In [97]:
```
!pip install chart_studio
```

```
Requirement already satisfied: chart_studio in /Users/mybeast/opt/anaconda3/
lib/python3.7/site-packages (1.1.0)
Requirement already satisfied: requests in /Users/mybeast/opt/anaconda3/lib/
python3.7/site-packages (from chart_studio) (2.24.0)
Requirement already satisfied: plotly in /Users/mybeast/opt/anaconda3/lib/py
thon3.7/site-packages (from chart_studio) (4.8.1)
Requirement already satisfied: retrying>=1.3.3 in /Users/mybeast/opt/anacond
a3/lib/python3.7/site-packages (from chart_studio) (1.3.3)
Requirement already satisfied: six in /Users/mybeast/opt/anaconda3/lib/pytho
n3.7/site-packages (from chart_studio) (1.14.0)
Requirement already satisfied: certifi>=2017.4.17 in /Users/mybeast/opt/anac
onda3/lib/python3.7/site-packages (from requests->chart_studio) (2019.11.28)
Requirement already satisfied: idna<3,>=2.5 in /Users/mybeast/opt/anaconda3/
lib/python3.7/site-packages (from requests->chart_studio) (2.8)
Requirement already satisfied: urllib3!=1.25.0,!=1.25.1,<1.26,>=1.21.1 in /U
sers/mybeast/opt/anaconda3/lib/python3.7/site-packages (from requests->chart
_studio) (1.25.8)
Requirement already satisfied: chardet<4,>=3.0.2 in /Users/mybeast/opt/anaco
nda3/lib/python3.7/site-packages (from requests->chart_studio) (3.0.4)
```

In [98]:
```
!pip install cufflinks
```

```
Requirement already satisfied: cufflinks in /Users/mybeast/opt/anaconda3/li
b/python3.7/site-packages (0.17.3)
Requirement already satisfied: six>=1.9.0 in /Users/mybeast/opt/anaconda3/li
b/python3.7/site-packages (from cufflinks) (1.14.0)
Requirement already satisfied: ipywidgets>=7.0.0 in /Users/mybeast/opt/anaco
nda3/lib/python3.7/site-packages (from cufflinks) (7.5.1)
Requirement already satisfied: colorlover>=0.2.1 in /Users/mybeast/opt/anaco
nda3/lib/python3.7/site-packages (from cufflinks) (0.3.0)
Requirement already satisfied: setuptools>=34.4.1 in /Users/mybeast/opt/anac
onda3/lib/python3.7/site-packages (from cufflinks) (46.0.0.post20200309)
Requirement already satisfied: numpy>=1.9.2 in /Users/mybeast/opt/anaconda3/
lib/python3.7/site-packages (from cufflinks) (1.18.1)
Requirement already satisfied: plotly>=4.1.1 in /Users/mybeast/opt/anaconda
3/lib/python3.7/site-packages (from cufflinks) (4.8.1)
Requirement already satisfied: ipython>=5.3.0 in /Users/mybeast/opt/anaconda
3/lib/python3.7/site-packages (from cufflinks) (7.12.0)
Requirement already satisfied: pandas>=0.19.2 in /Users/mybeast/opt/anaconda
3/lib/python3.7/site-packages (from cufflinks) (1.0.5)
Requirement already satisfied: ipykernel>=4.5.1 in /Users/mybeast/opt/anacon
da3/lib/python3.7/site-packages (from ipywidgets>=7.0.0->cufflinks) (5.1.4)
Requirement already satisfied: widgetsnbextension~=3.5.0 in /Users/mybeast/o
pt/anaconda3/lib/python3.7/site-packages (from ipywidgets>=7.0.0->cufflinks)
(3.5.1)
Requirement already satisfied: traitlets>=4.3.1 in /Users/mybeast/opt/anacon
da3/lib/python3.7/site-packages (from ipywidgets>=7.0.0->cufflinks) (4.3.3)
Requirement already satisfied: nbformat>=4.2.0 in /Users/mybeast/opt/anacond
a3/lib/python3.7/site-packages (from ipywidgets>=7.0.0->cufflinks) (5.0.4)
Requirement already satisfied: retrying>=1.3.3 in /Users/mybeast/opt/anacond
a3/lib/python3.7/site-packages (from plotly>=4.1.1->cufflinks) (1.3.3)
Requirement already satisfied: jedi>=0.10 in /Users/mybeast/opt/anaconda3/li
b/python3.7/site-packages (from ipython>=5.3.0->cufflinks) (0.14.1)
Requirement already satisfied: backcall in /Users/mybeast/opt/anaconda3/lib/
python3.7/site-packages (from ipython>=5.3.0->cufflinks) (0.1.0)
Requirement already satisfied: prompt-toolkit!=3.0.0,!=3.0.1,<3.1.0,>=2.0.0
in /Users/mybeast/opt/anaconda3/lib/python3.7/site-packages (from ipython>=
5.3.0->cufflinks) (3.0.3)
Requirement already satisfied: pickleshare in /Users/mybeast/opt/anaconda3/l
ib/python3.7/site-packages (from ipython>=5.3.0->cufflinks) (0.7.5)
Requirement already satisfied: pexpect; sys_platform != "win32" in /Users/my
beast/opt/anaconda3/lib/python3.7/site-packages (from ipython>=5.3.0->cuffli
nks) (4.8.0)
Requirement already satisfied: appnope; sys_platform == "darwin" in /Users/m
ybeast/opt/anaconda3/lib/python3.7/site-packages (from ipython>=5.3.0->cuffl
inks) (0.1.0)
Requirement already satisfied: pygments in /Users/mybeast/opt/anaconda3/lib/
python3.7/site-packages (from ipython>=5.3.0->cufflinks) (2.5.2)
Requirement already satisfied: decorator in /Users/mybeast/opt/anaconda3/li
b/python3.7/site-packages (from ipython>=5.3.0->cufflinks) (4.4.1)
Requirement already satisfied: python-dateutil>=2.6.1 in /Users/mybeast/opt/
anaconda3/lib/python3.7/site-packages (from pandas>=0.19.2->cufflinks) (2.8.
1)
Requirement already satisfied: pytz>=2017.2 in /Users/mybeast/opt/anaconda3/
lib/python3.7/site-packages (from pandas>=0.19.2->cufflinks) (2019.3)
Requirement already satisfied: jupyter-client in /Users/mybeast/opt/anaconda
3/lib/python3.7/site-packages (from ipykernel>=4.5.1->ipywidgets>=7.0.0->cuf
flinks) (5.3.4)
```

```
Requirement already satisfied: tornado>=4.2 in /Users/mybeast/opt/anaconda3/
lib/python3.7/site-packages (from ipykernel>=4.5.1->ipywidgets>=7.0.0->cuffl
inks) (5.1.1)
Requirement already satisfied: notebook>=4.4.1 in /Users/mybeast/opt/anacond
a3/lib/python3.7/site-packages (from widgetsnbextension~=3.5.0->ipywidgets>=
7.0.0->cufflinks) (6.0.3)
Requirement already satisfied: ipython-genutils in /Users/mybeast/opt/anacon
da3/lib/python3.7/site-packages (from traitlets>=4.3.1->ipywidgets>=7.0.0->c
ufflinks) (0.2.0)
Requirement already satisfied: jupyter-core in /Users/mybeast/opt/anaconda3/
lib/python3.7/site-packages (from nbformat>=4.2.0->ipywidgets>=7.0.0->cuffli
nks) (4.6.1)
Requirement already satisfied: jsonschema!=2.5.0,>=2.4 in /Users/mybeast/op
t/anaconda3/lib/python3.7/site-packages (from nbformat>=4.2.0->ipywidgets>=
7.0.0->cufflinks) (3.2.0)
Requirement already satisfied: parso>=0.5.0 in /Users/mybeast/opt/anaconda3/
lib/python3.7/site-packages (from jedi>=0.10->ipython>=5.3.0->cufflinks) (0.
5.2)
Requirement already satisfied: wcwidth in /Users/mybeast/opt/anaconda3/lib/p
ython3.7/site-packages (from prompt-toolkit!=3.0.0,!=3.0.1,<3.1.0,>=2.0.0->i
python>=5.3.0->cufflinks) (0.1.8)
Requirement already satisfied: ptyprocess>=0.5 in /Users/mybeast/opt/anacond
a3/lib/python3.7/site-packages (from pexpect; sys_platform != "win32"->ipyth
on>=5.3.0->cufflinks) (0.6.0)
Requirement already satisfied: pyzmq>=13 in /Users/mybeast/opt/anaconda3/li
b/python3.7/site-packages (from jupyter-client->ipykernel>=4.5.1->ipywidgets
>=7.0.0->cufflinks) (18.1.1)
Requirement already satisfied: nbconvert in /Users/mybeast/opt/anaconda3/li
b/python3.7/site-packages (from notebook>=4.4.1->widgetsnbextension~=3.5.0->
ipywidgets>=7.0.0->cufflinks) (5.6.1)
Requirement already satisfied: Send2Trash in /Users/mybeast/opt/anaconda3/li
b/python3.7/site-packages (from notebook>=4.4.1->widgetsnbextension~=3.5.0->
ipywidgets>=7.0.0->cufflinks) (1.5.0)
Requirement already satisfied: terminado>=0.8.1 in /Users/mybeast/opt/anacon
da3/lib/python3.7/site-packages (from notebook>=4.4.1->widgetsnbextension~=
3.5.0->ipywidgets>=7.0.0->cufflinks) (0.8.3)
Requirement already satisfied: jinja2 in /Users/mybeast/opt/anaconda3/lib/py
thon3.7/site-packages (from notebook>=4.4.1->widgetsnbextension~=3.5.0->ipyw
idgets>=7.0.0->cufflinks) (2.11.1)
Requirement already satisfied: prometheus-client in /Users/mybeast/opt/anaco
nda3/lib/python3.7/site-packages (from notebook>=4.4.1->widgetsnbextension~=
3.5.0->ipywidgets>=7.0.0->cufflinks) (0.7.1)
Requirement already satisfied: attrs>=17.4.0 in /Users/mybeast/opt/anaconda
3/lib/python3.7/site-packages (from jsonschema!=2.5.0,>=2.4->nbformat>=4.2.0
->ipywidgets>=7.0.0->cufflinks) (19.3.0)
Requirement already satisfied: importlib-metadata; python_version < "3.8" in
/Users/mybeast/opt/anaconda3/lib/python3.7/site-packages (from jsonschema!=
2.5.0,>=2.4->nbformat>=4.2.0->ipywidgets>=7.0.0->cufflinks) (1.5.0)
Requirement already satisfied: pyrsistent>=0.14.0 in /Users/mybeast/opt/anac
onda3/lib/python3.7/site-packages (from jsonschema!=2.5.0,>=2.4->nbformat>=
4.2.0->ipywidgets>=7.0.0->cufflinks) (0.15.7)
Requirement already satisfied: testpath in /Users/mybeast/opt/anaconda3/lib/
python3.7/site-packages (from nbconvert->notebook>=4.4.1->widgetsnbextension
~=3.5.0->ipywidgets>=7.0.0->cufflinks) (0.4.4)
Requirement already satisfied: entrypoints>=0.2.2 in /Users/mybeast/opt/anac
onda3/lib/python3.7/site-packages (from nbconvert->notebook>=4.4.1->widgetsn
```

```
bextension~=3.5.0->ipywidgets>=7.0.0->cufflinks) (0.3)
Requirement already satisfied: pandocfilters>=1.4.1 in /Users/mybeast/opt/an
aconda3/lib/python3.7/site-packages (from nbconvert->notebook>=4.4.1->widget
snbextension~=3.5.0->ipywidgets>=7.0.0->cufflinks) (1.4.2)
Requirement already satisfied: bleach in /Users/mybeast/opt/anaconda3/lib/py
thon3.7/site-packages (from nbconvert->notebook>=4.4.1->widgetsnbextension~=
3.5.0->ipywidgets>=7.0.0->cufflinks) (3.1.0)
Requirement already satisfied: defusedxml in /Users/mybeast/opt/anaconda3/li
b/python3.7/site-packages (from nbconvert->notebook>=4.4.1->widgetsnbextensi
on~=3.5.0->ipywidgets>=7.0.0->cufflinks) (0.6.0)
Requirement already satisfied: mistune<2,>=0.8.1 in /Users/mybeast/opt/anaco
nda3/lib/python3.7/site-packages (from nbconvert->notebook>=4.4.1->widgetsnb
extension~=3.5.0->ipywidgets>=7.0.0->cufflinks) (0.8.4)
Requirement already satisfied: MarkupSafe>=0.23 in /Users/mybeast/opt/anacon
da3/lib/python3.7/site-packages (from jinja2->notebook>=4.4.1->widgetsnbexte
nsion~=3.5.0->ipywidgets>=7.0.0->cufflinks) (1.1.1)
Requirement already satisfied: zipp>=0.5 in /Users/mybeast/opt/anaconda3/li
b/python3.7/site-packages (from importlib-metadata; python_version < "3.8"->
jsonschema!=2.5.0,>=2.4->nbformat>=4.2.0->ipywidgets>=7.0.0->cufflinks) (2.
2.0)
Requirement already satisfied: webencodings in /Users/mybeast/opt/anaconda3/
lib/python3.7/site-packages (from bleach->nbconvert->notebook>=4.4.1->widget
snbextension~=3.5.0->ipywidgets>=7.0.0->cufflinks) (0.5.1)
```

In [1]:
```
import numpy as np
import pandas as pd
import matplotlib.pyplot as plt
from chart_studio.plotly import plot,iplot
import cufflinks as cf
import seaborn as sns


%matplotlib inline
```

In [100…
```
df=pd.read_excel("Data_Train.xlsx")
```

In [101…
```
df.head()
```

Out[101…

	Airline	Date_of_Journey	Source	Destination	Route	Dep_Time	Arrival_T
0	IndiGo	24/03/2019	Banglore	New Delhi	BLR → DEL	22:20	01:10 22
1	Air India	1/05/2019	Kolkata	Banglore	CCU → IXR → BBI → BLR	05:50	13
2	Jet Airways	9/06/2019	Delhi	Cochin	DEL → LKO → BOM → COK	09:25	04:25 10
3	IndiGo	12/05/2019	Kolkata	Banglore	CCU → NAG → BLR	18:05	23
4	IndiGo	01/03/2019	Banglore	New Delhi	BLR → NAG → DEL	16:50	21

Automated EDA

In [ ]:
```
# !pip install pandas-profiling
```

In [102…
```
import pandas_profiling as pf
```

In [103…
```
 pf.ProfileReport(df)
```

```
HBox(children=(FloatProgress(value=0.0, description='Summarize dataset', max
=25.0, style=ProgressStyle(descrip…
HBox(children=(FloatProgress(value=0.0, description='Generate report structu
re', max=1.0, style=ProgressStyle(…
HBox(children=(FloatProgress(value=0.0, description='Render HTML', max=1.0,
style=ProgressStyle(description_wi…
```

Overview

Dataset statistics

Number of variables	11
Number of observations	10683
Missing cells	2
Missing cells (%)	< 0.1%
Duplicate rows	220
Duplicate rows (%)	2.1%
Total size in memory	918.2 KiB
Average record size in memory	88.0 B

Variable types

CAT	10
NUM	1

Reproduction

Analysis started	2020-07-16 06:01:04.945436
Analysis finished	2020-07-16 06:01:13.454719
Duration	8.51 seconds

Out[103…

Manual EDA

In [104…

```
df.shape
```

Out[104… (10683, 11)

In [105…
```
df.dtypes #checking the data types
```

Out[105…
```
Airline            object
Date_of_Journey    object
Source             object
Destination        object
Route              object
Dep_Time           object
Arrival_Time       object
Duration           object
Total_Stops        object
Additional_Info    object
Price               int64
dtype: object
```

In [106…
```
df.isna().sum() #Checking null values
```

Out[106…
```
Airline            0
Date_of_Journey    0
Source             0
Destination        0
Route              1
Dep_Time           0
Arrival_Time       0
Duration           0
Total_Stops        1
Additional_Info    0
Price              0
dtype: int64
```

In [107…
```
#Remove the NaN values from the dataset
df.dropna(how='any',inplace=True)
df.isnull().sum()
```

Out[107…
```
Airline            0
Date_of_Journey    0
Source             0
Destination        0
Route              0
Dep_Time           0
Arrival_Time       0
Duration           0
Total_Stops        0
Additional_Info    0
Price              0
dtype: int64
```

Feature Engineering

Let's convert **Date_of_Journey** to its appropriate format as **datetime** with regards to **day** and **month**

In [108…
```
df.head(3)
```

Out[108…

	Airline	Date_of_Journey	Source	Destination	Route	Dep_Time	Arrival_T
0	IndiGo	24/03/2019	Banglore	New Delhi	BLR → DEL	22:20	01:10 22
1	Air India	1/05/2019	Kolkata	Banglore	CCU → IXR → BBI → BLR	05:50	1
2	Jet Airways	9/06/2019	Delhi	Cochin	DEL → LKO → BOM → COK	09:25	04:25 10

Date_of_journey

In [109…
```
df['Date_of_Journey']=pd.to_datetime(df['Date_of_Journey'])
df['Day_of_Journey']=(df['Date_of_Journey']).dt.day
df['Month_of_Journey']=(df['Date_of_Journey']).dt.month
```

In [110…
```
df.head(3)
```

Out[110…

	Airline	Date_of_Journey	Source	Destination	Route	Dep_Time	Arrival_T
0	IndiGo	2019-03-24	Banglore	New Delhi	BLR → DEL	22:20	01:10 22
1	Air India	2019-01-05	Kolkata	Banglore	CCU → IXR → BBI → BLR	05:50	1
2	Jet Airways	2019-09-06	Delhi	Cochin	DEL → LKO → BOM → COK	09:25	04:25 10

In [111…
```
#we can now drop the Date_of_journey
df.drop(["Date_of_Journey"],axis=1,inplace=True)
```

