DSC680 Sri R Sankaranarayanan

Applied Data Science - Project 2 (week 5 - 7)

Web Scraping - Airline Price Analysis

July 2022

In [8]:
```
!pip install selenium
```

```
Requirement already satisfied: selenium in c:\users\rengs\appdata\roaming\p
ython\python38\site-packages (4.3.0)
Requirement already satisfied: trio-websocket~=0.9 in c:\users\rengs\appdat
a\roaming\python\python38\site-packages (from selenium) (0.9.2)
Requirement already satisfied: trio~=0.17 in c:\users\rengs\appdata\roaming
\python\python38\site-packages (from selenium) (0.21.0)
Requirement already satisfied: urllib3[secure,socks]~=1.26 in c:\users\reng
s\appdata\roaming\python\python38\site-packages (from selenium) (1.26.10)
Requirement already satisfied: sniffio in c:\users\rengs\appdata\roaming\py
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Requirement already satisfied: outcome in c:\users\rengs\appdata\roaming\py
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Requirement already satisfied: async-generator>=1.9 in c:\users\rengs\appda
ta\roaming\python\python38\site-packages (from trio~=0.17->selenium) (1.10)
Requirement already satisfied: cffi>=1.14 in c:\users\rengs\appdata\roaming
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Requirement already satisfied: attrs>=19.2.0 in c:\users\rengs\appdata\roam
ing\python\python38\site-packages (from trio~=0.17->selenium) (21.4.0)
Requirement already satisfied: idna in c:\users\rengs\appdata\roaming\pytho
n\python38\site-packages (from trio~=0.17->selenium) (3.3)
Requirement already satisfied: sortedcontainers in c:\users\rengs\appdata\r
oaming\python\python38\site-packages (from trio~=0.17->selenium) (2.4.0)
Requirement already satisfied: wsproto>=0.14 in c:\users\rengs\appdata\roam
ing\python\python38\site-packages (from trio-websocket~=0.9->selenium) (1.
1.0)
Requirement already satisfied: PySocks!=1.5.7,<2.0,>=1.5.6 in c:\users\reng
s\appdata\roaming\python\python38\site-packages (from urllib3[secure,socks]
~=1.26->selenium) (1.7.1)
Requirement already satisfied: pyOpenSSL>=0.14 in c:\users\rengs\appdata\ro
aming\python\python38\site-packages (from urllib3[secure,socks]~=1.26->sele
nium) (22.0.0)
Requirement already satisfied: cryptography>=1.3.4 in c:\users\rengs\appdat
a\roaming\python\python38\site-packages (from urllib3[secure,socks]~=1.26->
selenium) (37.0.4)
Requirement already satisfied: certifi in c:\users\rengs\appdata\roaming\py
thon\python38\site-packages (from urllib3[secure,socks]~=1.26->selenium) (2
022.6.15)
Requirement already satisfied: pycparser in c:\users\rengs\appdata\roaming
\python\python38\site-packages (from cffi>=1.14->trio~=0.17->selenium) (2.2
1)
Requirement already satisfied: h11<1,>=0.9.0 in c:\users\rengs\appdata\roam
ing\python\python38\site-packages (from wsproto>=0.14->trio-websocket~=0.9-
>selenium) (0.13.0)
```

```
WARNING: Ignoring invalid distribution -rllib3 (c:\programdata\anaconda3
\lib\site-packages)
WARNING: Ignoring invalid distribution -rapt (c:\programdata\anaconda3\li
b\site-packages)
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b\site-packages)
WARNING: Ignoring invalid distribution - (c:\programdata\anaconda3\lib\si
te-packages)
```

In [16]:

```python
import numpy as np # linear algebra
import pandas as pd # data processing

import os
for dirname, _, filenames in os.walk('/kaggle/input'):
    for filename in filenames:
        print(os.path.join(dirname, filename))

# You can write up to 20GB to the current directory (/kaggle/working/) th
# You can also write temporary files to /kaggle/temp/, but they won't be
```

