401       105.062870
min    3.335000e+03       1.000000        10.000000
25%    2.875975e+06       4.000000        75.000000
50%    5.615620e+06       7.000000       109.000000
75%    7.873345e+06      10.000000       160.000000
max    1.034016e+07      12.000000      1650.000000
```

1.4 Sections 4 and 5: Data Modelling and Evaluate the results

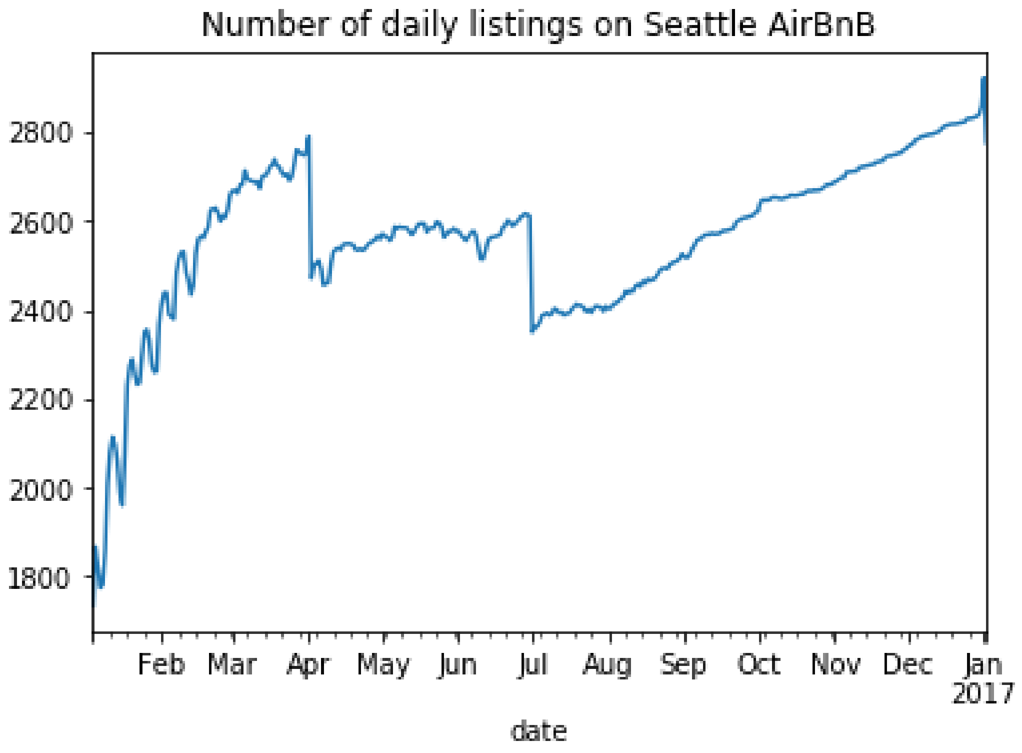
[239]:
```
#View number of daily listings - there is some variation, but not much, could␣
↪be due to change in regulation
df_calendar.date.hist(bins=num_days_in_dataset);
```



```
[241]: df_calendar.groupby("month").count().price.plot(title = "Number of monthly␣