Let's do the same for the other relative columns

Dep_time

In [112…
```
#covert to datetime
df['Dep_hr']=pd.to_datetime(df['Dep_Time']).dt.hour
df['Dep_min']=pd.to_datetime(df['Dep_Time']).dt.minute
```

In [113…
```
#we can now drop the 'Dep_Time'

df.drop(["Dep_Time"],axis=1,inplace=True)
```

Arrival_time

In [114…
```
df['Arrival_hr']=pd.to_datetime(df['Arrival_Time']).dt.hour
df['Arrival_min']=pd.to_datetime(df['Arrival_Time']).dt.minute
```

In [115…
```
#we can now drop the 'Arrival_Time'

df.drop(["Arrival_Time"],axis=1,inplace=True)
```

Duration Time

In [116…
```
duration=df['Duration'].str.split(' ',expand=True) #split duration datapoint
duration[1].fillna('00m',inplace=True)   #fill all "NAN" with '00m'
df['duration_hr']=duration[0].apply(lambda x: x[:-1]) #select the item at ir
df['duration_min']=duration[1].apply(lambda x: x[:-1]) #select the item at i
```

In [117…
```
#we can now drop the 'Duration'

df.drop(["Duration"],axis=1,inplace=True)
```

In [118…
```
df.head(3)
```

Out[118…

	Airline	Source	Destination	Route	Total_Stops	Additional_Info	Price	D
0	IndiGo	Banglore	New Delhi	BLR → DEL	non-stop	No info	3897	
1	Air India	Kolkata	Banglore	CCU → IXR → BBI → BLR	2 stops	No info	7662	
2	Jet Airways	Delhi	Cochin	DEL → LKO → BOM → COK	2 stops	No info	13882	

In [119…
```
cf.set_config_file(theme='ggplot',sharing='public',offline=True)
```

Count of Airlines

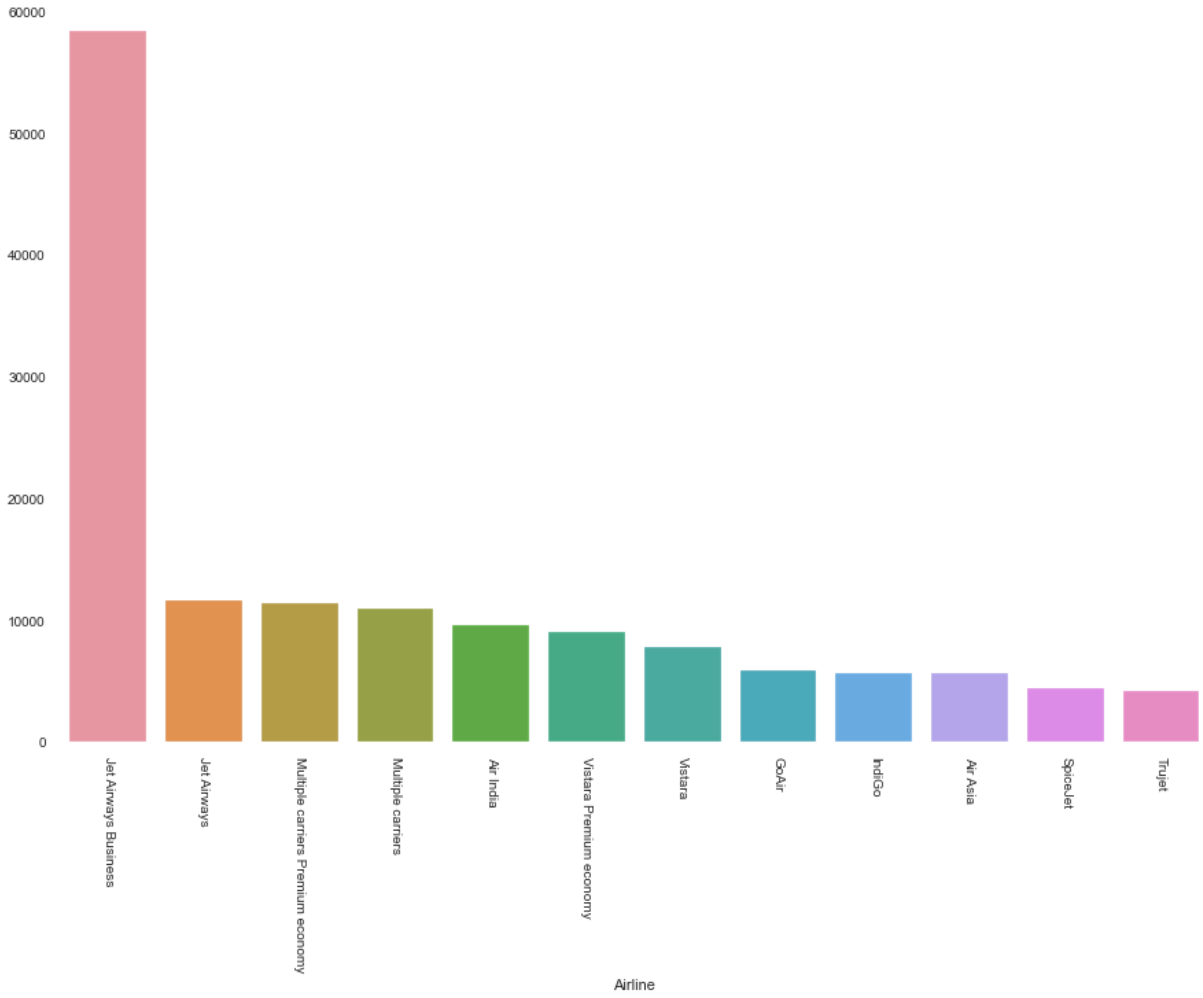
In [120…
```
df['Airline'].value_counts()
```

Out[120…
```
Jet Airways                          3849
IndiGo                               2053
Air India                            1751
Multiple carriers                    1196
SpiceJet                              818
Vistara                               479
Air Asia                              319
GoAir                                 194
Multiple carriers Premium economy      13
Jet Airways Business                    6
Vistara Premium economy                 3
Trujet                                  1
Name: Airline, dtype: int64
```

Airline vs Price

In [121…
```
Airprices=df.groupby('Airline')['Price'].mean().sort_values(ascending=False)
plt.figure(figsize=(15,10))
sns.barplot(Airprices.index,Airprices.values)
plt.xticks(rotation=270)
```

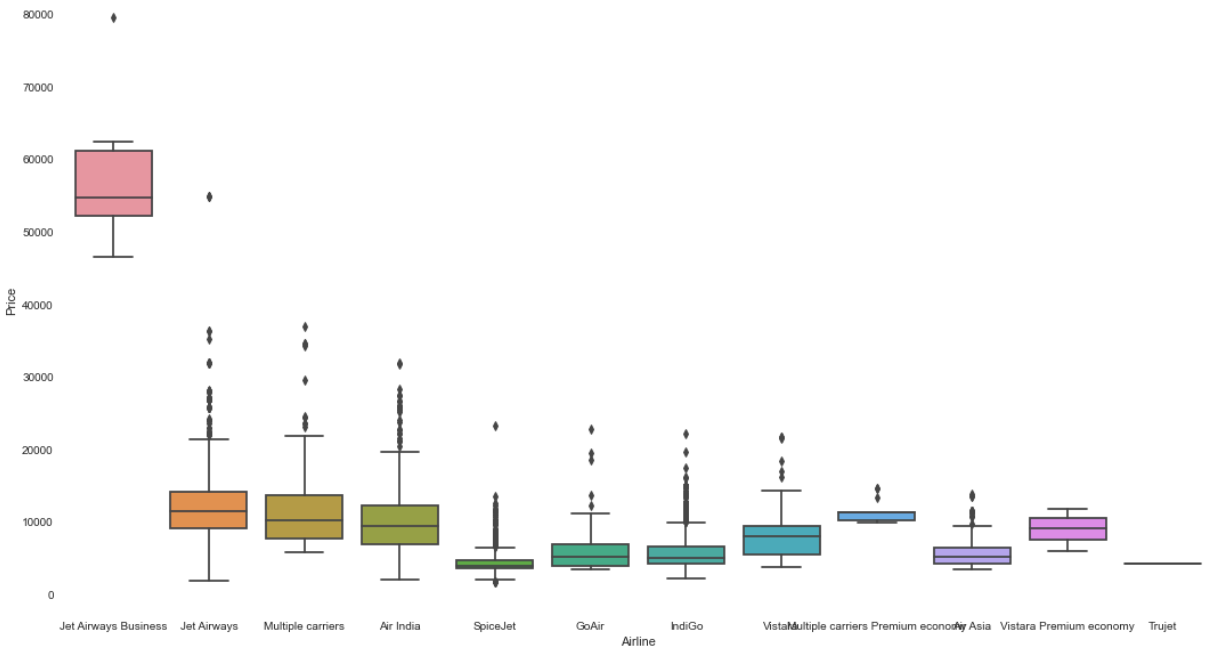
Out[121…
```
(array([ 0,  1,  2,  3,  4,  5,  6,  7,  8,  9, 10, 11]),
 <a list of 12 Text major ticklabel objects>)
```



Jet Airways Business has the highest price with Trujet having the lowest

In [122…
```
plt.figure(figsize=(18,10))
sns.boxplot(y='Price',x='Airline',data= df.sort_values('Price',ascending=Fal
plt.show
```

Out[122…
```
<function matplotlib.pyplot.show(*args, **kw)>
```



Price based on number of stops

In [123…

```
df.groupby(['Airline','Total_Stops'])['Price'].mean()
```

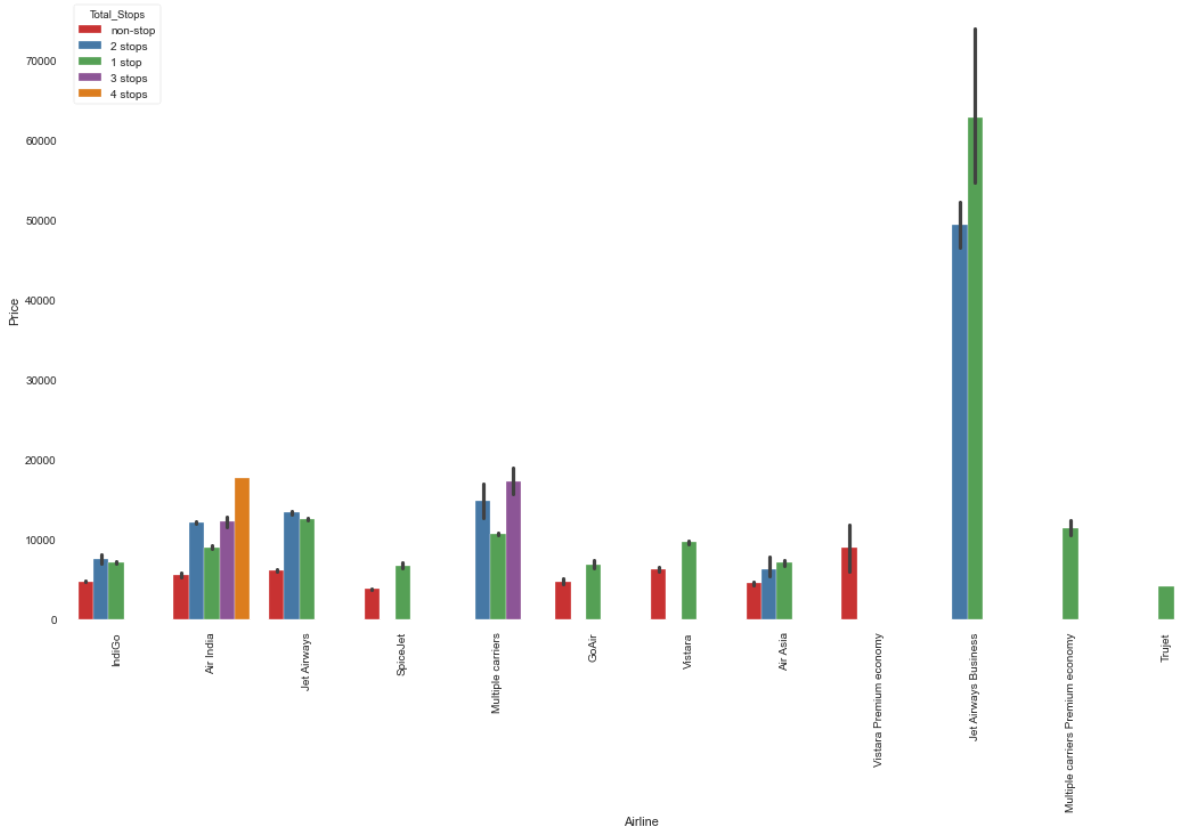
Out[123…

Airline	Total_Stops	
Air Asia	1 stop	7078.325581
	2 stops	6341.888889
	non-stop	4492.331492
Air India	1 stop	9041.509259
	2 stops	12092.779101
	3 stops	12208.054054
	4 stops	17686.000000
	non-stop	5605.326139
GoAir	1 stop	6884.676471
	non-stop	4726.173913
IndiGo	1 stop	7104.717528
	2 stops	7507.526316
	non-stop	4731.174053
Jet Airways	1 stop	12512.741223
	2 stops	13387.247467
	non-stop	6175.078652
Jet Airways Business	1 stop	62844.250000
	2 stops	49387.500000
Multiple carriers	1 stop	10711.316157
	2 stops	14809.395349
	3 stops	17292.750000
Multiple carriers Premium economy	1 stop	11418.846154
SpiceJet	1 stop	6750.560811
	non-stop	3805.423881
Trujet	1 stop	4140.000000
Vistara	1 stop	9641.148837
	non-stop	6293.954545
Vistara Premium economy	non-stop	8962.333333

Name: Price, dtype: float64

In [124…

```
plt.figure(figsize=(18,10))
ax=sns.barplot(x=df['Airline'],y=df['Price'],hue=df['Total_Stops'],palette="
ax.set_xticklabels(ax.get_xticklabels(),rotation=90)
plt.show()
```



One stop and two stpos Jet Airways Business is having the highest price

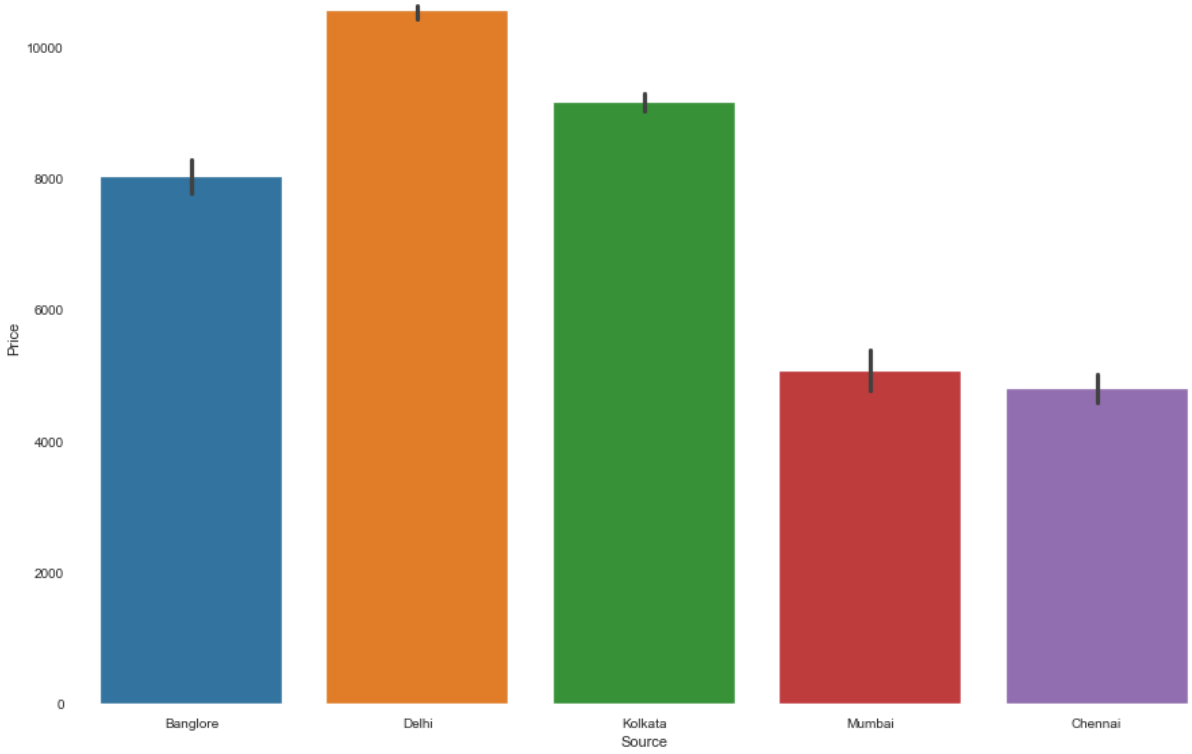
In [125…
```
df['Source'].value_counts()
```

Out[125…
```
Delhi       4536
Kolkata     2871
Banglore    2197
Mumbai       697
Chennai      381
Name: Source, dtype: int64
```

Source vs Price

In [126…
```
plt.figure(figsize=(15,10))
sns.barplot(y='Price',x='Source',data=df.sort_values('Price',ascending=False
plt.show
```