In [17]:

```python
import pandas as pd
import numpy as np
import matplotlib.pyplot as plt
import seaborn as sns
sns.set_theme(style="darkgrid")
```

In [18]:

```python
## Testing Web Scraped dataset from Kaggle for Data Analysis

df = pd.read_csv('C:\SRINATH\Bellevue\DSC680\Project 2\Data\Clean_Dataset
df.head()
```

Out[18]:

	Unnamed: 0	airline	flight	source_city	departure_time	stops	arrival_time	destination_ci
0	0	SpiceJet	SG-8709	Delhi	Evening	zero	Night	Mumb
1	1	SpiceJet	SG-8157	Delhi	Early_Morning	zero	Morning	Mumb
2	2	AirAsia	I5-764	Delhi	Early_Morning	zero	Early_Morning	Mumb
3	3	Vistara	UK-995	Delhi	Morning	zero	Afternoon	Mumb
4	4	Vistara	UK-963	Delhi	Morning	zero	Morning	Mumb

In [19]:
```
df.describe()
```
Out[19]:

	Unnamed: 0	duration	days_left	price
count	300153.000000	300153.000000	300153.000000	300153.000000
mean	150076.000000	12.221021	26.004751	20889.660523
std	86646.852011	7.191997	13.561004	22697.767366
min	0.000000	0.830000	1.000000	1105.000000
25%	75038.000000	6.830000	15.000000	4783.000000
50%	150076.000000	11.250000	26.000000	7425.000000
75%	225114.000000	16.170000	38.000000	42521.000000
max	300152.000000	49.830000	49.000000	123071.000000

In [20]:
```
df.info()
```
```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 300153 entries, 0 to 300152
Data columns (total 12 columns):
 #   Column            Non-Null Count   Dtype  
---  ------            --------------   -----  
 0   Unnamed: 0        300153 non-null  int64  
 1   airline           300153 non-null  object 
 2   flight            300153 non-null  object 
 3   source_city       300153 non-null  object 
 4   departure_time    300153 non-null  object 
 5   stops             300153 non-null  object 
 6   arrival_time      300153 non-null  object 
 7   destination_city  300153 non-null  object 
 8   class             300153 non-null  object 
 9   duration          300153 non-null  float64
 10  days_left         300153 non-null  int64  
 11  price             300153 non-null  int64  
dtypes: float64(1), int64(3), object(8)
memory usage: 27.5+ MB
```

In [21]:
```
df.shape
```
Out[21]:
```
(300153, 12)
```

Data Cleaning

In [22]:
```
df.isnull().sum()
```

Out[22]:
```
Unnamed: 0          0
airline             0
flight              0
source_city         0
departure_time      0
stops               0
arrival_time        0
destination_city    0
class               0
duration            0
days_left           0
price               0
dtype: int64
```

In [23]:
```
df.drop(['Unnamed: 0'],inplace = True,axis=1)
df.head()
```

Out[23]:

	airline	flight	source_city	departure_time	stops	arrival_time	destination_city	class
0	SpiceJet	SG-8709	Delhi	Evening	zero	Night	Mumbai	Economy
1	SpiceJet	SG-8157	Delhi	Early_Morning	zero	Morning	Mumbai	Economy
2	AirAsia	I5-764	Delhi	Early_Morning	zero	Early_Morning	Mumbai	Economy
3	Vistara	UK-995	Delhi	Morning	zero	Afternoon	Mumbai	Economy
4	Vistara	UK-963	Delhi	Morning	zero	Morning	Mumbai	Economy

Data Visualization

In [24]:
```
column=[column for column in df.columns if df[column].dtype=='object']
column
```

Out[24]:
```
['airline',
 'flight',
 'source_city',
 'departure_time',
 'stops',
 'arrival_time',
 'destination_city',
 'class']
```

In [25]:
```
categorical = df[column]
```

In [26]:
```
categorical.head()
```

Out[26]:

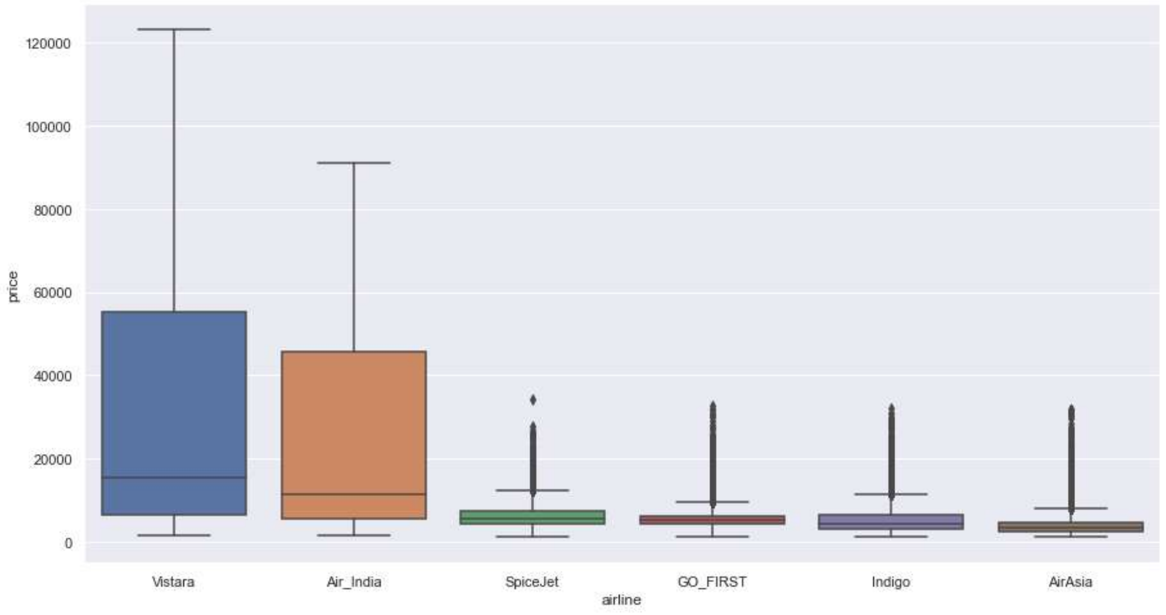
	airline	flight	source_city	departure_time	stops	arrival_time	destination_city	class
0	SpiceJet	SG-8709	Delhi	Evening	zero	Night	Mumbai	Economy
1	SpiceJet	SG-8157	Delhi	Early_Morning	zero	Morning	Mumbai	Economy
2	AirAsia	I5-764	Delhi	Early_Morning	zero	Early_Morning	Mumbai	Economy
3	Vistara	UK-995	Delhi	Morning	zero	Afternoon	Mumbai	Economy
4	Vistara	UK-963	Delhi	Morning	zero	Morning	Mumbai	Economy

In [27]:
```
categorical['airline'].value_counts()
```

Out[27]:
```
Vistara      127859
Air_India     80892
Indigo        43120
GO_FIRST      23173
AirAsia       16098
SpiceJet       9011
Name: airline, dtype: int64
```

In [28]:
```
plt.figure(figsize=(15,8))
sns.boxplot(x='airline',y='price',data=df.sort_values('price',ascending=
```