        ↪listings on Seattle AirBnB");
```

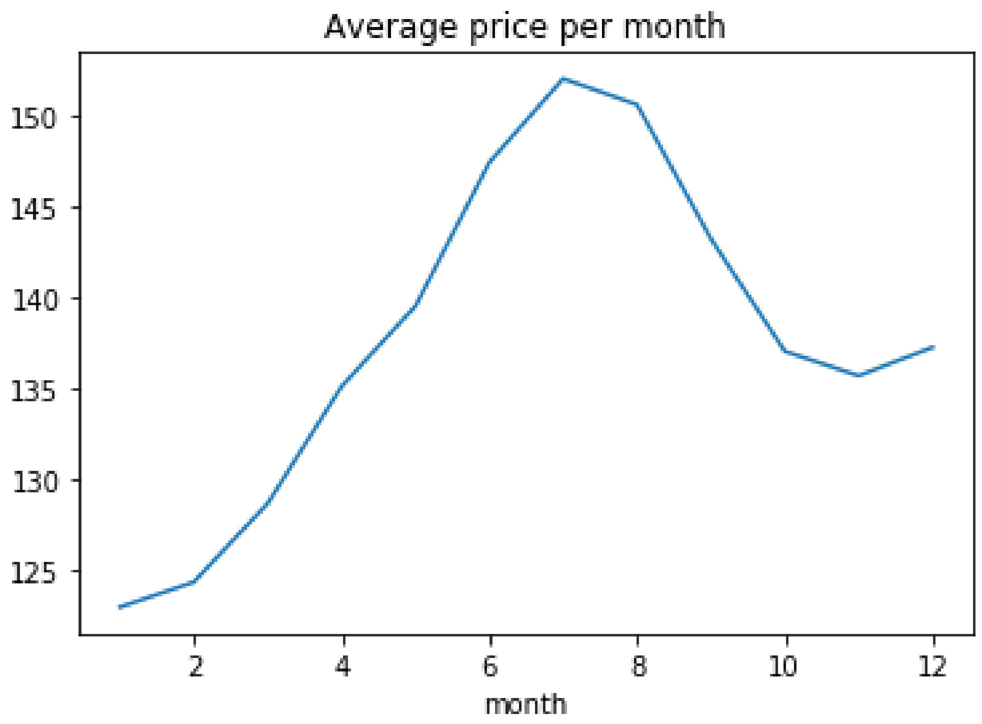


[242]:
```
df_calendar.groupby("date").count().price.plot(title = "Number of daily␣
↪listings on Seattle AirBnB");
```



1.4.1 Q1: Should the price be the same during every month of the year?

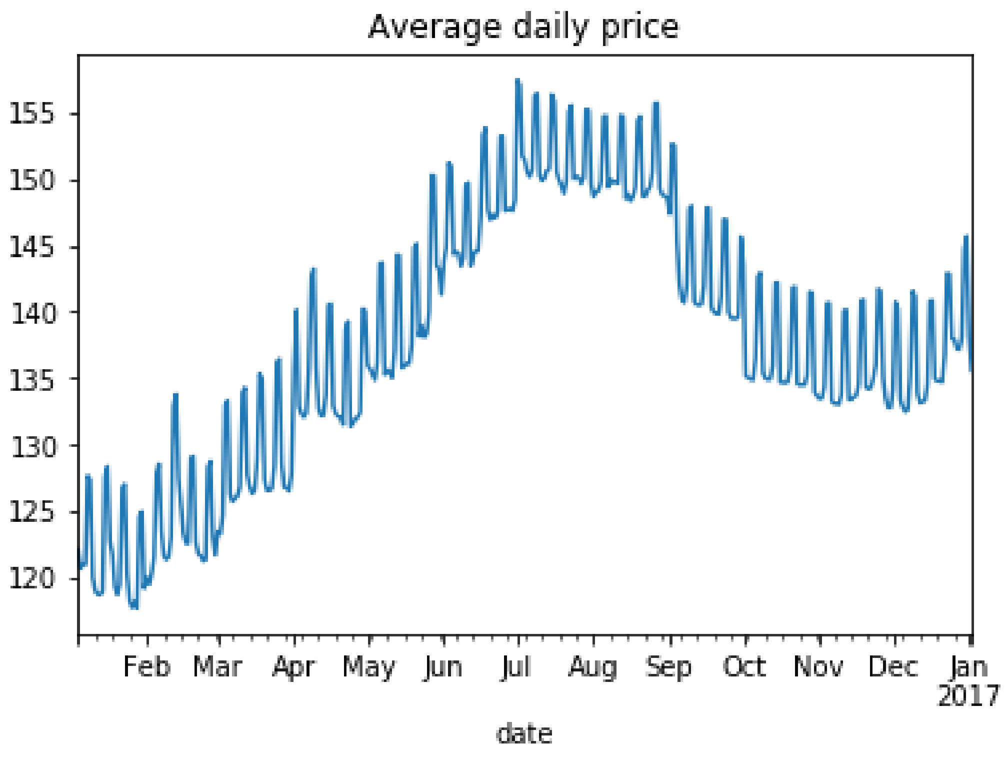
[240]:
```
# View average price per month
df_calendar.groupby("month").price_numerical.mean().plot(title="Average price␣
↪per month");
```



1.4.2 A1: Summer months are the most expensive, followed by the shoulder seasons, fall has higher price as compared to spring