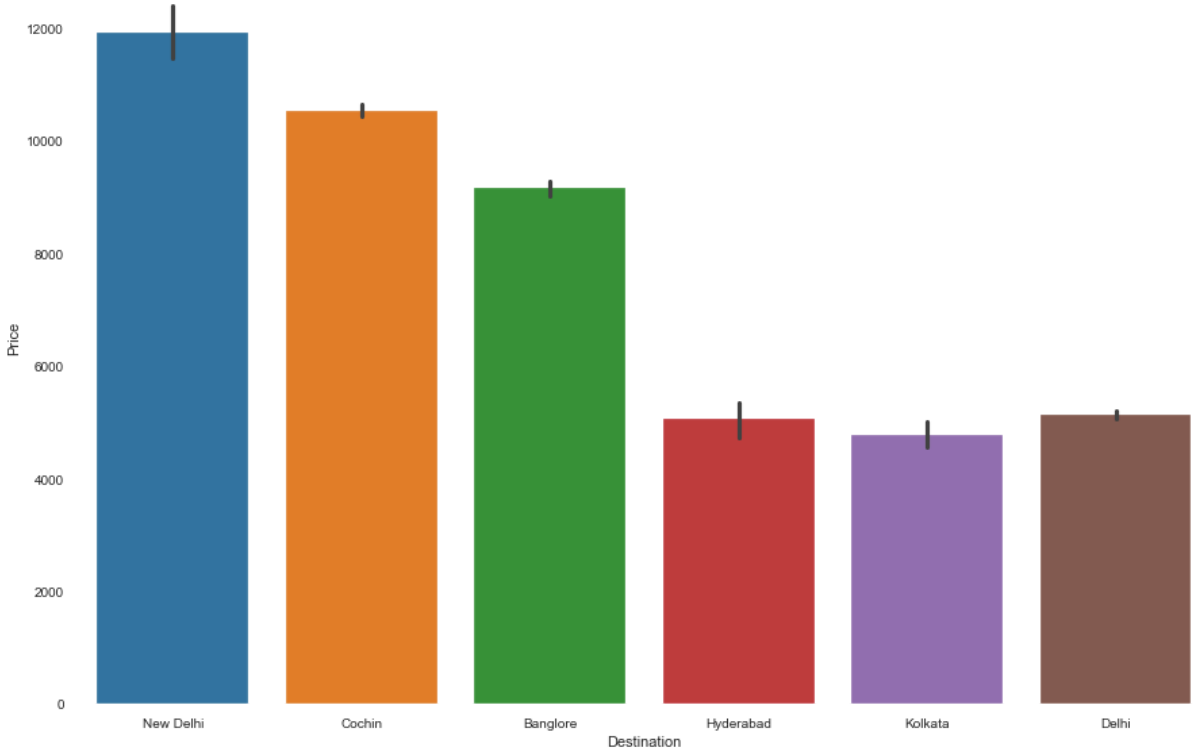
Out[126…
```
<function matplotlib.pyplot.show(*args, **kw)>
```



Destination vs Price

In [127…
```
plt.figure(figsize=(15,10))
sns.barplot(y='Price',x='Destination',data=df.sort_values('Price',ascending=
plt.show
```

Out[127…
```
<function matplotlib.pyplot.show(*args, **kw)>
```



In [128…
```
df['Destination'].value_counts()
```

Out[128…
```
Cochin       4536
Banglore     2871
Delhi        1265
New Delhi     932
Hyderabad     697
Kolkata       381
Name: Destination, dtype: int64
```

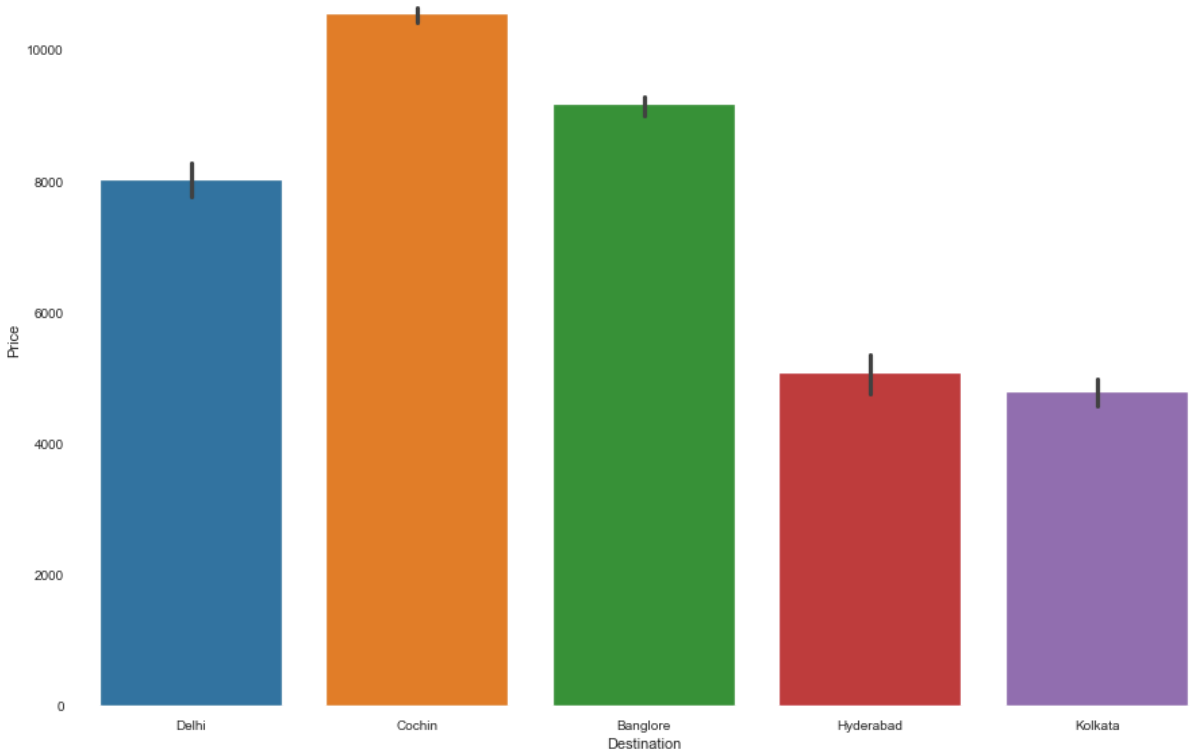
In [129…
```
for i in df:
    df.replace('New Delhi','Delhi',inplace=True)
```

In [130…
```
df['Destination'].unique()
```

Out[130…
```
array(['Delhi', 'Banglore', 'Cochin', 'Kolkata', 'Hyderabad'],
      dtype=object)
```

In [131…
```
plt.figure(figsize=(15,10))
sns.barplot(y='Price',x='Destination',data=df.sort_values('Price',ascending=
plt.show
```

Out[131…
```
<function matplotlib.pyplot.show(*args, **kw)>
```

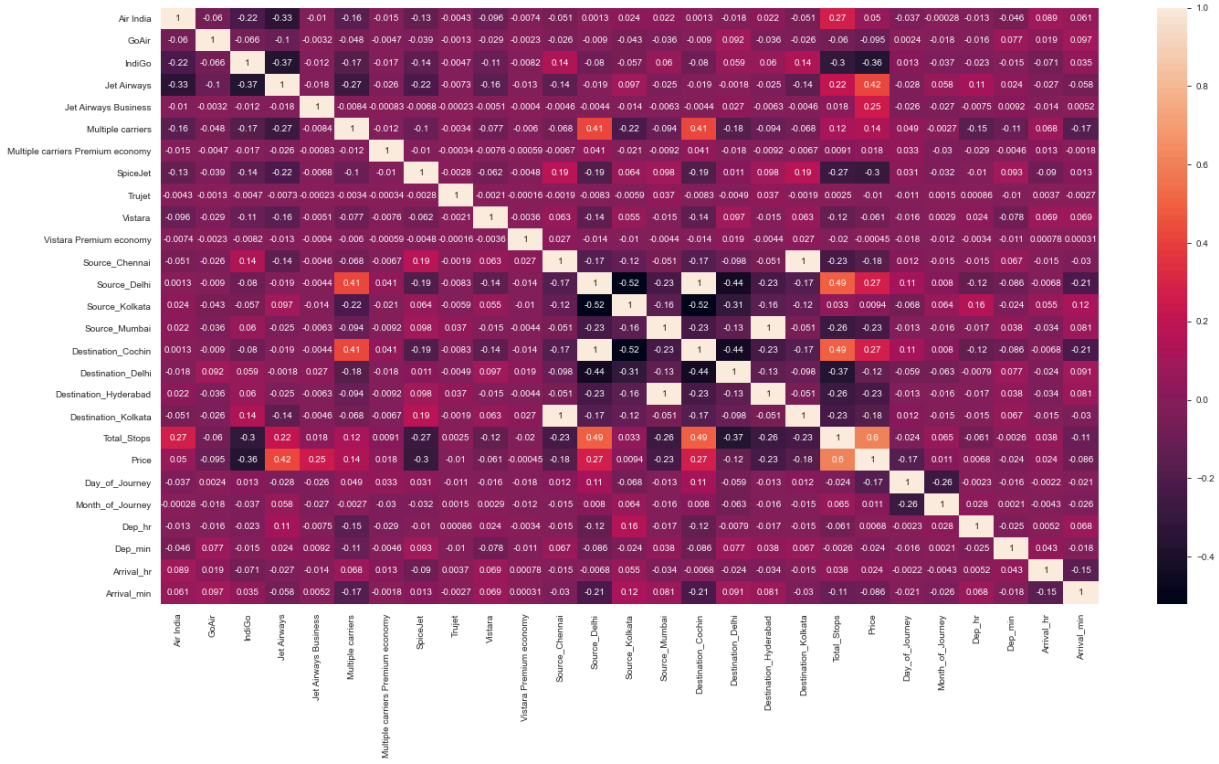


In [132…
```
df['Destination'].value_counts()
```

Out[132…
```
Cochin       4536
Banglore     2871
Delhi        2197
Hyderabad     697
Kolkata       381
Name: Destination, dtype: int64
```

In [149…
```
plt.figure(figsize=(23,12))
sns.heatmap(df.corr(),annot=True)
```

Out[149…
```
<matplotlib.axes._subplots.AxesSubplot at 0x1a2b061b90>
```



The features are less correlated which is a good thing for us to avoid **Multicollinearity**

Apply Onehot Encoding on the categorical variables

In [133…
```
#Handling Categorical Values
df['Total_Stops']=df['Total_Stops'].map({'non-stop':0, '2 stops':2, '1 stop'
air_dummy=pd.get_dummies(df['Airline'],drop_first=True)
# print(df['Source'].value_counts())
# print(df['Destination'].value_counts())

source_dest_dummy=pd.get_dummies(df[['Source','Destination']],drop_first=Tru
df=pd.concat([air_dummy,source_dest_dummy,df],axis=1)
```

In [134…
```
df.drop(['Airline','Source','Destination'],inplace=True,axis=1)
```

In [135…
```
df.head()
```

Out[135…

	Air India	GoAir	IndiGo	Jet Airways	Jet Airways Business	Multiple carriers	Multiple carriers Premium economy	SpiceJet	Truje
0	0	0	1	0	0	0	0	0	
1	1	0	0	0	0	0	0	0	
2	0	0	0	1	0	0	0	0	
3	0	0	1	0	0	0	0	0	
4	0	0	1	0	0	0	0	0	

5 rows × 31 columns

In [136…
```
df.shape
```

Out[136… (10682, 31)

Test Data

In [137…
```
df_test=pd.read_excel("Test_set.xlsx")
```

In [138…
```
df_test.head()
```

Out[138…

	Airline	Date_of_Journey	Source	Destination	Route	Dep_Time	Arrival_T
0	Jet Airways	6/06/2019	Delhi	Cochin	DEL → BOM → COK	17:30	04:25 07
1	IndiGo	12/05/2019	Kolkata	Banglore	CCU → MAA → BLR	06:20	1(
2	Jet Airways	21/05/2019	Delhi	Cochin	DEL → BOM → COK	19:15	19:00 22
3	Multiple carriers	21/05/2019	Delhi	Cochin	DEL → BOM → COK	08:00	2
4	Air Asia	24/06/2019	Banglore	Delhi	BLR → DEL	23:55	02:45 25

Let's Perform that same steps as we did for train data earlier

In [139…
```
df_test['Date_of_Journey']=pd.to_datetime(df_test['Date_of_Journey'])
df_test['Day_of_Journey']=(df_test['Date_of_Journey']).dt.day
df_test['Month_of_Journey']=(df_test['Date_of_Journey']).dt.month

#Dep_time
df_test['Dep_hr']=pd.to_datetime(df_test['Dep_Time']).dt.hour
df_test['Dep_min']=pd.to_datetime(df_test['Dep_Time']).dt.minute

#Arrival_time
df_test['Arrival_hr']=pd.to_datetime(df_test['Arrival_Time']).dt.hour
df_test['Arrival_min']=pd.to_datetime(df_test['Arrival_Time']).dt.minute

#Splitting duration  time

a=df_test['Duration'].str.split(' ',expand=True)
a[1].fillna('00m',inplace=True)
df_test['dur_hr']=a[0].apply(lambda x: x[:-1])
df_test['dur_min']=a[1].apply(lambda x: x[:-1])

#dropping the data
df_test.drop(['Date_of_Journey','Duration','Arrival_Time','Dep_Time'],inplac

#Handling Categorical Values
df_test['Total_Stops']=df_test['Total_Stops'].map({'non-stop':0, '2 stops':2

air_dummy=pd.get_dummies(df_test['Airline'],drop_first=True)
source_dest_dummy=pd.get_dummies(df_test[['Source','Destination']],drop_firs
df_test=pd.concat([air_dummy,source_dest_dummy,df_test],axis=1)
```

In [140…
```
df_test.drop(['Airline','Source','Destination','Additional_Info',"Route"],ir
```

In [141…
```
print('train_shape',df.shape)
print('test_shape',df_test.shape)
```

```
train_shape (10682, 31)
test_shape (2671, 28)
```

In [142…
```
df.head()
```

Out[142…

	Air India	GoAir	IndiGo	Jet Airways	Jet Airways Business	Multiple carriers	Multiple carriers Premium economy	SpiceJet	Truje
0	0	0	1	0	0	0	0	0	
1	1	0	0	0	0	0	0	0	
2	0	0	0	1	0	0	0	0	
3	0	0	1	0	0	0	0	0	
4	0	0	1	0	0	0	0	0	

5 rows × 31 columns

In [144…
```
x=df.drop(['Route', 'Price','Additional_Info'],axis=1)
y=df['Price']
```

In [154…
```
x.head(3)
```

Out[154…

	Air India	GoAir	IndiGo	Jet Airways	Jet Airways Business	Multiple carriers	Multiple carriers Premium economy	SpiceJet	Truje
0	0	0	1	0	0	0	0	0	
1	1	0	0	0	0	0	0	0	
2	0	0	0	1	0	0	0	0	

3 rows × 28 columns

Model Building and Hyperparameter Tuning

ExtraTreesRegressor

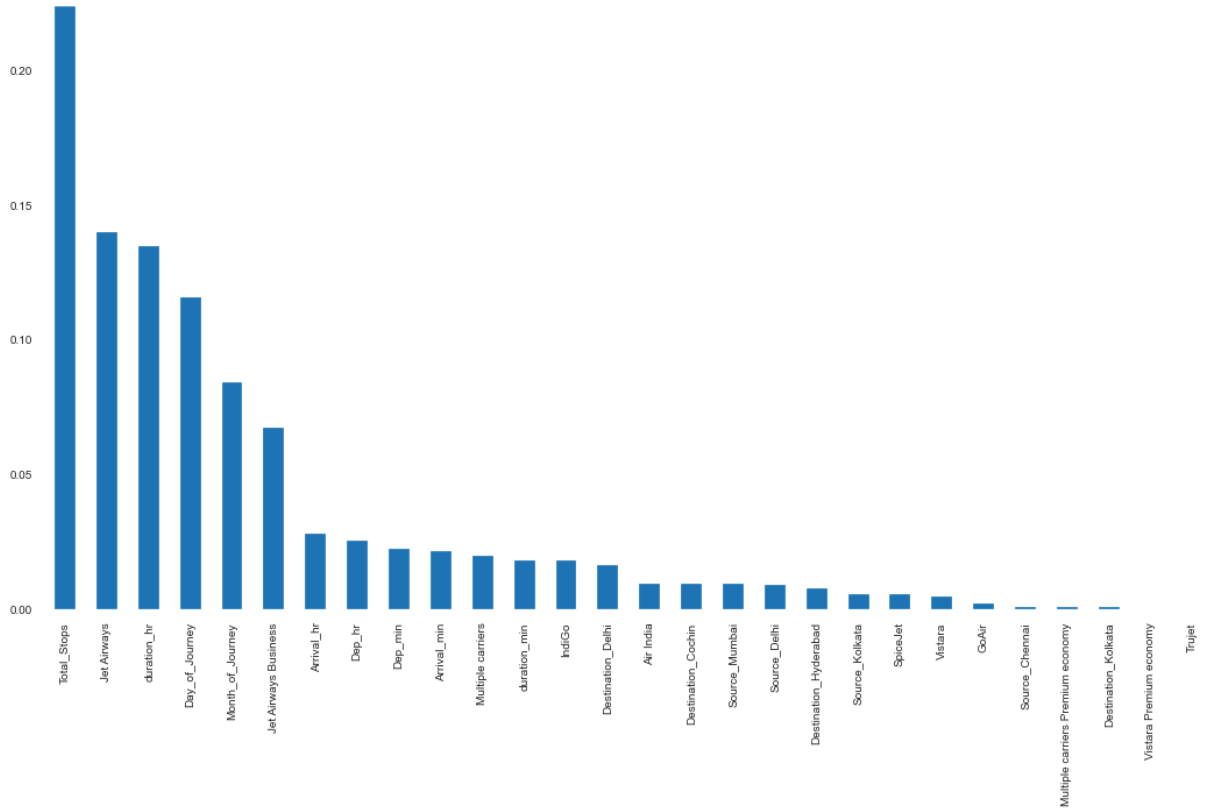
In [150…
```
from sklearn.ensemble import ExtraTreesRegressor
ET_Model=ExtraTreesRegressor()
ET_Model.fit(x,y)
```

Out[150…
```
ExtraTreesRegressor(bootstrap=False, ccp_alpha=0.0, criterion='mse',
                    max_depth=None, max_features='auto', max_leaf_nodes=Non
e,
                    max_samples=None, min_impurity_decrease=0.0,
                    min_impurity_split=None, min_samples_leaf=1,
                    min_samples_split=2, min_weight_fraction_leaf=0.0,
                    n_estimators=100, n_jobs=None, oob_score=False,
                    random_state=None, verbose=0, warm_start=False)
```