Out[28]:
```
<AxesSubplot:xlabel='airline', ylabel='price'>
```



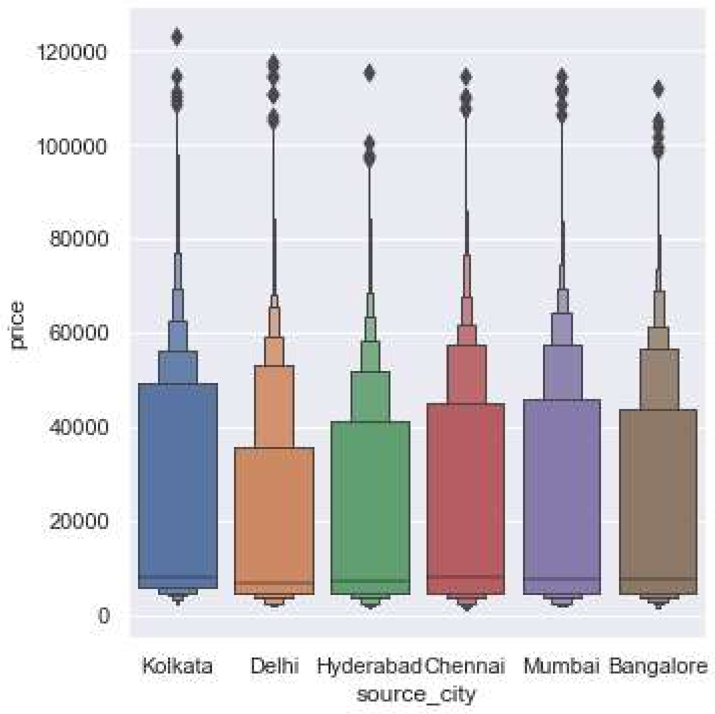
In [29]:
```
categorical['source_city'].value_counts()
```

Out[29]:
```
Delhi        61343
Mumbai       60896
Bangalore    52061
Kolkata      46347
Hyderabad    40806
Chennai      38700
Name: source_city, dtype: int64
```

In [30]:
```
plt.figure(figsize=(15,15))
sns.catplot(x='source_city',y='price',data=df.sort_values('price',ascend
```

Out[30]:
```
<seaborn.axisgrid.FacetGrid at 0x1fb15d9f670>

<Figure size 1080x1080 with 0 Axes>
```



Using Python Selenium and latest chrome driver for Web Scraping

In [2]:
```
from time import sleep, strftime
from random import randint
import pandas as pd
from selenium import webdriver
from selenium.webdriver.common.keys import Keys
import smtplib
from email.mime.multipart import MIMEMultipart

# Change this to your own chromedriver path!
chromedriver_path = 'C:/ProgramData/Google Chrome/chromedriver.exe'

driver = webdriver.Chrome(executable_path=chromedriver_path) # This will

driver.maximize_window() # For maximizing window
driver.implicitly_wait(20) # gives an implicit wait for 20 seconds

sleep(2)
```

```
<ipython-input-2-c727342d0168>:12: DeprecationWarning: executable_path has
been deprecated, please pass in a Service object
  driver = webdriver.Chrome(executable_path=chromedriver_path) # This will
open the Chrome window
```

First search in Kayak.com for Flight tickets from Dallas, USA to Chennai, India (my Native)

In [5]:
```
Kayak='https://www.kayak.com/flights/DFW-MAA/2022-08-23/2022-08-30?sort=
driver.get(Kayak)
sleep(3)
```

In [6]:
```
# This is what I used to define the "Cheapest" button

cheap_results = '//a[@data-code = "price"]'
```

In [7]:
```
driver.find_element("xpath", '//a[@data-code = "price"]')


```

Out[7]:
```
<selenium.webdriver.remote.webelement.WebElement (session="d35ad25ddd5025c5
90d4ff72262a9f8c", element="706be657-d056-41e7-917a-9efb73091c73")>
```

In [8]:
```
# Loading more results to maximize the scraping

def load_more():
    try:
        more_results = '//a[@class = "moreButton"]'
        driver.find_element("xpath", more_results).click()
        # Printing these notes during the program helps me quickly check
        print('sleeping.....')
        sleep(randint(45,60))
    except:
        pass
```