1.4.3 Q2: Should the price be the same for weekdays and weekends?

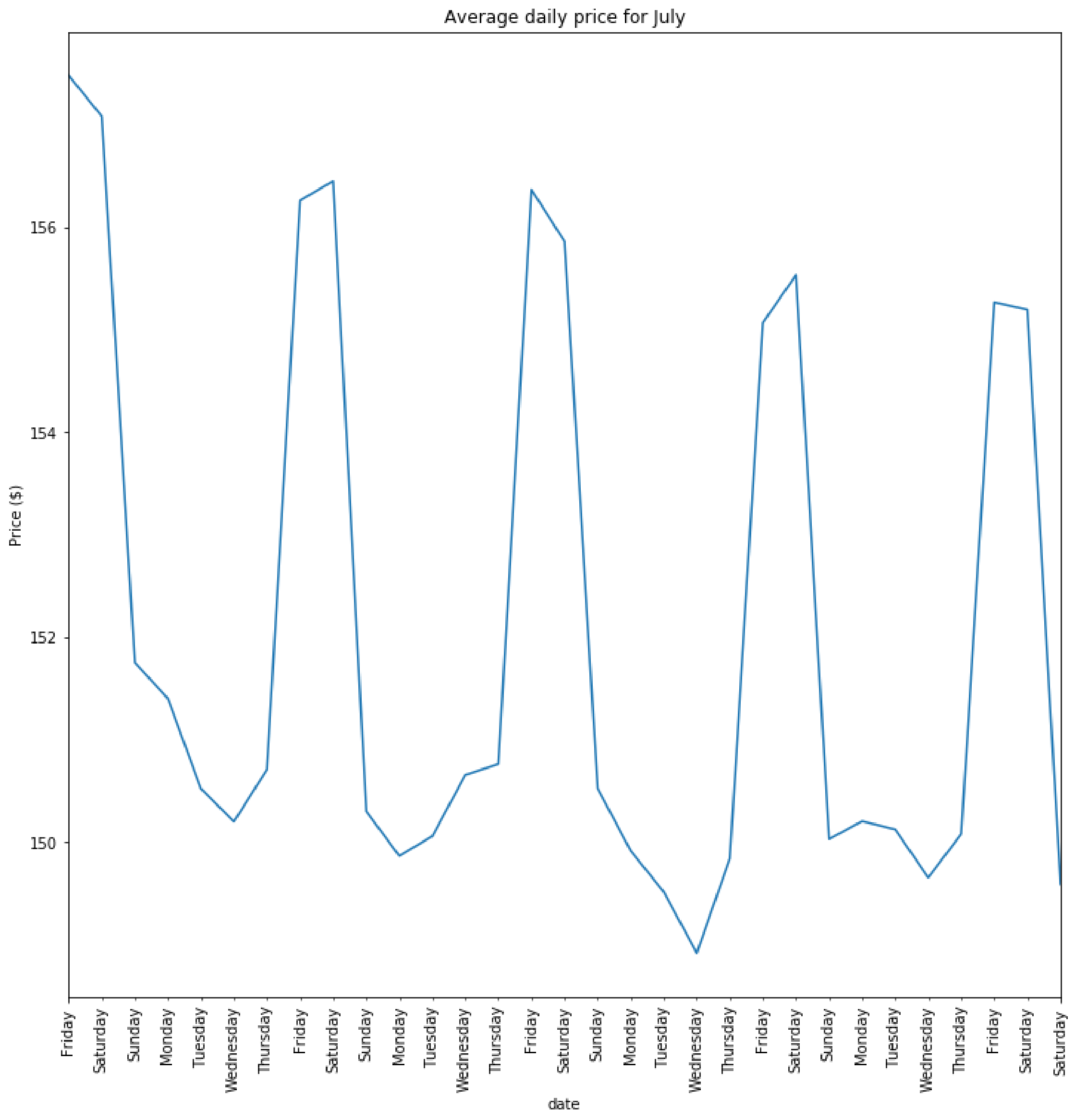
```
[243]: df_calendar.groupby("date").price_numerical.mean().plot(title = "Average daily␣
        ↪price");
```



1.4.4 Finding: There is weekly variability, but need to dive further down to see the exact trends

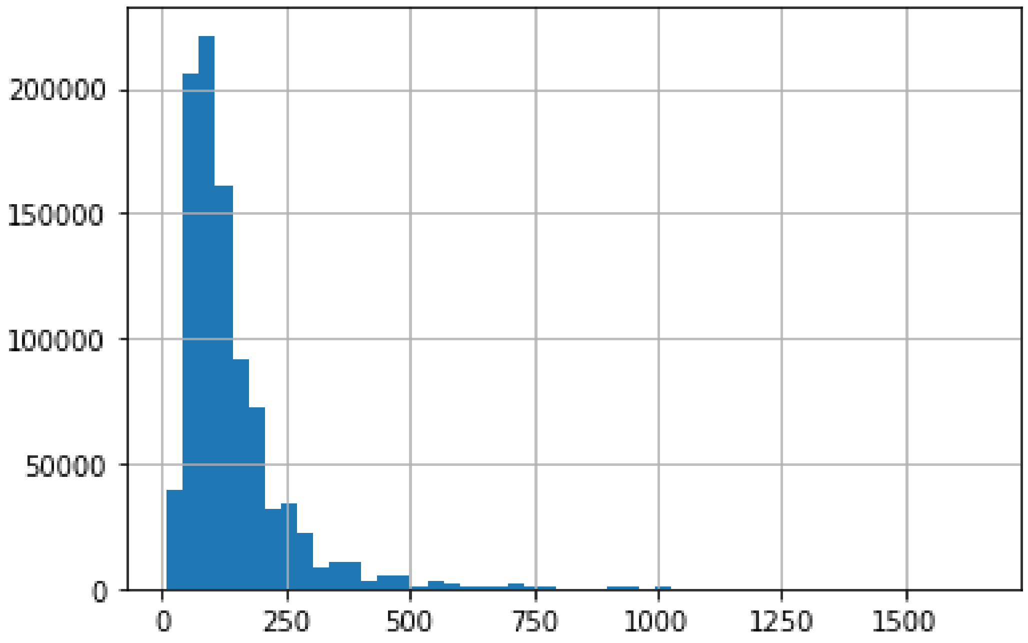
[244]:
```
def get_xtickslabels (date_range):
    """Returns the day of the week labels for a specific time range"""
    labels = []
    for date in date_range:
        labels.append (calendar.day_name[date[0].weekday()])
    return labels
```

[246]:
```
axes = df_calendar.query("month==7").groupby("date").price_numerical.mean().
 ↪plot(title = "Average daily price for July", figsize = (12,12));
xticklabels = get_xtickslabels(df_calendar.query("month==7").groupby("date").