Future Importance

In [153…
```
pd.Series(ET_Model.feature_importances_,index=x.columns).sort_values(ascendi
```

Out[153…
```
<matplotlib.axes._subplots.AxesSubplot at 0x1a2e1c8050>
```



In [156…
```
#splitting the dataset
from sklearn.model_selection import train_test_split
X_train, X_test, y_train, y_test = train_test_split(x, y, test_size = 0.2, r
```

In [157…
```
#Preparing Extra Tree Regression
from sklearn.ensemble import  ExtraTreesRegressor
ET_Model=ExtraTreesRegressor(n_estimators = 120)
ET_Model.fit(X_train,y_train)
y_predict=ET_Model.predict(X_test)


from sklearn.metrics import r2_score
r2_score(y_test,y_predict)
```

Out[157… 0.7682238280133812

In [160…
```
from sklearn.ensemble import RandomForestRegressor
RF_Model=RandomForestRegressor()
RF_Model.fit(X_train,y_train)
y_predict=RF_Model.predict(X_test)
r2_score(y_test,y_predict)
```

Out[160… 0.792954708381232

Hyperparameter

In [178…
```
from sklearn.model_selection import RandomizedSearchCV

n_estimators = [int(x) for x in np.linspace(start = 80, stop = 1500, num = 1
max_features = ['auto', 'sqrt']
max_depth = [int(x) for x in np.linspace(6, 45, num = 5)]
min_samples_split = [2, 5, 10, 15, 100]
min_samples_leaf = [1, 2, 5, 10]

# create random grid

rand_grid={'n_estimators': n_estimators,
               'max_features': max_features,
               'max_depth': max_depth,
               'min_samples_split': min_samples_split,
               'min_samples_leaf': min_samples_leaf}

rf=RandomForestRegressor()

rCV=RandomizedSearchCV(estimator=rf,param_distributions=rand_grid,scoring='r
```

In [179…
```
rCV.fit(X_train,y_train)
```

Out[179…
```
RandomizedSearchCV(cv=3, error_score=nan,
                   estimator=RandomForestRegressor(bootstrap=True,
                                                   ccp_alpha=0.0,
                                                   criterion='mse',
                                                   max_depth=None,
                                                   max_features='auto',
                                                   max_leaf_nodes=None,
                                                   max_samples=None,
                                                   min_impurity_decrease=0.
0,
                                                   min_impurity_split=None,
                                                   min_samples_leaf=1,
                                                   min_samples_split=2,
                                                   min_weight_fraction_leaf
=0.0,
                                                   n_estimators=100,
                                                   n_jobs=None, oob_score=F
als...
                   iid='deprecated', n_iter=10, n_jobs=1,
                   param_distributions={'max_depth': [6, 15, 25, 35, 45],
                                        'max_features': ['auto', 'sqrt'],
                                        'min_samples_leaf': [1, 2, 5, 10],
                                        'min_samples_split': [2, 5, 10, 15,
                                                              100],
                                        'n_estimators': [80, 237, 395, 553,
711,
                                                         868, 1026, 1184, 1
342,
                                                         1500]},
                   pre_dispatch='2*n_jobs', random_state=42, refit=True,
                   return_train_score=False, scoring='neg_mean_squared_erro
r',
                   verbose=0)
```

In [180…
```
rf_pred=rCV.predict(X_test)
rf_pred
```

Out[180…
```
array([12500.2967405 ,  4286.76073494,  6136.50519908, ...,
       11657.36838275,  9659.32444484,  8655.77083065])
```

In [181…
```
from sklearn.metrics import mean_absolute_error,mean_squared_error
print('MAE',mean_absolute_error(y_test,rf_pred))
print('MSE',mean_squared_error(y_test,rf_pred))
```

```
MAE 1156.8110505706231
MSE 3974736.1005828027
```

In [182…
```
r2_score(y_test,rf_pred)
```

Out[182…
```
0.8064284149245494
```

In [189…
```
!pip install catboost
```

```
Collecting catboost
  Downloading catboost-0.23.2-cp37-none-macosx_10_6_intel.macosx_10_9_intel.
macosx_10_9_x86_64.macosx_10_10_intel.macosx_10_10_x86_64.whl (10.9 MB)
     |████████████████████████████████| 10.9 MB 140 kB/s eta 0:00:01
Requirement already satisfied: scipy in /Users/mybeast/opt/anaconda3/lib/pyt
hon3.7/site-packages (from catboost) (1.4.1)
Requirement already satisfied: plotly in /Users/mybeast/opt/anaconda3/lib/py
thon3.7/site-packages (from catboost) (4.8.1)
Requirement already satisfied: six in /Users/mybeast/opt/anaconda3/lib/pytho
n3.7/site-packages (from catboost) (1.14.0)
Collecting graphviz
  Downloading graphviz-0.14.1-py2.py3-none-any.whl (18 kB)
Requirement already satisfied: matplotlib in /Users/mybeast/opt/anaconda3/li
b/python3.7/site-packages (from catboost) (3.2.2)
Requirement already satisfied: pandas>=0.24.0 in /Users/mybeast/opt/anaconda
3/lib/python3.7/site-packages (from catboost) (1.0.5)
Requirement already satisfied: numpy>=1.16.0 in /Users/mybeast/opt/anaconda
3/lib/python3.7/site-packages (from catboost) (1.18.1)
Requirement already satisfied: retrying>=1.3.3 in /Users/mybeast/opt/anacond
a3/lib/python3.7/site-packages (from plotly->catboost) (1.3.3)
Requirement already satisfied: kiwisolver>=1.0.1 in /Users/mybeast/opt/anaco
nda3/lib/python3.7/site-packages (from matplotlib->catboost) (1.1.0)
Requirement already satisfied: pyparsing!=2.0.4,!=2.1.2,!=2.1.6,>=2.0.1 in /
Users/mybeast/opt/anaconda3/lib/python3.7/site-packages (from matplotlib->ca
tboost) (2.4.6)
Requirement already satisfied: python-dateutil>=2.1 in /Users/mybeast/opt/an
aconda3/lib/python3.7/site-packages (from matplotlib->catboost) (2.8.1)
Requirement already satisfied: cycler>=0.10 in /Users/mybeast/opt/anaconda3/
lib/python3.7/site-packages (from matplotlib->catboost) (0.10.0)
Requirement already satisfied: pytz>=2017.2 in /Users/mybeast/opt/anaconda3/
lib/python3.7/site-packages (from pandas>=0.24.0->catboost) (2019.3)
Requirement already satisfied: setuptools in /Users/mybeast/opt/anaconda3/li
b/python3.7/site-packages (from kiwisolver>=1.0.1->matplotlib->catboost) (4
6.0.0.post20200309)
Installing collected packages: graphviz, catboost
Successfully installed catboost-0.23.2 graphviz-0.14.1
```

In [190…]

In [192…]

```
from catboost import CatBoostRegressor

cat=CatBoostRegressor()
cat.fit(X_train,y_train)
```

```
Learning rate set to 0.05718
0:      learn: 4466.5316537     total: 87ms     remaining: 1m 26s
1:      learn: 4319.1952920     total: 90.7ms   remaining: 45.3s
2:      learn: 4170.0874200     total: 96.7ms   remaining: 32.2s
3:      learn: 4033.1061207     total: 99.4ms   remaining: 24.7s
4:      learn: 3909.5332929     total: 102ms    remaining: 20.3s
5:      learn: 3788.8771850     total: 105ms    remaining: 17.3s
6:      learn: 3677.5795256     total: 107ms    remaining: 15.2s
7:      learn: 3585.9715553     total: 110ms    remaining: 13.7s
8:      learn: 3499.6424958     total: 113ms    remaining: 12.4s
9:      learn: 3408.9602975     total: 115ms    remaining: 11.4s
10:     learn: 3329.4018172     total: 118ms    remaining: 10.6s
11:     learn: 3258.4306577     total: 120ms    remaining: 9.9s
12:     learn: 3188.9732731     total: 123ms    remaining: 9.32s
13:     learn: 3126.6519374     total: 125ms    remaining: 8.82s
14:     learn: 3064.8092738     total: 128ms    remaining: 8.39s
15:     learn: 3011.9738031     total: 132ms    remaining: 8.12s
16:     learn: 2960.0953295     total: 136ms    remaining: 7.85s
17:     learn: 2917.5532184     total: 140ms    remaining: 7.62s
18:     learn: 2874.4984902     total: 143ms    remaining: 7.41s
19:     learn: 2834.7855065     total: 149ms    remaining: 7.29s
20:     learn: 2794.1762110     total: 156ms    remaining: 7.29s
21:     learn: 2760.7792230     total: 160ms    remaining: 7.11s
22:     learn: 2726.8733479     total: 164ms    remaining: 6.98s
23:     learn: 2695.3790438     total: 168ms    remaining: 6.83s
24:     learn: 2670.8605702     total: 175ms    remaining: 6.82s
25:     learn: 2647.4501132     total: 184ms    remaining: 6.89s
26:     learn: 2623.6716170     total: 188ms    remaining: 6.78s
27:     learn: 2602.1128494     total: 202ms    remaining: 7.03s
28:     learn: 2577.7394452     total: 208ms    remaining: 6.96s
29:     learn: 2557.0239652     total: 213ms    remaining: 6.89s
30:     learn: 2539.9850937     total: 219ms    remaining: 6.85s
31:     learn: 2521.2973464     total: 224ms    remaining: 6.77s
32:     learn: 2506.6020214     total: 230ms    remaining: 6.74s
33:     learn: 2493.3873963     total: 235ms    remaining: 6.69s
34:     learn: 2481.9476194     total: 241ms    remaining: 6.64s
35:     learn: 2468.9910088     total: 246ms    remaining: 6.59s
36:     learn: 2453.5406419     total: 255ms    remaining: 6.64s
37:     learn: 2442.0130430     total: 261ms    remaining: 6.61s
38:     learn: 2429.2347974     total: 268ms    remaining: 6.6s
39:     learn: 2421.0736808     total: 271ms    remaining: 6.51s
40:     learn: 2411.2867315     total: 275ms    remaining: 6.42s
41:     learn: 2399.0683018     total: 278ms    remaining: 6.33s
42:     learn: 2389.5066278     total: 282ms    remaining: 6.27s
43:     learn: 2378.0596149     total: 285ms    remaining: 6.2s
44:     learn: 2367.0534712     total: 289ms    remaining: 6.14s
45:     learn: 2361.2994933     total: 293ms    remaining: 6.08s
46:     learn: 2350.9244823     total: 315ms    remaining: 6.38s
47:     learn: 2340.5835539     total: 320ms    remaining: 6.35s
48:     learn: 2334.9962574     total: 324ms    remaining: 6.3s
49:     learn: 2324.4454107     total: 329ms    remaining: 6.24s
50:     learn: 2317.7856448     total: 333ms    remaining: 6.19s
51:     learn: 2311.5834150     total: 337ms    remaining: 6.13s
52:     learn: 2305.1831481     total: 341ms    remaining: 6.09s
53:     learn: 2301.7712183     total: 348ms    remaining: 6.1s
54:     learn: 2297.5615019     total: 352ms    remaining: 6.04s
```

```
55:     learn: 2289.3114364     total: 355ms    remaining: 5.99s
56:     learn: 2284.7806757     total: 359ms    remaining: 5.94s
57:     learn: 2277.1245331     total: 363ms    remaining: 5.9s
58:     learn: 2271.0612929     total: 370ms    remaining: 5.9s
59:     learn: 2265.2579293     total: 376ms    remaining: 5.89s
60:     learn: 2259.4969888     total: 382ms    remaining: 5.87s
61:     learn: 2252.3647669     total: 387ms    remaining: 5.86s
62:     learn: 2248.0554611     total: 392ms    remaining: 5.83s
63:     learn: 2240.3898511     total: 398ms    remaining: 5.82s
64:     learn: 2236.0814000     total: 407ms    remaining: 5.86s
65:     learn: 2231.0892268     total: 423ms    remaining: 5.99s
66:     learn: 2222.1938866     total: 434ms    remaining: 6.04s
67:     learn: 2218.7035354     total: 442ms    remaining: 6.06s
68:     learn: 2215.4146330     total: 447ms    remaining: 6.03s
69:     learn: 2212.2852730     total: 451ms    remaining: 5.99s
70:     learn: 2205.3406331     total: 464ms    remaining: 6.07s
71:     learn: 2199.5180690     total: 469ms    remaining: 6.05s
72:     learn: 2195.1048807     total: 476ms    remaining: 6.04s
73:     learn: 2193.1993206     total: 482ms    remaining: 6.04s
74:     learn: 2190.3081661     total: 489ms    remaining: 6.03s
75:     learn: 2188.0053983     total: 497ms    remaining: 6.04s
76:     learn: 2183.6878244     total: 504ms    remaining: 6.04s
77:     learn: 2178.1450078     total: 516ms    remaining: 6.1s
78:     learn: 2175.1511266     total: 525ms    remaining: 6.12s
79:     learn: 2171.6635233     total: 550ms    remaining: 6.32s
80:     learn: 2169.3310786     total: 557ms    remaining: 6.32s
81:     learn: 2167.0627407     total: 582ms    remaining: 6.52s
82:     learn: 2164.1921245     total: 599ms    remaining: 6.62s
83:     learn: 2159.4451991     total: 609ms    remaining: 6.64s
84:     learn: 2156.8824836     total: 616ms    remaining: 6.63s
85:     learn: 2152.8842606     total: 622ms    remaining: 6.61s
86:     learn: 2150.8464412     total: 632ms    remaining: 6.63s
87:     learn: 2147.3481385     total: 642ms    remaining: 6.66s
88:     learn: 2145.0847406     total: 648ms    remaining: 6.64s
89:     learn: 2141.0616103     total: 653ms    remaining: 6.6s
90:     learn: 2138.6225360     total: 657ms    remaining: 6.57s
91:     learn: 2134.6407931     total: 663ms    remaining: 6.55s
92:     learn: 2130.6204889     total: 668ms    remaining: 6.51s
93:     learn: 2126.8730947     total: 674ms    remaining: 6.5s
94:     learn: 2124.3016306     total: 678ms    remaining: 6.46s
95:     learn: 2123.0562847     total: 682ms    remaining: 6.42s
96:     learn: 2120.3216832     total: 687ms    remaining: 6.39s
97:     learn: 2117.2904762     total: 693ms    remaining: 6.38s
98:     learn: 2112.1868063     total: 698ms    remaining: 6.35s
99:     learn: 2107.5311464     total: 702ms    remaining: 6.32s
100:    learn: 2102.6510890     total: 707ms    remaining: 6.29s
101:    learn: 2100.0566188     total: 711ms    remaining: 6.26s
102:    learn: 2097.3614787     total: 715ms    remaining: 6.23s
103:    learn: 2094.1082270     total: 719ms    remaining: 6.2s
104:    learn: 2090.5751501     total: 725ms    remaining: 6.18s
105:    learn: 2087.9066198     total: 729ms    remaining: 6.15s
106:    learn: 2084.3711197     total: 733ms    remaining: 6.12s
107:    learn: 2082.3205794     total: 737ms    remaining: 6.09s
108:    learn: 2078.1762658     total: 742ms    remaining: 6.07s
109:    learn: 2075.2136859     total: 746ms    remaining: 6.04s
110:    learn: 2073.9698522     total: 751ms    remaining: 6.01s
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111:    learn: 2071.1454116     total: 757ms    remaining: 6s
112:    learn: 2069.3364150     total: 762ms    remaining: 5.98s
113:    learn: 2066.7048195     total: 766ms    remaining: 5.96s
114:    learn: 2065.2124465     total: 771ms    remaining: 5.93s
115:    learn: 2062.5258393     total: 779ms    remaining: 5.93s
116:    learn: 2059.3931802     total: 786ms    remaining: 5.93s
117:    learn: 2055.9149371     total: 791ms    remaining: 5.92s
118:    learn: 2051.6171216     total: 797ms    remaining: 5.9s
119:    learn: 2049.4715024     total: 803ms    remaining: 5.89s
120:    learn: 2047.1575871     total: 810ms    remaining: 5.88s
121:    learn: 2044.0926515     total: 817ms    remaining: 5.88s
122:    learn: 2040.4190263     total: 822ms    remaining: 5.86s
123:    learn: 2036.6132737     total: 828ms    remaining: 5.85s
124:    learn: 2035.9067615     total: 834ms    remaining: 5.83s
125:    learn: 2032.5918896     total: 840ms    remaining: 5.83s
126:    learn: 2031.5404031     total: 845ms    remaining: 5.81s
127:    learn: 2029.9805768     total: 853ms    remaining: 5.81s
128:    learn: 2026.6310266     total: 859ms    remaining: 5.8s
129:    learn: 2024.5205394     total: 864ms    remaining: 5.78s
130:    learn: 2022.2536214     total: 869ms    remaining: 5.76s
131:    learn: 2018.9274490     total: 873ms    remaining: 5.74s
132:    learn: 2016.0832145     total: 877ms    remaining: 5.72s
133:    learn: 2014.7314735     total: 882ms    remaining: 5.7s
134:    learn: 2009.8739313     total: 886ms    remaining: 5.68s
135:    learn: 2008.8775762     total: 890ms    remaining: 5.66s
136:    learn: 2006.2661964     total: 895ms    remaining: 5.63s
137:    learn: 2003.1278867     total: 899ms    remaining: 5.61s
138:    learn: 2001.0776841     total: 903ms    remaining: 5.59s
139:    learn: 1998.3164684     total: 907ms    remaining: 5.57s
140:    learn: 1996.1961508     total: 913ms    remaining: 5.56s
141:    learn: 1993.4028512     total: 917ms    remaining: 5.54s
142:    learn: 1991.5883384     total: 922ms    remaining: 5.52s
143:    learn: 1987.9881625     total: 926ms    remaining: 5.5s
144:    learn: 1985.9779110     total: 930ms    remaining: 5.48s
145:    learn: 1984.0403378     total: 934ms    remaining: 5.46s
146:    learn: 1982.3117521     total: 941ms    remaining: 5.46s
147:    learn: 1980.5212029     total: 947ms    remaining: 5.45s
148:    learn: 1977.6453273     total: 951ms    remaining: 5.43s
149:    learn: 1976.9108656     total: 955ms    remaining: 5.41s
150:    learn: 1974.2375913     total: 960ms    remaining: 5.4s
151:    learn: 1971.0803092     total: 964ms    remaining: 5.38s
152:    learn: 1968.2244922     total: 971ms    remaining: 5.38s
153:    learn: 1965.3142249     total: 976ms    remaining: 5.36s
154:    learn: 1962.1094228     total: 981ms    remaining: 5.35s
155:    learn: 1960.1052657     total: 987ms    remaining: 5.34s
156:    learn: 1957.7395675     total: 993ms    remaining: 5.33s
157:    learn: 1956.2192077     total: 998ms    remaining: 5.32s
158:    learn: 1953.8061817     total: 1s       remaining: 5.32s
159:    learn: 1952.7697326     total: 1.01s    remaining: 5.31s
160:    learn: 1951.1012882     total: 1.02s    remaining: 5.31s
161:    learn: 1948.6492071     total: 1.02s    remaining: 5.3s
162:    learn: 1945.1133182     total: 1.03s    remaining: 5.29s
163:    learn: 1942.7228013     total: 1.03s    remaining: 5.28s
164:    learn: 1940.9073624     total: 1.04s    remaining: 5.27s
165:    learn: 1938.0460170     total: 1.05s    remaining: 5.26s
166:    learn: 1935.3286398     total: 1.05s    remaining: 5.25s
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167:    learn: 1932.9545795     total: 1.06s    remaining: 5.24s
168:    learn: 1931.6124443     total: 1.06s    remaining: 5.24s
169:    learn: 1929.5307514     total: 1.07s    remaining: 5.22s
170:    learn: 1927.4963218     total: 1.07s    remaining: 5.2s
171:    learn: 1925.4669384     total: 1.08s    remaining: 5.19s
172:    learn: 1924.3200339     total: 1.08s    remaining: 5.18s
173:    learn: 1922.7154464     total: 1.09s    remaining: 5.16s
174:    learn: 1920.9589969     total: 1.09s    remaining: 5.15s
175:    learn: 1919.1457003     total: 1.1s     remaining: 5.14s
176:    learn: 1918.1069516     total: 1.1s     remaining: 5.12s
177:    learn: 1916.2214512     total: 1.11s    remaining: 5.11s
178:    learn: 1913.5124519     total: 1.11s    remaining: 5.09s
179:    learn: 1911.4800432     total: 1.11s    remaining: 5.08s
180:    learn: 1909.3957573     total: 1.12s    remaining: 5.06s
181:    learn: 1908.4135607     total: 1.12s    remaining: 5.04s
182:    learn: 1906.5491885     total: 1.13s    remaining: 5.03s
183:    learn: 1904.6147159     total: 1.13s    remaining: 5.01s
184:    learn: 1903.7135890     total: 1.13s    remaining: 5s
185:    learn: 1902.4011221     total: 1.14s    remaining: 4.99s
186:    learn: 1901.0717891     total: 1.14s    remaining: 4.97s
187:    learn: 1899.6407868     total: 1.15s    remaining: 4.96s
188:    learn: 1898.5577875     total: 1.15s    remaining: 4.95s
189:    learn: 1897.2225162     total: 1.16s    remaining: 4.93s
190:    learn: 1895.2033936     total: 1.16s    remaining: 4.92s
191:    learn: 1893.4908193     total: 1.17s    remaining: 4.92s
192:    learn: 1893.0729664     total: 1.18s    remaining: 4.92s
193:    learn: 1891.4099192     total: 1.18s    remaining: 4.92s
194:    learn: 1890.6753302     total: 1.19s    remaining: 4.92s
195:    learn: 1889.7612651     total: 1.2s     remaining: 4.92s
196:    learn: 1889.0516784     total: 1.21s    remaining: 4.92s
197:    learn: 1887.9756826     total: 1.21s    remaining: 4.91s
198:    learn: 1886.5853132     total: 1.22s    remaining: 4.91s
199:    learn: 1885.2670134     total: 1.22s    remaining: 4.9s
200:    learn: 1884.9171654     total: 1.23s    remaining: 4.89s
201:    learn: 1883.0163251     total: 1.24s    remaining: 4.89s
202:    learn: 1881.5130257     total: 1.24s    remaining: 4.89s
203:    learn: 1879.9115917     total: 1.25s    remaining: 4.88s
204:    learn: 1878.2024622     total: 1.26s    remaining: 4.87s
205:    learn: 1876.5491935     total: 1.26s    remaining: 4.87s
206:    learn: 1875.7912620     total: 1.27s    remaining: 4.86s
207:    learn: 1874.8975405     total: 1.27s    remaining: 4.85s
208:    learn: 1874.4832107     total: 1.28s    remaining: 4.84s
209:    learn: 1873.0687112     total: 1.28s    remaining: 4.84s
210:    learn: 1871.7010933     total: 1.29s    remaining: 4.83s
211:    learn: 1870.3004288     total: 1.29s    remaining: 4.81s
212:    learn: 1869.5272892     total: 1.3s     remaining: 4.8s
213:    learn: 1867.3722104     total: 1.31s    remaining: 4.8s
214:    learn: 1867.0684325     total: 1.32s    remaining: 4.81s
215:    learn: 1865.1670373     total: 1.32s    remaining: 4.81s
216:    learn: 1863.2110487     total: 1.33s    remaining: 4.8s
217:    learn: 1862.9098189     total: 1.34s    remaining: 4.79s
218:    learn: 1861.5219818     total: 1.34s    remaining: 4.79s
219:    learn: 1860.1257880     total: 1.35s    remaining: 4.78s
220:    learn: 1856.4667108     total: 1.36s    remaining: 4.78s
221:    learn: 1855.4684082     total: 1.36s    remaining: 4.77s
222:    learn: 1854.2391492     total: 1.37s    remaining: 4.78s
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223:    learn: 1853.2812508     total: 1.39s    remaining: 4.8s
224:    learn: 1851.3906071     total: 1.39s    remaining: 4.8s
225:    learn: 1850.9825967     total: 1.4s     remaining: 4.8s
226:    learn: 1847.5402035     total: 1.41s    remaining: 4.79s
227:    learn: 1846.7449371     total: 1.41s    remaining: 4.78s
228:    learn: 1844.3913864     total: 1.42s    remaining: 4.77s
229:    learn: 1844.0531666     total: 1.42s    remaining: 4.76s
230:    learn: 1843.5939669     total: 1.43s    remaining: 4.75s
231:    learn: 1841.3182846     total: 1.43s    remaining: 4.75s
232:    learn: 1839.4888278     total: 1.44s    remaining: 4.74s
233:    learn: 1839.0953436     total: 1.45s    remaining: 4.74s
234:    learn: 1837.4815579     total: 1.46s    remaining: 4.74s
235:    learn: 1837.2987924     total: 1.56s    remaining: 5.06s
236:    learn: 1834.1158669     total: 1.6s     remaining: 5.14s
237:    learn: 1833.9969404     total: 1.62s    remaining: 5.18s
238:    learn: 1832.2356222     total: 1.63s    remaining: 5.19s
239:    learn: 1830.6332391     total: 1.64s    remaining: 5.19s
240:    learn: 1828.2769141     total: 1.65s    remaining: 5.18s
241:    learn: 1828.1508444     total: 1.66s    remaining: 5.18s
242:    learn: 1827.7464088     total: 1.67s    remaining: 5.2s
243:    learn: 1825.1337079     total: 1.68s    remaining: 5.21s
244:    learn: 1823.5455690     total: 1.7s     remaining: 5.22s
245:    learn: 1821.2139006     total: 1.71s    remaining: 5.24s
246:    learn: 1819.5582544     total: 1.72s    remaining: 5.25s
247:    learn: 1818.1351245     total: 1.76s    remaining: 5.33s
248:    learn: 1816.2518763     total: 1.77s    remaining: 5.33s
249:    learn: 1816.2126990     total: 1.77s    remaining: 5.32s
250:    learn: 1814.3241850     total: 1.78s    remaining: 5.3s
251:    learn: 1812.1701303     total: 1.78s    remaining: 5.29s
252:    learn: 1812.0343771     total: 1.79s    remaining: 5.28s
253:    learn: 1810.7288190     total: 1.8s     remaining: 5.28s
254:    learn: 1810.6414167     total: 1.8s     remaining: 5.27s
255:    learn: 1808.9161486     total: 1.82s    remaining: 5.29s
256:    learn: 1807.0040232     total: 1.83s    remaining: 5.28s
257:    learn: 1805.5304019     total: 1.83s    remaining: 5.28s
258:    learn: 1805.4429565     total: 1.84s    remaining: 5.27s
259:    learn: 1805.1011942     total: 1.85s    remaining: 5.26s
260:    learn: 1804.9684809     total: 1.86s    remaining: 5.26s
261:    learn: 1802.9538899     total: 1.86s    remaining: 5.25s
262:    learn: 1802.5606026     total: 1.87s    remaining: 5.25s
263:    learn: 1801.3718791     total: 1.88s    remaining: 5.24s
264:    learn: 1800.7549745     total: 1.89s    remaining: 5.23s
265:    learn: 1799.7611195     total: 1.89s    remaining: 5.22s
266:    learn: 1798.4438507     total: 1.9s     remaining: 5.22s
267:    learn: 1797.1262487     total: 1.91s    remaining: 5.22s
268:    learn: 1795.5058086     total: 1.92s    remaining: 5.22s
269:    learn: 1794.9747205     total: 1.93s    remaining: 5.22s
270:    learn: 1793.9020520     total: 1.94s    remaining: 5.21s
271:    learn: 1792.7651976     total: 1.95s    remaining: 5.21s
272:    learn: 1791.8441773     total: 1.98s    remaining: 5.28s
273:    learn: 1790.0864256     total: 1.99s    remaining: 5.28s
274:    learn: 1789.8789200     total: 2s       remaining: 5.26s
275:    learn: 1789.8097677     total: 2s       remaining: 5.25s
276:    learn: 1788.0888425     total: 2.01s    remaining: 5.24s
277:    learn: 1787.5142346     total: 2.02s    remaining: 5.25s
278:    learn: 1787.4864687     total: 2.03s    remaining: 5.24s
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279:    learn: 1785.8832405     total: 2.03s    remaining: 5.22s
280:    learn: 1784.6182102     total: 2.04s    remaining: 5.21s
281:    learn: 1784.4857630     total: 2.05s    remaining: 5.21s
282:    learn: 1784.4602074     total: 2.07s    remaining: 5.24s
283:    learn: 1783.0524530     total: 2.09s    remaining: 5.26s
284:    learn: 1781.5498730     total: 2.09s    remaining: 5.25s
285:    learn: 1781.0218542     total: 2.1s     remaining: 5.25s
286:    learn: 1778.7214829     total: 2.12s    remaining: 5.28s
287:    learn: 1777.5582948     total: 2.13s    remaining: 5.27s
288:    learn: 1775.9191418     total: 2.14s    remaining: 5.27s
289:    learn: 1774.8937650     total: 2.15s    remaining: 5.27s
290:    learn: 1773.9038805     total: 2.15s    remaining: 5.25s
291:    learn: 1773.5871868     total: 2.16s    remaining: 5.25s
292:    learn: 1772.5023340     total: 2.17s    remaining: 5.23s
293:    learn: 1770.9383534     total: 2.18s    remaining: 5.22s
294:    learn: 1769.9121160     total: 2.18s    remaining: 5.21s
295:    learn: 1767.9087320     total: 2.19s    remaining: 5.2s
296:    learn: 1767.5529615     total: 2.19s    remaining: 5.18s
297:    learn: 1767.3610890     total: 2.2s     remaining: 5.18s
298:    learn: 1766.1120416     total: 2.2s     remaining: 5.17s
299:    learn: 1764.9784489     total: 2.22s    remaining: 5.19s
300:    learn: 1763.3574504     total: 2.24s    remaining: 5.19s
301:    learn: 1762.2789071     total: 2.24s    remaining: 5.18s
302:    learn: 1760.9603717     total: 2.25s    remaining: 5.17s
303:    learn: 1760.7806926     total: 2.26s    remaining: 5.17s
304:    learn: 1759.8024534     total: 2.27s    remaining: 5.16s
305:    learn: 1757.9686838     total: 2.27s    remaining: 5.16s
306:    learn: 1756.8120485     total: 2.28s    remaining: 5.14s
307:    learn: 1755.6147170     total: 2.29s    remaining: 5.14s
308:    learn: 1755.3360909     total: 2.29s    remaining: 5.13s
309:    learn: 1754.2969425     total: 2.3s     remaining: 5.12s
310:    learn: 1752.8608733     total: 2.31s    remaining: 5.11s
311:    learn: 1751.4281754     total: 2.31s    remaining: 5.09s
312:    learn: 1749.8473530     total: 2.31s    remaining: 5.08s
313:    learn: 1749.6952143     total: 2.32s    remaining: 5.06s
314:    learn: 1749.1317173     total: 2.32s    remaining: 5.05s
315:    learn: 1747.8635196     total: 2.33s    remaining: 5.04s
316:    learn: 1746.1192150     total: 2.33s    remaining: 5.02s
317:    learn: 1745.9081839     total: 2.34s    remaining: 5.01s
318:    learn: 1745.5901590     total: 2.34s    remaining: 5s
319:    learn: 1745.5765557     total: 2.35s    remaining: 4.98s
320:    learn: 1744.1031020     total: 2.35s    remaining: 4.97s
321:    learn: 1742.8866256     total: 2.35s    remaining: 4.96s
322:    learn: 1741.8273962     total: 2.36s    remaining: 4.95s
323:    learn: 1740.8624193     total: 2.36s    remaining: 4.93s
324:    learn: 1739.2263355     total: 2.37s    remaining: 4.92s
325:    learn: 1738.2951082     total: 2.37s    remaining: 4.91s
326:    learn: 1737.8994124     total: 2.38s    remaining: 4.89s
327:    learn: 1737.2891842     total: 2.39s    remaining: 4.89s
328:    learn: 1736.2589351     total: 2.39s    remaining: 4.88s
329:    learn: 1735.4256185     total: 2.4s     remaining: 4.87s
330:    learn: 1735.2946332     total: 2.4s     remaining: 4.86s
331:    learn: 1734.5323241     total: 2.41s    remaining: 4.85s
332:    learn: 1732.6404977     total: 2.42s    remaining: 4.84s
333:    learn: 1732.5282950     total: 2.42s    remaining: 4.83s
334:    learn: 1731.4241971     total: 2.43s    remaining: 4.82s
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335:    learn: 1729.9668045     total: 2.43s    remaining: 4.81s
336:    learn: 1729.1779869     total: 2.44s    remaining: 4.8s
337:    learn: 1729.0852102     total: 2.45s    remaining: 4.8s
338:    learn: 1728.1482089     total: 2.47s    remaining: 4.82s
339:    learn: 1726.7783890     total: 2.48s    remaining: 4.82s
340:    learn: 1726.2547590     total: 2.5s     remaining: 4.82s
341:    learn: 1724.9434243     total: 2.56s    remaining: 4.92s
342:    learn: 1724.9309222     total: 2.57s    remaining: 4.92s
343:    learn: 1723.3258449     total: 2.57s    remaining: 4.9s
344:    learn: 1722.4287769     total: 2.57s    remaining: 4.89s
345:    learn: 1721.3414872     total: 2.58s    remaining: 4.88s
346:    learn: 1720.2014300     total: 2.58s    remaining: 4.87s
347:    learn: 1719.6390060     total: 2.59s    remaining: 4.85s
348:    learn: 1718.3140866     total: 2.59s    remaining: 4.84s
349:    learn: 1717.3394270     total: 2.6s     remaining: 4.83s
350:    learn: 1716.4750581     total: 2.6s     remaining: 4.81s
351:    learn: 1714.7302070     total: 2.61s    remaining: 4.8s
352:    learn: 1713.9624067     total: 2.61s    remaining: 4.79s
353:    learn: 1711.8966387     total: 2.62s    remaining: 4.78s
354:    learn: 1710.0600389     total: 2.62s    remaining: 4.76s
355:    learn: 1709.4564664     total: 2.63s    remaining: 4.75s
356:    learn: 1708.4228043     total: 2.63s    remaining: 4.74s
357:    learn: 1707.3570736     total: 2.64s    remaining: 4.73s
358:    learn: 1706.7182613     total: 2.64s    remaining: 4.72s
359:    learn: 1705.6052237     total: 2.65s    remaining: 4.71s
360:    learn: 1704.3424263     total: 2.65s    remaining: 4.7s
361:    learn: 1703.6951246     total: 2.66s    remaining: 4.68s
362:    learn: 1702.6925447     total: 2.66s    remaining: 4.67s
363:    learn: 1702.4981771     total: 2.67s    remaining: 4.66s
364:    learn: 1702.4788415     total: 2.67s    remaining: 4.65s
365:    learn: 1700.6380273     total: 2.68s    remaining: 4.64s
366:    learn: 1698.9732681     total: 2.68s    remaining: 4.63s
367:    learn: 1698.4934176     total: 2.69s    remaining: 4.62s
368:    learn: 1697.8317250     total: 2.69s    remaining: 4.61s
369:    learn: 1697.6146189     total: 2.7s     remaining: 4.6s
370:    learn: 1696.4908709     total: 2.71s    remaining: 4.59s
371:    learn: 1695.3707016     total: 2.71s    remaining: 4.57s
372:    learn: 1694.4249800     total: 2.72s    remaining: 4.57s
373:    learn: 1692.8636708     total: 2.72s    remaining: 4.56s
374:    learn: 1691.9105426     total: 2.73s    remaining: 4.55s
375:    learn: 1691.0001079     total: 2.73s    remaining: 4.54s
376:    learn: 1689.3539822     total: 2.74s    remaining: 4.53s
377:    learn: 1688.5976712     total: 2.75s    remaining: 4.52s
378:    learn: 1687.3608479     total: 2.75s    remaining: 4.51s
379:    learn: 1687.2498993     total: 2.76s    remaining: 4.5s
380:    learn: 1686.3166885     total: 2.77s    remaining: 4.5s
381:    learn: 1685.3745620     total: 2.77s    remaining: 4.49s
382:    learn: 1685.3653260     total: 2.78s    remaining: 4.47s
383:    learn: 1684.1481337     total: 2.78s    remaining: 4.47s
384:    learn: 1683.8657016     total: 2.79s    remaining: 4.46s
385:    learn: 1682.9522747     total: 2.8s     remaining: 4.45s
386:    learn: 1681.8587897     total: 2.8s     remaining: 4.44s
387:    learn: 1680.9730217     total: 2.81s    remaining: 4.43s
388:    learn: 1680.3523861     total: 2.81s    remaining: 4.42s
389:    learn: 1680.3393557     total: 2.82s    remaining: 4.41s
390:    learn: 1679.5157645     total: 2.82s    remaining: 4.4s
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391:    learn: 1678.5450866     total: 2.83s    remaining: 4.39s
392:    learn: 1678.5349414     total: 2.83s    remaining: 4.38s
393:    learn: 1678.0638827     total: 2.84s    remaining: 4.37s
394:    learn: 1677.1815786     total: 2.85s    remaining: 4.36s
395:    learn: 1677.1217073     total: 2.85s    remaining: 4.35s
396:    learn: 1676.5684318     total: 2.86s    remaining: 4.34s
397:    learn: 1675.7954593     total: 2.86s    remaining: 4.33s
398:    learn: 1675.7835668     total: 2.87s    remaining: 4.32s
399:    learn: 1674.7612864     total: 2.88s    remaining: 4.31s
400:    learn: 1674.2057797     total: 2.88s    remaining: 4.31s
401:    learn: 1673.1210041     total: 2.89s    remaining: 4.3s
402:    learn: 1671.8989914     total: 2.9s     remaining: 4.29s
403:    learn: 1671.0132465     total: 2.9s     remaining: 4.28s
404:    learn: 1669.6052730     total: 2.91s    remaining: 4.27s
405:    learn: 1668.5677684     total: 2.91s    remaining: 4.26s
406:    learn: 1667.8235172     total: 2.92s    remaining: 4.25s
407:    learn: 1667.2640515     total: 2.93s    remaining: 4.25s
408:    learn: 1666.4183042     total: 2.93s    remaining: 4.24s
409:    learn: 1665.1922919     total: 2.94s    remaining: 4.22s
410:    learn: 1664.3444414     total: 2.94s    remaining: 4.22s
411:    learn: 1663.5322809     total: 2.95s    remaining: 4.21s
412:    learn: 1663.1110489     total: 2.96s    remaining: 4.2s
413:    learn: 1662.3295291     total: 2.96s    remaining: 4.19s
414:    learn: 1662.3178579     total: 2.97s    remaining: 4.18s
415:    learn: 1661.4256768     total: 2.97s    remaining: 4.17s
416:    learn: 1660.2996854     total: 2.98s    remaining: 4.16s
417:    learn: 1660.2883295     total: 2.98s    remaining: 4.15s
418:    learn: 1659.5739251     total: 2.99s    remaining: 4.14s
419:    learn: 1659.4331703     total: 2.99s    remaining: 4.13s
420:    learn: 1658.7654846     total: 3s       remaining: 4.12s
421:    learn: 1658.6997380     total: 3s       remaining: 4.12s
422:    learn: 1657.7758444     total: 3.02s    remaining: 4.12s
423:    learn: 1656.9715590     total: 3.03s    remaining: 4.12s
424:    learn: 1656.2299347     total: 3.05s    remaining: 4.12s
425:    learn: 1655.5928004     total: 3.05s    remaining: 4.11s
426:    learn: 1655.5263499     total: 3.06s    remaining: 4.1s
427:    learn: 1654.3392687     total: 3.06s    remaining: 4.09s
428:    learn: 1653.6757216     total: 3.07s    remaining: 4.09s
429:    learn: 1652.9284810     total: 3.08s    remaining: 4.08s
430:    learn: 1652.7471543     total: 3.08s    remaining: 4.07s
431:    learn: 1651.5762822     total: 3.08s    remaining: 4.06s
432:    learn: 1650.5166276     total: 3.09s    remaining: 4.05s
433:    learn: 1649.2263116     total: 3.1s     remaining: 4.05s
434:    learn: 1648.0138401     total: 3.11s    remaining: 4.04s
435:    learn: 1647.4017471     total: 3.12s    remaining: 4.03s
436:    learn: 1646.8880711     total: 3.12s    remaining: 4.02s
437:    learn: 1646.8778889     total: 3.13s    remaining: 4.01s
438:    learn: 1646.4465430     total: 3.13s    remaining: 4s
439:    learn: 1646.3675477     total: 3.13s    remaining: 3.99s
440:    learn: 1646.2902404     total: 3.14s    remaining: 3.98s
441:    learn: 1645.8640896     total: 3.14s    remaining: 3.96s
442:    learn: 1645.8575707     total: 3.15s    remaining: 3.96s
443:    learn: 1644.3390666     total: 3.15s    remaining: 3.94s
444:    learn: 1643.6667267     total: 3.15s    remaining: 3.93s
445:    learn: 1643.6453776     total: 3.16s    remaining: 3.92s
446:    learn: 1642.7000443     total: 3.16s    remaining: 3.91s
```

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447:    learn: 1642.2685157     total: 3.17s    remaining: 3.9s
448:    learn: 1641.4684339     total: 3.17s    remaining: 3.89s
449:    learn: 1640.5308829     total: 3.17s    remaining: 3.88s
450:    learn: 1639.8548059     total: 3.18s    remaining: 3.87s
451:    learn: 1638.7182125     total: 3.18s    remaining: 3.86s
452:    learn: 1638.2741264     total: 3.19s    remaining: 3.85s
453:    learn: 1637.5761972     total: 3.19s    remaining: 3.84s
454:    learn: 1636.6130268     total: 3.19s    remaining: 3.83s
455:    learn: 1635.2122401     total: 3.21s    remaining: 3.83s
456:    learn: 1634.3739190     total: 3.21s    remaining: 3.82s
457:    learn: 1633.4613240     total: 3.22s    remaining: 3.81s
458:    learn: 1632.6107945     total: 3.22s    remaining: 3.8s
459:    learn: 1631.6348372     total: 3.23s    remaining: 3.79s
460:    learn: 1630.7430086     total: 3.23s    remaining: 3.78s
461:    learn: 1629.7120952     total: 3.24s    remaining: 3.77s
462:    learn: 1628.7039625     total: 3.24s    remaining: 3.76s
463:    learn: 1628.0058899     total: 3.25s    remaining: 3.75s
464:    learn: 1627.3083549     total: 3.25s    remaining: 3.74s
465:    learn: 1626.7228473     total: 3.25s    remaining: 3.73s
466:    learn: 1626.0910173     total: 3.26s    remaining: 3.72s
467:    learn: 1625.5368954     total: 3.26s    remaining: 3.71s
468:    learn: 1625.4496746     total: 3.27s    remaining: 3.7s
469:    learn: 1624.7112217     total: 3.27s    remaining: 3.69s
470:    learn: 1624.2622200     total: 3.27s    remaining: 3.68s
471:    learn: 1624.2544618     total: 3.28s    remaining: 3.67s
472:    learn: 1623.7022772     total: 3.28s    remaining: 3.66s
473:    learn: 1622.9758180     total: 3.29s    remaining: 3.65s
474:    learn: 1622.4563447     total: 3.29s    remaining: 3.64s
475:    learn: 1621.7731100     total: 3.29s    remaining: 3.63s
476:    learn: 1621.1142457     total: 3.3s     remaining: 3.62s
477:    learn: 1619.8373853     total: 3.3s     remaining: 3.61s
478:    learn: 1619.0926589     total: 3.31s    remaining: 3.6s
479:    learn: 1619.0830420     total: 3.31s    remaining: 3.59s
480:    learn: 1619.0772375     total: 3.32s    remaining: 3.58s
481:    learn: 1618.4094727     total: 3.32s    remaining: 3.57s
482:    learn: 1617.6254499     total: 3.33s    remaining: 3.56s
483:    learn: 1616.7895567     total: 3.34s    remaining: 3.56s
484:    learn: 1615.6639556     total: 3.35s    remaining: 3.56s
485:    learn: 1615.0438262     total: 3.37s    remaining: 3.56s
486:    learn: 1614.3352333     total: 3.37s    remaining: 3.55s
487:    learn: 1614.3024114     total: 3.38s    remaining: 3.55s
488:    learn: 1613.6410348     total: 3.41s    remaining: 3.57s
489:    learn: 1612.8816057     total: 3.42s    remaining: 3.56s
490:    learn: 1612.5222079     total: 3.43s    remaining: 3.56s
491:    learn: 1611.5621219     total: 3.44s    remaining: 3.55s
492:    learn: 1610.8252079     total: 3.45s    remaining: 3.55s
493:    learn: 1609.9525343     total: 3.45s    remaining: 3.54s
494:    learn: 1608.4691461     total: 3.46s    remaining: 3.53s
495:    learn: 1607.9883122     total: 3.46s    remaining: 3.52s
496:    learn: 1607.2751655     total: 3.46s    remaining: 3.51s
497:    learn: 1606.8330984     total: 3.47s    remaining: 3.5s
498:    learn: 1606.8248170     total: 3.47s    remaining: 3.49s
499:    learn: 1606.2762544     total: 3.48s    remaining: 3.48s
500:    learn: 1605.7741311     total: 3.48s    remaining: 3.47s
501:    learn: 1604.7832547     total: 3.49s    remaining: 3.46s
502:    learn: 1604.0246624     total: 3.49s    remaining: 3.45s
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503:    learn: 1603.4539587    total: 3.5s     remaining: 3.44s
504:    learn: 1602.6018182    total: 3.5s     remaining: 3.43s
505:    learn: 1601.9053810    total: 3.5s     remaining: 3.42s
506:    learn: 1601.7180851    total: 3.51s    remaining: 3.41s
507:    learn: 1601.1230396    total: 3.51s    remaining: 3.4s
508:    learn: 1601.0062587    total: 3.52s    remaining: 3.39s
509:    learn: 1600.4310960    total: 3.53s    remaining: 3.39s
510:    learn: 1600.0121639    total: 3.54s    remaining: 3.39s
511:    learn: 1598.7379098    total: 3.54s    remaining: 3.38s
512:    learn: 1597.8127483    total: 3.55s    remaining: 3.37s
513:    learn: 1597.8080633    total: 3.55s    remaining: 3.36s
514:    learn: 1597.1631563    total: 3.56s    remaining: 3.35s
515:    learn: 1596.1793943    total: 3.56s    remaining: 3.34s
516:    learn: 1595.4842590    total: 3.57s    remaining: 3.33s
517:    learn: 1593.9161420    total: 3.58s    remaining: 3.33s
518:    learn: 1593.1073916    total: 3.59s    remaining: 3.33s
519:    learn: 1593.0693129    total: 3.62s    remaining: 3.34s
520:    learn: 1592.2321611    total: 3.62s    remaining: 3.33s
521:    learn: 1591.2905653    total: 3.63s    remaining: 3.33s
522:    learn: 1590.4213259    total: 3.64s    remaining: 3.32s
523:    learn: 1590.3399523    total: 3.64s    remaining: 3.31s
524:    learn: 1589.7436960    total: 3.65s    remaining: 3.3s
525:    learn: 1589.1939304    total: 3.65s    remaining: 3.29s
526:    learn: 1588.8468717    total: 3.66s    remaining: 3.29s
527:    learn: 1588.8433189    total: 3.67s    remaining: 3.28s
528:    learn: 1588.2166192    total: 3.67s    remaining: 3.27s
529:    learn: 1587.6074543    total: 3.67s    remaining: 3.26s
530:    learn: 1586.5424952    total: 3.68s    remaining: 3.25s
531:    learn: 1586.5358638    total: 3.69s    remaining: 3.24s
532:    learn: 1585.6948721    total: 3.69s    remaining: 3.23s
533:    learn: 1585.2232425    total: 3.69s    remaining: 3.22s
534:    learn: 1584.6888646    total: 3.7s     remaining: 3.21s
535:    learn: 1583.5615763    total: 3.7s     remaining: 3.21s
536:    learn: 1582.6483115    total: 3.71s    remaining: 3.2s
537:    learn: 1582.0557037    total: 3.71s    remaining: 3.19s
538:    learn: 1581.2143040    total: 3.72s    remaining: 3.18s
539:    learn: 1580.4380867    total: 3.72s    remaining: 3.17s
540:    learn: 1579.5303061    total: 3.73s    remaining: 3.16s
541:    learn: 1578.8410565    total: 3.73s    remaining: 3.15s
542:    learn: 1578.1809600    total: 3.73s    remaining: 3.14s
543:    learn: 1577.7203095    total: 3.74s    remaining: 3.13s
544:    learn: 1577.7129904    total: 3.74s    remaining: 3.12s
545:    learn: 1577.2242673    total: 3.75s    remaining: 3.12s
546:    learn: 1576.5582277    total: 3.75s    remaining: 3.11s
547:    learn: 1576.1212833    total: 3.76s    remaining: 3.1s
548:    learn: 1575.8786560    total: 3.76s    remaining: 3.09s
549:    learn: 1575.2344320    total: 3.77s    remaining: 3.08s
550:    learn: 1575.1915938    total: 3.77s    remaining: 3.07s
551:    learn: 1574.2996311    total: 3.77s    remaining: 3.06s
552:    learn: 1573.5210742    total: 3.78s    remaining: 3.05s
553:    learn: 1572.7087063    total: 3.78s    remaining: 3.05s
554:    learn: 1572.1456153    total: 3.79s    remaining: 3.04s
555:    learn: 1571.5981772    total: 3.79s    remaining: 3.03s
556:    learn: 1571.1349874    total: 3.8s     remaining: 3.02s
557:    learn: 1570.5098133    total: 3.8s     remaining: 3.01s
558:    learn: 1569.4602782    total: 3.81s    remaining: 3s
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559:    learn: 1568.5203017     total: 3.81s    remaining: 3s
560:    learn: 1568.0813176     total: 3.82s    remaining: 2.99s
561:    learn: 1567.0769469     total: 3.82s    remaining: 2.98s
562:    learn: 1567.0696187     total: 3.83s    remaining: 2.97s
563:    learn: 1566.6670831     total: 3.83s    remaining: 2.96s
564:    learn: 1566.2504390     total: 3.84s    remaining: 2.95s
565:    learn: 1566.1996582     total: 3.84s    remaining: 2.94s
566:    learn: 1565.2957164     total: 3.85s    remaining: 2.94s
567:    learn: 1564.4645508     total: 3.85s    remaining: 2.93s
568:    learn: 1563.7485387     total: 3.85s    remaining: 2.92s
569:    learn: 1563.2254266     total: 3.86s    remaining: 2.91s
570:    learn: 1562.7083823     total: 3.86s    remaining: 2.9s
571:    learn: 1562.4788015     total: 3.87s    remaining: 2.89s
572:    learn: 1561.9515071     total: 3.87s    remaining: 2.88s
573:    learn: 1561.3996844     total: 3.87s    remaining: 2.87s
574:    learn: 1560.7232462     total: 3.88s    remaining: 2.87s
575:    learn: 1560.7166069     total: 3.88s    remaining: 2.86s
576:    learn: 1560.3653283     total: 3.88s    remaining: 2.85s
577:    learn: 1560.3589083     total: 3.89s    remaining: 2.84s
578:    learn: 1559.3463316     total: 3.89s    remaining: 2.83s
579:    learn: 1559.1597505     total: 3.9s     remaining: 2.82s
580:    learn: 1559.1560512     total: 3.9s     remaining: 2.81s
581:    learn: 1558.4373278     total: 3.9s     remaining: 2.8s
582:    learn: 1557.9849492     total: 3.91s    remaining: 2.79s
583:    learn: 1557.9470459     total: 3.91s    remaining: 2.79s
584:    learn: 1556.6449363     total: 3.92s    remaining: 2.78s
585:    learn: 1555.9259679     total: 3.92s    remaining: 2.77s
586:    learn: 1555.2808913     total: 3.92s    remaining: 2.76s
587:    learn: 1554.6569249     total: 3.93s    remaining: 2.75s
588:    learn: 1554.1697493     total: 3.93s    remaining: 2.75s
589:    learn: 1553.5382235     total: 3.94s    remaining: 2.74s
590:    learn: 1552.7263924     total: 3.94s    remaining: 2.73s
591:    learn: 1552.3175944     total: 3.95s    remaining: 2.72s
592:    learn: 1551.7437021     total: 3.95s    remaining: 2.71s
593:    learn: 1551.7395104     total: 3.96s    remaining: 2.7s
594:    learn: 1551.2834197     total: 3.96s    remaining: 2.7s
595:    learn: 1550.1361809     total: 3.96s    remaining: 2.69s
596:    learn: 1549.2039450     total: 3.97s    remaining: 2.68s
597:    learn: 1548.9102460     total: 3.97s    remaining: 2.67s
598:    learn: 1548.5554289     total: 3.98s    remaining: 2.66s
599:    learn: 1547.6290297     total: 3.98s    remaining: 2.65s
600:    learn: 1547.2791161     total: 3.99s    remaining: 2.65s
601:    learn: 1546.7289073     total: 4s       remaining: 2.64s
602:    learn: 1546.7231909     total: 4s       remaining: 2.63s
603:    learn: 1545.5372196     total: 4s       remaining: 2.63s
604:    learn: 1544.6245534     total: 4.01s    remaining: 2.62s
605:    learn: 1543.8451760     total: 4.01s    remaining: 2.61s
606:    learn: 1543.3621785     total: 4.02s    remaining: 2.6s
607:    learn: 1542.9041120     total: 4.02s    remaining: 2.59s
608:    learn: 1542.5344686     total: 4.03s    remaining: 2.58s
609:    learn: 1542.1057756     total: 4.03s    remaining: 2.58s
610:    learn: 1541.0586696     total: 4.04s    remaining: 2.57s
611:    learn: 1540.7820514     total: 4.04s    remaining: 2.56s
612:    learn: 1539.8654707     total: 4.04s    remaining: 2.55s
613:    learn: 1539.2353129     total: 4.05s    remaining: 2.54s
614:    learn: 1538.8736950     total: 4.05s    remaining: 2.54s
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615:    learn: 1538.2131674     total: 4.06s    remaining: 2.53s
616:    learn: 1537.5554887     total: 4.06s    remaining: 2.52s
617:    learn: 1537.2131922     total: 4.06s    remaining: 2.51s
618:    learn: 1536.8173234     total: 4.07s    remaining: 2.5s
619:    learn: 1536.1052756     total: 4.07s    remaining: 2.5s
620:    learn: 1535.1996869     total: 4.08s    remaining: 2.49s
621:    learn: 1534.7568360     total: 4.08s    remaining: 2.48s
622:    learn: 1533.6734381     total: 4.09s    remaining: 2.47s
623:    learn: 1533.2817782     total: 4.09s    remaining: 2.46s
624:    learn: 1531.9847430     total: 4.1s     remaining: 2.46s
625:    learn: 1531.6709164     total: 4.12s    remaining: 2.46s
626:    learn: 1531.4089851     total: 4.13s    remaining: 2.46s
627:    learn: 1531.0177469     total: 4.14s    remaining: 2.45s
628:    learn: 1530.6774057     total: 4.15s    remaining: 2.44s
629:    learn: 1530.0732918     total: 4.15s    remaining: 2.44s
630:    learn: 1529.6138379     total: 4.16s    remaining: 2.43s
631:    learn: 1529.1466712     total: 4.16s    remaining: 2.42s
632:    learn: 1528.6969230     total: 4.17s    remaining: 2.42s
633:    learn: 1528.4074316     total: 4.18s    remaining: 2.41s
634:    learn: 1527.8535961     total: 4.18s    remaining: 2.4s
635:    learn: 1526.8717055     total: 4.19s    remaining: 2.4s
636:    learn: 1526.5451433     total: 4.2s     remaining: 2.39s
637:    learn: 1525.9539998     total: 4.21s    remaining: 2.39s
638:    learn: 1525.3612626     total: 4.21s    remaining: 2.38s
639:    learn: 1525.3580688     total: 4.21s    remaining: 2.37s
640:    learn: 1525.3549660     total: 4.21s    remaining: 2.36s
641:    learn: 1525.1129634     total: 4.22s    remaining: 2.35s
642:    learn: 1524.2170038     total: 4.22s    remaining: 2.34s
643:    learn: 1523.6686018     total: 4.23s    remaining: 2.34s
644:    learn: 1522.9980245     total: 4.23s    remaining: 2.33s
645:    learn: 1521.9763270     total: 4.24s    remaining: 2.32s
646:    learn: 1521.9710780     total: 4.24s    remaining: 2.31s
647:    learn: 1521.4298819     total: 4.25s    remaining: 2.31s
648:    learn: 1521.4247958     total: 4.25s    remaining: 2.3s
649:    learn: 1520.9368289     total: 4.25s    remaining: 2.29s
650:    learn: 1520.2509763     total: 4.26s    remaining: 2.28s
651:    learn: 1519.1263824     total: 4.26s    remaining: 2.27s
652:    learn: 1518.7260604     total: 4.26s    remaining: 2.27s
653:    learn: 1518.3368834     total: 4.27s    remaining: 2.26s
654:    learn: 1517.6375620     total: 4.27s    remaining: 2.25s
655:    learn: 1517.2213237     total: 4.28s    remaining: 2.24s
656:    learn: 1516.9710948     total: 4.28s    remaining: 2.23s
657:    learn: 1516.2691380     total: 4.29s    remaining: 2.23s
658:    learn: 1515.8044648     total: 4.29s    remaining: 2.22s
659:    learn: 1514.8206724     total: 4.29s    remaining: 2.21s
660:    learn: 1514.3504639     total: 4.3s     remaining: 2.2s
661:    learn: 1514.3229831     total: 4.3s     remaining: 2.2s
662:    learn: 1513.6007305     total: 4.31s    remaining: 2.19s
663:    learn: 1513.0918781     total: 4.31s    remaining: 2.18s
664:    learn: 1512.7977061     total: 4.32s    remaining: 2.17s
665:    learn: 1512.4112519     total: 4.32s    remaining: 2.17s
666:    learn: 1512.1090491     total: 4.33s    remaining: 2.16s
667:    learn: 1511.3236721     total: 4.33s    remaining: 2.15s
668:    learn: 1510.6262787     total: 4.34s    remaining: 2.15s
669:    learn: 1510.6236099     total: 4.34s    remaining: 2.14s
670:    learn: 1509.8371387     total: 4.35s    remaining: 2.13s
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671:    learn: 1509.2874087     total: 4.36s    remaining: 2.13s
672:    learn: 1509.2834648     total: 4.36s    remaining: 2.12s
673:    learn: 1509.2783078     total: 4.37s    remaining: 2.11s
674:    learn: 1508.6425759     total: 4.38s    remaining: 2.11s
675:    learn: 1507.9908505     total: 4.39s    remaining: 2.1s
676:    learn: 1507.4353868     total: 4.39s    remaining: 2.1s
677:    learn: 1506.6989363     total: 4.4s     remaining: 2.09s
678:    learn: 1506.1226434     total: 4.4s     remaining: 2.08s
679:    learn: 1505.6428927     total: 4.41s    remaining: 2.08s
680:    learn: 1505.3656753     total: 4.42s    remaining: 2.07s
681:    learn: 1504.5243896     total: 4.42s    remaining: 2.06s
682:    learn: 1504.4896435     total: 4.42s    remaining: 2.05s
683:    learn: 1503.9619162     total: 4.43s    remaining: 2.05s
684:    learn: 1503.7882074     total: 4.43s    remaining: 2.04s
685:    learn: 1502.7354588     total: 4.44s    remaining: 2.03s
686:    learn: 1502.2006975     total: 4.44s    remaining: 2.02s
687:    learn: 1501.8801632     total: 4.45s    remaining: 2.02s
688:    learn: 1501.4683597     total: 4.45s    remaining: 2.01s
689:    learn: 1501.2054638     total: 4.46s    remaining: 2s
690:    learn: 1500.8709512     total: 4.47s    remaining: 2s
691:    learn: 1500.5730072     total: 4.47s    remaining: 1.99s
692:    learn: 1499.7862031     total: 4.48s    remaining: 1.98s
693:    learn: 1499.5505532     total: 4.48s    remaining: 1.98s
694:    learn: 1498.9040313     total: 4.49s    remaining: 1.97s
695:    learn: 1498.0356110     total: 4.49s    remaining: 1.96s
696:    learn: 1497.4218832     total: 4.5s     remaining: 1.96s
697:    learn: 1497.0780310     total: 4.51s    remaining: 1.95s
698:    learn: 1496.6375892     total: 4.51s    remaining: 1.94s
699:    learn: 1496.0922301     total: 4.52s    remaining: 1.94s
700:    learn: 1495.2260921     total: 4.53s    remaining: 1.93s
701:    learn: 1494.7987280     total: 4.53s    remaining: 1.92s
702:    learn: 1494.2722220     total: 4.54s    remaining: 1.92s
703:    learn: 1493.8836251     total: 4.55s    remaining: 1.91s
704:    learn: 1493.3291796     total: 4.55s    remaining: 1.9s
705:    learn: 1493.0720436     total: 4.56s    remaining: 1.9s
706:    learn: 1492.2969504     total: 4.56s    remaining: 1.89s
707:    learn: 1491.9967125     total: 4.57s    remaining: 1.88s
708:    learn: 1491.6785699     total: 4.57s    remaining: 1.88s
709:    learn: 1490.9308481     total: 4.58s    remaining: 1.87s
710:    learn: 1490.7545667     total: 4.58s    remaining: 1.86s
711:    learn: 1490.4655127     total: 4.58s    remaining: 1.85s
712:    learn: 1490.1238831     total: 4.59s    remaining: 1.85s
713:    learn: 1489.8331838     total: 4.6s     remaining: 1.84s
714:    learn: 1489.4296741     total: 4.6s     remaining: 1.83s
715:    learn: 1489.0651978     total: 4.61s    remaining: 1.83s
716:    learn: 1488.7996804     total: 4.61s    remaining: 1.82s
717:    learn: 1488.6740871     total: 4.62s    remaining: 1.81s
718:    learn: 1488.2827462     total: 4.63s    remaining: 1.81s
719:    learn: 1488.0238320     total: 4.63s    remaining: 1.8s
720:    learn: 1487.3662632     total: 4.65s    remaining: 1.8s
721:    learn: 1486.8443457     total: 4.66s    remaining: 1.79s
722:    learn: 1485.9918883     total: 4.67s    remaining: 1.79s
723:    learn: 1485.6340797     total: 4.67s    remaining: 1.78s
724:    learn: 1484.9905478     total: 4.68s    remaining: 1.77s
725:    learn: 1484.4843779     total: 4.68s    remaining: 1.77s
726:    learn: 1484.1954503     total: 4.69s    remaining: 1.76s
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727:    learn: 1483.6560772     total: 4.69s    remaining: 1.75s
728:    learn: 1483.6536038     total: 4.7s     remaining: 1.75s
729:    learn: 1483.1775397     total: 4.7s     remaining: 1.74s
730:    learn: 1482.7431368     total: 4.71s    remaining: 1.73s
731:    learn: 1482.2211218     total: 4.71s    remaining: 1.73s
732:    learn: 1481.4104156     total: 4.72s    remaining: 1.72s
733:    learn: 1481.0754196     total: 4.72s    remaining: 1.71s
734:    learn: 1480.6449104     total: 4.73s    remaining: 1.71s
735:    learn: 1479.8553875     total: 4.74s    remaining: 1.7s
736:    learn: 1479.6147841     total: 4.74s    remaining: 1.69s
737:    learn: 1479.6097116     total: 4.75s    remaining: 1.69s
738:    learn: 1479.2266130     total: 4.75s    remaining: 1.68s
739:    learn: 1478.7468385     total: 4.76s    remaining: 1.67s
740:    learn: 1478.2448187     total: 4.77s    remaining: 1.67s
741:    learn: 1477.9312039     total: 4.77s    remaining: 1.66s
742:    learn: 1477.3674445     total: 4.78s    remaining: 1.65s
743:    learn: 1476.5042142     total: 4.79s    remaining: 1.65s
744:    learn: 1476.0905853     total: 4.8s     remaining: 1.64s
745:    learn: 1475.7560802     total: 4.81s    remaining: 1.64s
746:    learn: 1475.5600092     total: 4.82s    remaining: 1.63s
747:    learn: 1475.5550884     total: 4.82s    remaining: 1.62s
748:    learn: 1475.2031736     total: 4.83s    remaining: 1.62s
749:    learn: 1474.7343241     total: 4.84s    remaining: 1.61s
750:    learn: 1474.3655389     total: 4.84s    remaining: 1.61s
751:    learn: 1474.0582962     total: 4.85s    remaining: 1.6s
752:    learn: 1473.7466707     total: 4.86s    remaining: 1.59s
753:    learn: 1473.5724441     total: 4.87s    remaining: 1.59s
754:    learn: 1473.2367642     total: 4.87s    remaining: 1.58s
755:    learn: 1472.7266545     total: 4.88s    remaining: 1.57s
756:    learn: 1472.7226038     total: 4.89s    remaining: 1.57s
757:    learn: 1472.7187060     total: 4.89s    remaining: 1.56s
758:    learn: 1472.3058197     total: 4.9s     remaining: 1.55s
759:    learn: 1472.0110004     total: 4.91s    remaining: 1.55s
760:    learn: 1471.5231324     total: 4.92s    remaining: 1.54s
761:    learn: 1471.5209949     total: 4.93s    remaining: 1.54s
762:    learn: 1471.1386098     total: 4.94s    remaining: 1.53s
763:    learn: 1470.3570407     total: 4.96s    remaining: 1.53s
764:    learn: 1469.8520225     total: 4.96s    remaining: 1.52s
765:    learn: 1469.8483934     total: 4.97s    remaining: 1.52s
766:    learn: 1469.3414735     total: 4.98s    remaining: 1.51s
767:    learn: 1468.8742368     total: 4.98s    remaining: 1.5s
768:    learn: 1468.6593169     total: 4.99s    remaining: 1.5s
769:    learn: 1468.4238280     total: 5s       remaining: 1.49s
770:    learn: 1468.2419287     total: 5s       remaining: 1.49s
771:    learn: 1467.8771263     total: 5.01s    remaining: 1.48s
772:    learn: 1467.7027453     total: 5.01s    remaining: 1.47s
773:    learn: 1467.1872726     total: 5.03s    remaining: 1.47s
774:    learn: 1466.3956019     total: 5.03s    remaining: 1.46s
775:    learn: 1466.0473430     total: 5.04s    remaining: 1.45s
776:    learn: 1465.5061050     total: 5.04s    remaining: 1.45s
777:    learn: 1465.0647425     total: 5.05s    remaining: 1.44s
778:    learn: 1464.8589386     total: 5.06s    remaining: 1.43s
779:    learn: 1464.5699796     total: 5.06s    remaining: 1.43s
780:    learn: 1464.2398427     total: 5.07s    remaining: 1.42s
781:    learn: 1463.5882305     total: 5.07s    remaining: 1.41s
782:    learn: 1463.2603730     total: 5.08s    remaining: 1.41s
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783:    learn: 1462.8708785     total: 5.09s    remaining: 1.4s
784:    learn: 1462.6241174     total: 5.09s    remaining: 1.39s
785:    learn: 1461.8440981     total: 5.1s     remaining: 1.39s
786:    learn: 1461.5016436     total: 5.1s     remaining: 1.38s
787:    learn: 1461.3249833     total: 5.12s    remaining: 1.38s
788:    learn: 1461.3197895     total: 5.13s    remaining: 1.37s
789:    learn: 1461.3177745     total: 5.14s    remaining: 1.37s
790:    learn: 1461.0518284     total: 5.16s    remaining: 1.36s
791:    learn: 1460.5921315     total: 5.18s    remaining: 1.36s
792:    learn: 1460.2121733     total: 5.19s    remaining: 1.35s
793:    learn: 1459.9359226     total: 5.19s    remaining: 1.35s
794:    learn: 1459.3348157     total: 5.2s     remaining: 1.34s
795:    learn: 1458.8742722     total: 5.21s    remaining: 1.33s
796:    learn: 1458.3295069     total: 5.22s    remaining: 1.33s
797:    learn: 1457.9688362     total: 5.23s    remaining: 1.32s
798:    learn: 1457.9648254     total: 5.24s    remaining: 1.32s
799:    learn: 1457.5744072     total: 5.25s    remaining: 1.31s
800:    learn: 1457.4719176     total: 5.25s    remaining: 1.3s
801:    learn: 1456.9861579     total: 5.28s    remaining: 1.3s
802:    learn: 1456.5283355     total: 5.29s    remaining: 1.3s
803:    learn: 1455.7776125     total: 5.3s     remaining: 1.29s
804:    learn: 1455.4551489     total: 5.31s    remaining: 1.29s
805:    learn: 1455.0160226     total: 5.32s    remaining: 1.28s
806:    learn: 1454.4274768     total: 5.36s    remaining: 1.28s
807:    learn: 1454.2174687     total: 5.38s    remaining: 1.28s
808:    learn: 1453.9611610     total: 5.39s    remaining: 1.27s
809:    learn: 1453.6671879     total: 5.4s     remaining: 1.27s
810:    learn: 1453.3845026     total: 5.41s    remaining: 1.26s
811:    learn: 1453.0251589     total: 5.42s    remaining: 1.25s
812:    learn: 1452.5311085     total: 5.43s    remaining: 1.25s
813:    learn: 1452.2843317     total: 5.44s    remaining: 1.24s
814:    learn: 1451.7379793     total: 5.45s    remaining: 1.24s
815:    learn: 1451.2041760     total: 5.46s    remaining: 1.23s
816:    learn: 1451.2016797     total: 5.47s    remaining: 1.23s
817:    learn: 1450.8919318     total: 5.48s    remaining: 1.22s
818:    learn: 1450.8541328     total: 5.49s    remaining: 1.21s
819:    learn: 1450.6228085     total: 5.49s    remaining: 1.21s
820:    learn: 1450.4021460     total: 5.5s     remaining: 1.2s
821:    learn: 1449.9821603     total: 5.51s    remaining: 1.19s
822:    learn: 1449.4633392     total: 5.52s    remaining: 1.19s
823:    learn: 1449.1222171     total: 5.53s    remaining: 1.18s
824:    learn: 1448.7405650     total: 5.53s    remaining: 1.17s
825:    learn: 1448.4967965     total: 5.54s    remaining: 1.17s
826:    learn: 1448.3464289     total: 5.55s    remaining: 1.16s
827:    learn: 1448.0131327     total: 5.55s    remaining: 1.15s
828:    learn: 1447.7913809     total: 5.56s    remaining: 1.15s
829:    learn: 1447.2632152     total: 5.57s    remaining: 1.14s
830:    learn: 1446.9918422     total: 5.57s    remaining: 1.13s
831:    learn: 1446.7329213     total: 5.58s    remaining: 1.13s
832:    learn: 1446.4104391     total: 5.59s    remaining: 1.12s
833:    learn: 1445.9325543     total: 5.59s    remaining: 1.11s
834:    learn: 1445.7856855     total: 5.6s     remaining: 1.11s
835:    learn: 1445.5632822     total: 5.61s    remaining: 1.1s
836:    learn: 1445.4024114     total: 5.62s    remaining: 1.09s
837:    learn: 1444.9772217     total: 5.62s    remaining: 1.09s
838:    learn: 1444.9731111     total: 5.63s    remaining: 1.08s
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839:    learn: 1444.6856308     total: 5.63s    remaining: 1.07s
840:    learn: 1444.6836141     total: 5.64s    remaining: 1.07s
841:    learn: 1444.2557845     total: 5.65s    remaining: 1.06s
842:    learn: 1443.9635568     total: 5.66s    remaining: 1.05s
843:    learn: 1443.5793488     total: 5.66s    remaining: 1.05s
844:    learn: 1443.2765572     total: 5.67s    remaining: 1.04s
845:    learn: 1442.9203917     total: 5.68s    remaining: 1.03s
846:    learn: 1442.5857041     total: 5.69s    remaining: 1.03s
847:    learn: 1441.7708073     total: 5.71s    remaining: 1.02s
848:    learn: 1441.5323425     total: 5.72s    remaining: 1.02s
849:    learn: 1441.1731914     total: 5.72s    remaining: 1.01s
850:    learn: 1440.7375024     total: 5.73s    remaining: 1s
851:    learn: 1440.4006677     total: 5.74s    remaining: 997ms
852:    learn: 1440.3015257     total: 5.75s    remaining: 990ms
853:    learn: 1440.2978302     total: 5.75s    remaining: 983ms
854:    learn: 1439.9885696     total: 5.76s    remaining: 976ms
855:    learn: 1439.8309625     total: 5.76s    remaining: 970ms
856:    learn: 1439.1773033     total: 5.77s    remaining: 963ms
857:    learn: 1438.9957066     total: 5.79s    remaining: 958ms
858:    learn: 1438.4603273     total: 5.79s    remaining: 951ms
859:    learn: 1437.5399741     total: 5.8s     remaining: 945ms
860:    learn: 1437.2149320     total: 5.81s    remaining: 938ms
861:    learn: 1436.9406554     total: 5.82s    remaining: 931ms
862:    learn: 1436.4516603     total: 5.83s    remaining: 925ms
863:    learn: 1436.2854041     total: 5.83s    remaining: 918ms
864:    learn: 1435.9279608     total: 5.84s    remaining: 912ms
865:    learn: 1435.7649665     total: 5.85s    remaining: 905ms
866:    learn: 1435.2703883     total: 5.86s    remaining: 899ms
867:    learn: 1434.7197487     total: 5.87s    remaining: 892ms
868:    learn: 1434.2595065     total: 5.87s    remaining: 885ms
869:    learn: 1434.2560496     total: 5.88s    remaining: 879ms
870:    learn: 1433.9749701     total: 5.89s    remaining: 872ms
871:    learn: 1433.2291566     total: 5.89s    remaining: 865ms
872:    learn: 1432.8211329     total: 5.9s     remaining: 859ms
873:    learn: 1432.4084235     total: 5.91s    remaining: 852ms
874:    learn: 1432.0185610     total: 5.92s    remaining: 845ms
875:    learn: 1432.0168410     total: 5.92s    remaining: 838ms
876:    learn: 1431.4370466     total: 5.93s    remaining: 832ms
877:    learn: 1431.1682666     total: 5.94s    remaining: 825ms
878:    learn: 1430.9511382     total: 5.94s    remaining: 818ms
879:    learn: 1430.9477950     total: 5.95s    remaining: 811ms
880:    learn: 1430.4077459     total: 5.95s    remaining: 804ms
881:    learn: 1430.0129827     total: 5.96s    remaining: 797ms
882:    learn: 1429.4896655     total: 5.97s    remaining: 791ms
883:    learn: 1429.1418463     total: 5.97s    remaining: 784ms
884:    learn: 1428.9533784     total: 5.98s    remaining: 777ms
885:    learn: 1428.9514875     total: 5.99s    remaining: 770ms
886:    learn: 1428.6645775     total: 5.99s    remaining: 763ms
887:    learn: 1428.1646398     total: 6s       remaining: 757ms
888:    learn: 1427.9469079     total: 6.01s    remaining: 750ms
889:    learn: 1427.6874155     total: 6.01s    remaining: 743ms
890:    learn: 1427.6841885     total: 6.02s    remaining: 736ms
891:    learn: 1427.4921877     total: 6.02s    remaining: 729ms
892:    learn: 1427.2610947     total: 6.03s    remaining: 723ms
893:    learn: 1426.7911065     total: 6.04s    remaining: 716ms
894:    learn: 1426.4899662     total: 6.05s    remaining: 709ms
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895:    learn: 1426.3107111     total: 6.05s    remaining: 703ms
896:    learn: 1425.8850561     total: 6.06s    remaining: 696ms
897:    learn: 1425.5080254     total: 6.07s    remaining: 689ms
898:    learn: 1425.0569639     total: 6.07s    remaining: 682ms
899:    learn: 1424.5001044     total: 6.08s    remaining: 676ms
900:    learn: 1424.2669264     total: 6.09s    remaining: 669ms
901:    learn: 1423.8482508     total: 6.1s     remaining: 663ms
902:    learn: 1423.6212016     total: 6.1s     remaining: 656ms
903:    learn: 1423.2905391     total: 6.11s    remaining: 649ms
904:    learn: 1423.1176866     total: 6.12s    remaining: 642ms
905:    learn: 1423.1143925     total: 6.12s    remaining: 635ms
906:    learn: 1422.5288896     total: 6.13s    remaining: 629ms
907:    learn: 1422.2110598     total: 6.14s    remaining: 622ms
908:    learn: 1421.7953912     total: 6.14s    remaining: 615ms
909:    learn: 1421.6991174     total: 6.15s    remaining: 608ms
910:    learn: 1421.5456320     total: 6.16s    remaining: 602ms
911:    learn: 1421.3602840     total: 6.17s    remaining: 595ms
912:    learn: 1421.0583839     total: 6.17s    remaining: 588ms
913:    learn: 1420.5044573     total: 6.18s    remaining: 581ms
914:    learn: 1420.0678475     total: 6.19s    remaining: 575ms
915:    learn: 1419.9380979     total: 6.19s    remaining: 568ms
916:    learn: 1419.9358459     total: 6.2s     remaining: 561ms
917:    learn: 1419.5650873     total: 6.21s    remaining: 554ms
918:    learn: 1419.3920275     total: 6.21s    remaining: 548ms
919:    learn: 1418.7175500     total: 6.22s    remaining: 541ms
920:    learn: 1418.5597912     total: 6.23s    remaining: 534ms
921:    learn: 1418.2654170     total: 6.23s    remaining: 527ms
922:    learn: 1418.0691884     total: 6.24s    remaining: 521ms
923:    learn: 1417.6692082     total: 6.25s    remaining: 514ms
924:    learn: 1417.3704203     total: 6.26s    remaining: 507ms
925:    learn: 1416.9973968     total: 6.26s    remaining: 500ms
926:    learn: 1416.7039129     total: 6.27s    remaining: 494ms
927:    learn: 1416.3590845     total: 6.27s    remaining: 487ms
928:    learn: 1416.0422781     total: 6.28s    remaining: 480ms
929:    learn: 1415.6560550     total: 6.29s    remaining: 473ms
930:    learn: 1415.2973622     total: 6.29s    remaining: 467ms
931:    learn: 1414.7907054     total: 6.3s     remaining: 460ms
932:    learn: 1414.4380311     total: 6.31s    remaining: 453ms
933:    learn: 1413.9837997     total: 6.32s    remaining: 447ms
934:    learn: 1413.5659494     total: 6.33s    remaining: 440ms
935:    learn: 1413.3011488     total: 6.33s    remaining: 433ms
936:    learn: 1412.9309881     total: 6.34s    remaining: 426ms
937:    learn: 1412.9093580     total: 6.34s    remaining: 419ms
938:    learn: 1412.6984716     total: 6.35s    remaining: 413ms
939:    learn: 1412.4241309     total: 6.36s    remaining: 406ms
940:    learn: 1412.1012221     total: 6.37s    remaining: 399ms
941:    learn: 1411.8666136     total: 6.37s    remaining: 392ms
942:    learn: 1411.3555451     total: 6.38s    remaining: 386ms
943:    learn: 1411.2194518     total: 6.39s    remaining: 379ms
944:    learn: 1410.7058195     total: 6.4s     remaining: 373ms
945:    learn: 1410.2869816     total: 6.41s    remaining: 366ms
946:    learn: 1410.1688619     total: 6.42s    remaining: 359ms
947:    learn: 1409.9576388     total: 6.42s    remaining: 352ms
948:    learn: 1409.7019315     total: 6.43s    remaining: 346ms
949:    learn: 1409.5539003     total: 6.44s    remaining: 339ms
950:    learn: 1409.4242917     total: 6.45s    remaining: 332ms
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951:    learn: 1409.1164346     total: 6.46s    remaining: 326ms
952:    learn: 1408.9998123     total: 6.46s    remaining: 319ms
953:    learn: 1408.9456486     total: 6.47s    remaining: 312ms
954:    learn: 1408.3353653     total: 6.48s    remaining: 305ms
955:    learn: 1407.9314986     total: 6.48s    remaining: 298ms
956:    learn: 1407.6987672     total: 6.49s    remaining: 292ms
957:    learn: 1407.4323027     total: 6.5s     remaining: 285ms
958:    learn: 1406.9693403     total: 6.51s    remaining: 278ms
959:    learn: 1406.6843112     total: 6.51s    remaining: 271ms
960:    learn: 1406.4428982     total: 6.52s    remaining: 265ms
961:    learn: 1405.9767107     total: 6.53s    remaining: 258ms
962:    learn: 1405.7042827     total: 6.54s    remaining: 251ms
963:    learn: 1405.5023008     total: 6.54s    remaining: 244ms
964:    learn: 1405.1841130     total: 6.55s    remaining: 238ms
965:    learn: 1404.8240563     total: 6.56s    remaining: 231ms
966:    learn: 1404.6080570     total: 6.61s    remaining: 226ms
967:    learn: 1404.4669353     total: 6.64s    remaining: 220ms
968:    learn: 1404.3237897     total: 6.67s    remaining: 213ms
969:    learn: 1403.8947241     total: 6.68s    remaining: 207ms
970:    learn: 1403.6193009     total: 6.71s    remaining: 200ms
971:    learn: 1403.3692929     total: 6.72s    remaining: 193ms
972:    learn: 1403.1661247     total: 6.72s    remaining: 187ms
973:    learn: 1402.8613265     total: 6.73s    remaining: 180ms
974:    learn: 1402.5869729     total: 6.74s    remaining: 173ms
975:    learn: 1402.3533067     total: 6.74s    remaining: 166ms
976:    learn: 1402.0986185     total: 6.74s    remaining: 159ms
977:    learn: 1401.9177844     total: 6.75s    remaining: 152ms
978:    learn: 1401.7392305     total: 6.75s    remaining: 145ms
979:    learn: 1401.4846041     total: 6.75s    remaining: 138ms
980:    learn: 1401.2180049     total: 6.76s    remaining: 131ms
981:    learn: 1400.6664373     total: 6.76s    remaining: 124ms
982:    learn: 1400.3446627     total: 6.77s    remaining: 117ms
983:    learn: 1400.2177865     total: 6.77s    remaining: 110ms
984:    learn: 1399.8623806     total: 6.78s    remaining: 103ms
985:    learn: 1399.5501711     total: 6.78s    remaining: 96.3ms
986:    learn: 1399.0022085     total: 6.79s    remaining: 89.4ms
987:    learn: 1398.8291150     total: 6.79s    remaining: 82.5ms
988:    learn: 1398.5153012     total: 6.79s    remaining: 75.6ms
989:    learn: 1398.3524555     total: 6.8s     remaining: 68.7ms
990:    learn: 1397.9041039     total: 6.81s    remaining: 61.8ms
991:    learn: 1397.6403814     total: 6.81s    remaining: 54.9ms
992:    learn: 1397.2668980     total: 6.82s    remaining: 48ms
993:    learn: 1397.1235980     total: 6.82s    remaining: 41.2ms
994:    learn: 1396.9517827     total: 6.82s    remaining: 34.3ms
995:    learn: 1396.6956847     total: 6.83s    remaining: 27.4ms
996:    learn: 1396.4053953     total: 6.83s    remaining: 20.6ms
997:    learn: 1395.9340121     total: 6.84s    remaining: 13.7ms
998:    learn: 1395.8518997     total: 6.84s    remaining: 6.85ms
999:    learn: 1395.7331331     total: 6.85s    remaining: 0us
```

Out[192… <catboost.core.CatBoostRegressor at 0x1a53ab8690>

In [ ]:

In [193…
```
cat_pred=cat.predict(X_test)
```

In [195…
```
r2_score(y_test,cat_pred)
```

Out[195…
```
0.8301928561140887
```

In [196…
```
!pip install lightgbm
```

```
Collecting lightgbm
  Downloading lightgbm-2.3.1-py2.py3-none-macosx_10_9_x86_64.macosx_10_10_x8
6_64.macosx_10_11_x86_64.macosx_10_12_x86_64.macosx_10_13_x86_64.macosx_10_1
4_x86_64.macosx_10_15_x86_64.whl (679 kB)
     |████████████████████████████████| 679 kB 317 kB/s eta 0:00:01
Requirement already satisfied: scipy in /Users/mybeast/opt/anaconda3/lib/pyt
hon3.7/site-packages (from lightgbm) (1.4.1)
Requirement already satisfied: numpy in /Users/mybeast/opt/anaconda3/lib/pyt
hon3.7/site-packages (from lightgbm) (1.18.1)
Requirement already satisfied: scikit-learn in /Users/mybeast/opt/anaconda3/
lib/python3.7/site-packages (from lightgbm) (0.22.1)
Requirement already satisfied: joblib>=0.11 in /Users/mybeast/opt/anaconda3/
lib/python3.7/site-packages (from scikit-learn->lightgbm) (0.14.1)
Installing collected packages: lightgbm
Successfully installed lightgbm-2.3.1
```

In [201…
```
X_train[['duration_hr','duration_min']]=X_train[['duration_hr','duration_mir
X_test[['duration_hr','duration_min']]=X_test[['duration_hr','duration_min']
```

In [202…
```
from lightgbm import LGBMRegressor

lgb_model = LGBMRegressor()
lgb_model.fit(X_train,y_train)
```

Out[202…
```
LGBMRegressor(boosting_type='gbdt', class_weight=None, colsample_bytree=1.
0,
              importance_type='split', learning_rate=0.1, max_depth=-1,
              min_child_samples=20, min_child_weight=0.001, min_split_gain=
0.0,
              n_estimators=100, n_jobs=-1, num_leaves=31, objective=None,
              random_state=None, reg_alpha=0.0, reg_lambda=0.0, silent=Tru
e,
              subsample=1.0, subsample_for_bin=200000, subsample_freq=0)
```

In [204…
```
lgb_pred=lgb_model.predict(X_test)
r2_score(y_test,lgb_pred)
```

Out[204…
```
0.8030064936005559
```

In [ ]:
```

```

In [206…
```
!pip install xgboost
```

```
Collecting xgboost
  Downloading xgboost-1.1.1-py3-none-macosx_10_13_x86_64.macosx_10_14_x86_6
4.macosx_10_15_x86_64.whl (1.1 MB)
     |████████████████████████████████| 1.1 MB 857 kB/s eta 0:00:01
Requirement already satisfied: numpy in /Users/mybeast/opt/anaconda3/lib/pyt
hon3.7/site-packages (from xgboost) (1.18.1)
Requirement already satisfied: scipy in /Users/mybeast/opt/anaconda3/lib/pyt
hon3.7/site-packages (from xgboost) (1.4.1)
Installing collected packages: xgboost
Successfully installed xgboost-1.1.1
```

In [209…]
```
import xgboost as xgb
xgb_model=xgb.XGBRegressor()
xgb_model.fit(X_train,y_train)
xgb_pred=xgb_model.predict(X_test)
r2_score(y_test,xgb_pred)
```

Out[209…] 0.8212496826037233

In [210…]
```
df.head()
```

Out[210…]

	Air India	GoAir	IndiGo	Jet Airways	Jet Airways Business	Multiple carriers	Multiple carriers Premium economy	SpiceJet	Truje
0	0	0	1	0	0	0	0	0	
1	1	0	0	0	0	0	0	0	
2	0	0	0	1	0	0	0	0	
3	0	0	1	0	0	0	0	0	
4	0	0	1	0	0	0	0	0	

5 rows × 31 columns

In [219…]
```
# #Use pickle to save our model so that we can use it later

# import pickle
# # Saving model to disk
# pickle.dump(CAT_Model, open('model.pkl','wb'))
# model=pickle.load(open('model.pkl','rb'))
```

In [213…]
```
df.columns
```

Out[213…
```
Index(['Air India', 'GoAir', 'IndiGo', 'Jet Airways', 'Jet Airways Business',
       'Multiple carriers', 'Multiple carriers Premium economy', 'SpiceJet',
       'Trujet', 'Vistara', 'Vistara Premium economy', 'Source_Chennai',
       'Source_Delhi', 'Source_Kolkata', 'Source_Mumbai', 'Destination_Cochin',
       'Destination_Delhi', 'Destination_Hyderabad', 'Destination_Kolkata',
       'Route', 'Total_Stops', 'Additional_Info', 'Price', 'Day_of_Journey',
       'Month_of_Journey', 'Dep_hr', 'Dep_min', 'Arrival_hr', 'Arrival_min',
       'duration_hr', 'duration_min'],
      dtype='object')
```

In [216…
```
deploy_df=df.drop(['Route','Additional_Info'],axis=1)
```

In [217…
```
deploy_df.to_csv('deploy_df')
```

In [ ]:
```

```