In [9]:

```
def page_scrape():
    """This function takes care of the scraping part"""

    xp_sections = '//*[@class="section duration"]'
    sections = driver.find_elements("xpath", xp_sections)
    sections_list = [value.text for value in sections]
    section_a_list = sections_list[::2] # This is to separate the two fl
    section_b_list = sections_list[1::2] # This is to separate the two f


    if section_a_list == []:
        raise SystemExit

    # I'll use the letter A for the outbound flight and B for the inbound
    a_duration = []
    a_section_names = []
    for n in section_a_list:
        # Separate the time from the cities
        a_section_names.append(''.join(n.split()[2:5]))
        a_duration.append(''.join(n.split()[0:2]))
    b_duration = []
    b_section_names = []
    for n in section_b_list:
        # Separate the time from the cities
        b_section_names.append(''.join(n.split()[2:5]))
        b_duration.append(''.join(n.split()[0:2]))

    xp_dates = '//div[@class="section date"]'
    dates = driver.find_elements("xpath", xp_dates)
    dates_list = [value.text for value in dates]
    a_date_list = dates_list[::2]
    b_date_list = dates_list[1::2]
    # Separating the weekday from the day
    a_day = [value.split()[0] for value in a_date_list]
    a_weekday = [value.split()[1] for value in a_date_list]
    b_day = [value.split()[0] for value in b_date_list]
    b_weekday = [value.split()[1] for value in b_date_list]

    # getting the prices
    xp_prices = '//a[@class="booking-link"]/span[@class="price option-tex
    prices = driver.find_elements("xpath", xp_prices)
    prices_list = [price.text.replace('$','') for price in prices if pric
    prices_list = list(map(int, prices_list))

    # the stops are a big list with one leg on the even index and second
    xp_stops = '//div[@class="section stops"]/div[1]'
    stops = driver.find_elements("xpath", xp_stops)
    stops_list = [stop.text[0].replace('n','0') for stop in stops]
    a_stop_list = stops_list[::2]
    b_stop_list = stops_list[1::2]

    xp_stops_cities = '//div[@class="section stops"]/div[2]'
    stops_cities = driver.find_elements("xpath", xp_stops_cities)
    stops_cities_list = [stop.text for stop in stops_cities]
    a_stop_name_list = stops_cities_list[::2]
    b_stop_name_list = stops_cities_list[1::2]
```

```python

    # this part gets me the airline company and the departure and arrival
    xp_schedule = '//div[@class="section times"]'
    schedules = driver.find_elements("xpath", xp_schedule)
    hours_list = []
    carrier_list = []
    for schedule in schedules:
        hours_list.append(schedule.text.split('\n')[0])
        carrier_list.append(schedule.text.split('\n')[1])
    # split the hours and carriers, between a and b legs
    a_hours = hours_list[::2]
    a_carrier = carrier_list[::2]
    b_hours = hours_list[1::2]
    b_carrier = carrier_list[1::2]


    cols = (['Out Day', 'Out Time', 'Out Weekday', 'Out Airline', 'Out Ci
            'Return Day', 'Return Time', 'Return Weekday', 'Return Airli
            'Price'])

    flights_df = pd.DataFrame({'Out Day': a_day,
                               'Out Weekday': a_weekday,
                               'Out Duration': a_duration,
                               'Out Cities': a_section_names,
                               'Return Day': b_day,
                               'Return Weekday': b_weekday,
                               'Return Duration': b_duration,
                               'Return Cities': b_section_names,
                               'Out Stops': a_stop_list,
                               'Out Stop Cities': a_stop_name_list,
                               'Return Stops': b_stop_list,
                               'Return Stop Cities': b_stop_name_list,
                               'Out Time': a_hours,
                               'Out Airline': a_carrier,
                               'Return Time': b_hours,
                               'Return Airline': b_carrier,
                               'Price': prices_list})[cols]

    flights_df['timestamp'] = strftime("%Y%m%d-%H%M") # so we can know wh
    return flights_df
```