 ↪date)
axes.set_ylabel ("Price ($)")
axes.set_xticklabels (xticklabels, rotation = 90);
axes.set_xticklabels (xticklabels [1:], minor = True, rotation = 90);
```

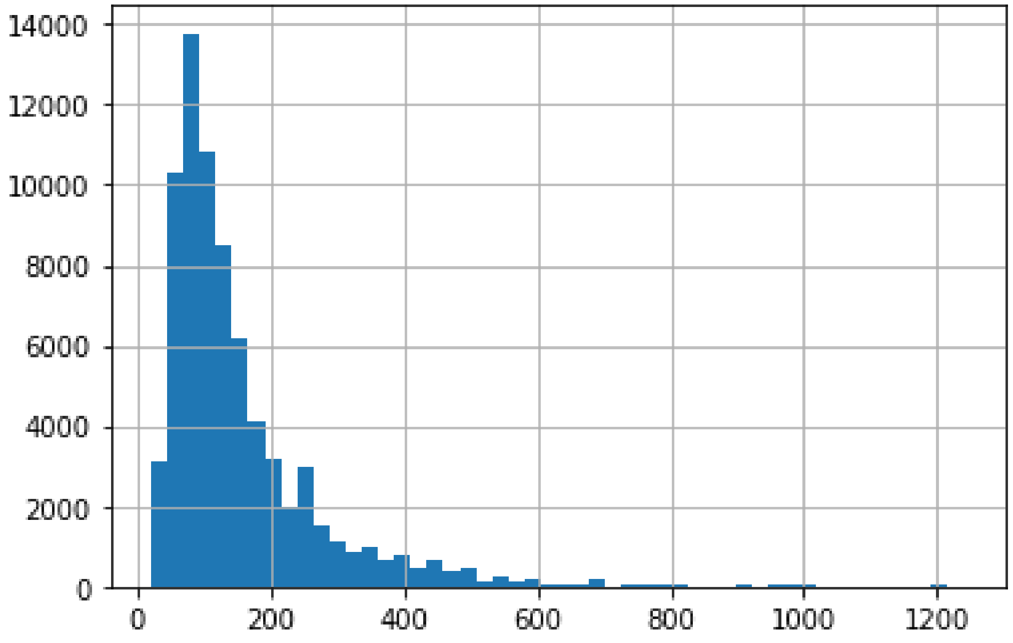


1.4.5 Answer 2: There is a price increase for Friday and Saturday night listings

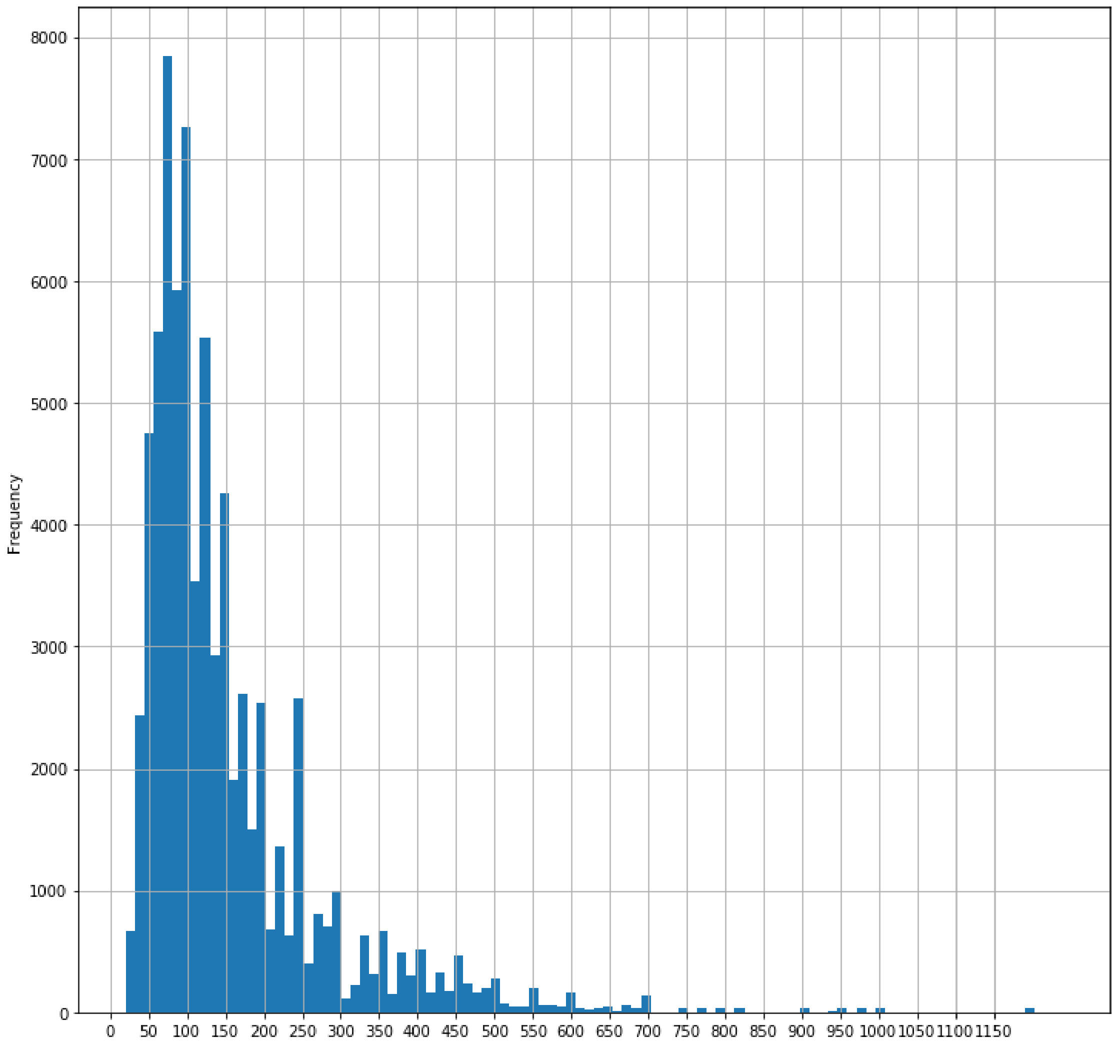
[247]:
```
#View price breakdowns
df_calendar.price_numerical.hist(bins=50);
```



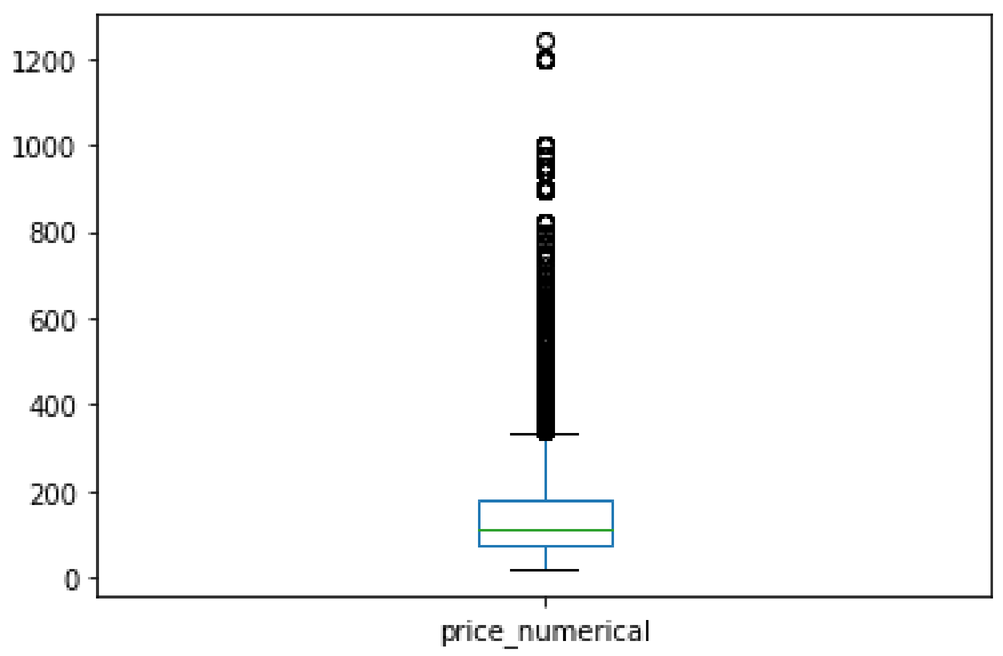
[248]:
```
#View price breakdowns for July
df_calendar.query("month==7").price_numerical.hist(bins=50);
```



[249]:
```
#View price breakdowns for July
df_calendar.query("month==7").price_numerical.plot(kind="hist", bins=100,␣
↪xticks = np.arange(0, 1200, step=50), figsize = (12,12), grid = True);
```

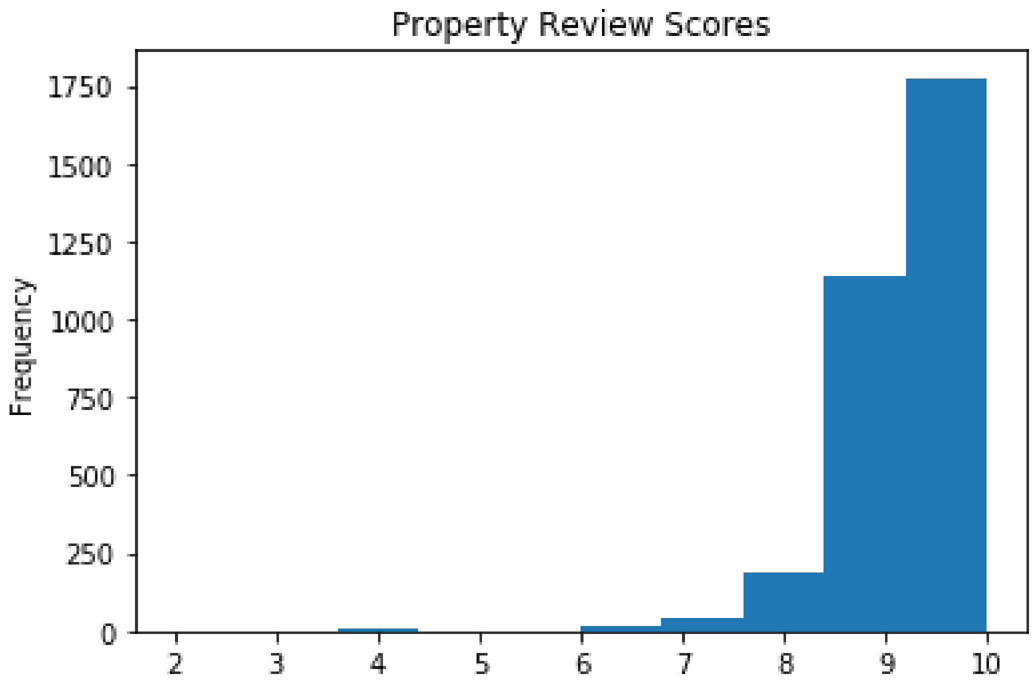


[250]:
```
#View price breakdowns
df_calendar.query("month==7").price_numerical.plot(kind="box");
```



1.4.6 Q3: When should you be worried that the ratings will negatively affect the ability to charge desired prices?

[251]:
```
# View the breakdown of property review scores
df_listings.review_scores_value.plot(kind="hist", title = "Property Review␣
↪Scores");
```



1.4.7 A3: Anything lower than a 9 would be considered a poor rating as it falls in the bottom quarter of all rating values.

[ ]:

```
```