In [10]:

```
def start_kayak(city_from, city_to, date_start, date_end):
    """City codes - it's the IATA codes!
    Date format -  YYYY-MM-DD"""

    kayak = ('https://www.kayak.com/flights/' + city_from + '-' + city_to
             '/' + date_start + '-flexible/' + date_end + '-flexible?sor
    driver.get(kayak)
    sleep(randint(8,10))

    # sometimes a popup shows up, so we can use a try statement to check
    try:
        xp_popup_close = '//button[contains(@id,"dialog-close") and conta
        driver.find_elements("xpath", xp_popup_close)[5].click()
    except Exception as e:
        pass
    sleep(randint(60,95))
    print('loading more.....')

#     load_more()

    print('starting first scrape.....')
    df_flights_best = page_scrape()
    df_flights_best['sort'] = 'best'
    sleep(randint(60,80))

    # Let's also get the lowest prices from the matrix on top
    matrix = driver.find_elements("xpath", '//*[contains(@id,"FlexMatrix
    matrix_prices = [price.text.replace('$','') for price in matrix]
    matrix_prices = list(map(int, matrix_prices))
    matrix_min = min(matrix_prices)
    matrix_avg = sum(matrix_prices)/len(matrix_prices)

    print('switching to cheapest results.....')
    cheap_results = '//a[@data-code = "price"]'
    driver.find_element("xpath", cheap_results).click()
    sleep(randint(60,90))
    print('loading more.....')

#     load_more()

    print('starting second scrape.....')
    df_flights_cheap = page_scrape()
    df_flights_cheap['sort'] = 'cheap'
    sleep(randint(60,80))

    print('switching to quickest results.....')
    quick_results = '//a[@data-code = "duration"]'
    driver.find_element("xpath", quick_results).click()
    sleep(randint(60,90))
    print('loading more.....')

#     load_more()

    print('starting third scrape.....')
    df_flights_fast = page_scrape()
    df_flights_fast['sort'] = 'fast'
    sleep(randint(60,80))

    # saving a new dataframe as an excel file. the name is custom made to
    final_df = df_flights_cheap.append(df_flights_best).append(df_flight
    final_df.to_excel('search_backups//{}_flights_{}-{}_from_{}_to_{}.xls


    print('saved df.....')

    # We can keep track of what they predict and how it actually turns ou
    xp_loading = '//div[contains(@id,"advice")]'
    loading = driver.find_element("xpath", xp_loading).text
    xp_prediction = '//span[@class="info-text"]'
    prediction = driver.find_element("xpath", xp_prediction).text
    print(loading+'\n'+prediction)

    # sometimes we get this string in the loading variable, which will co
    # just change it to "Not Sure" if it happens
    weird = '¯\\_(ツ)_/¯'
    if loading == weird:
        loading = 'Not sure'

    username = 'rengsankar1986@gmail.com'
    password = 'xxxxxxx' #   masking for confidentiality

    server = smtplib.SMTP('smtp.outlook.com', 587)
    server.ehlo()
    server.starttls()
    server.login(username, password)
    msg = ('Subject: Flight Scraper\n\n\
Cheapest Flight: {}\nAverage Price: {}\n\nRecommendation: {}\n\nEnd of me
    message = MIMEMultipart()
    message['From'] = 'rengsankar1986@gmail.com'
    message['to'] = 'rengsankar1986@gmail.com'
    server.sendmail('rengsankar1986@gmail.com', 'rengsankar1986@gmail.co
    print('sent email.....')
```

Now let's get ready to get the results for Vacation right after the last day of the course :)

In [*]:

```python

city_from = input('From which city? ')
city_to = input('Where to? ')
date_start = input('Search around which departure date? Please use YYYY-M
date_end = input('Return when? Please use YYYY-MM-DD format only ')

for n in range(0,5):
    start_kayak(city_from, city_to, date_start, date_end)
    print('iteration {} was complete @ {}'.format(n, strftime("%Y%m%d-%H

    # Wait 4 hours
    sleep(60*60*4)
    print('sleep finished.....')
```

```
From which city? DFW
Where to? MAA
Search around which departure date? Please use YYYY-MM-DD format only 2022-
08-13
Return when? Please use YYYY-MM-DD format only 2022-08-28
```

In [ ]: