PROBLEM STATEMENT : Which model is suitable for Flight Price Prediction

Importing Packages

In [1]:

```
import pandas as pd
import numpy as np
import matplotlib.pyplot as plt
import seaborn as sns
```

Read the Data

In [2]:

```
traindf=pd.read_csv(r"C:\Users\joel\Downloads\Copy of Data_Train.csv")
traindf
```

Out[2]:

	Airline	Date_of_Journey	Source	Destination	Route	Dep_Time	Arrival_Time	Duration	Total_Stops	Additional_Info	Price
0	IndiGo	24/03/2019	Banglore	New Delhi	BLR → DEL	22:20	01:10 22 Mar	2h 50m	non-stop	No info	3897
1	Air India	1/05/2019	Kolkata	Banglore	CCU → IXR → BBI → BLR	05:50	13:15	7h 25m	2 stops	No info	7662
2	Jet Airways	9/06/2019	Delhi	Cochin	DEL → LKO → BOM → COK	09:25	04:25 10 Jun	19h	2 stops	No info	13882
3	IndiGo	12/05/2019	Kolkata	Banglore	CCU → NAG → BLR	18:05	23:30	5h 25m	1 stop	No info	6218
4	IndiGo	01/03/2019	Banglore	New Delhi	BLR → NAG → DEL	16:50	21:35	4h 45m	1 stop	No info	13302
...	...	...	...	...	...	...	...	...	...	...	...
10678	Air Asia	9/04/2019	Kolkata	Banglore	CCU → BLR	19:55	22:25	2h 30m	non-stop	No info	4107
10679	Air India	27/04/2019	Kolkata	Banglore	CCU → BLR	20:45	23:20	2h 35m	non-stop	No info	4145
10680	Jet Airways	27/04/2019	Banglore	Delhi	BLR → DEL	08:20	11:20	3h	non-stop	No info	7229
10681	Vistara	01/03/2019	Banglore	New Delhi	BLR → DEL	11:30	14:10	2h 40m	non-stop	No info	12648
10682	Air India	9/05/2019	Delhi	Cochin	DEL → GOI → BOM → COK	10:55	19:15	8h 20m	2 stops	No info	11753

10683 rows × 11 columns

In [3]:
```
testdf=pd.read_csv(r"C:\Users\Venky\Downloads\Copy of Test_set.csv")
testdf
```

Out[3]:

	Airline	Date_of_Journey	Source	Destination	Route	Dep_Time	Arrival_Time	Duration	Total_Stops	Additional_Info
0	Jet Airways	6/06/2019	Delhi	Cochin	DEL → BOM → COK	17:30	04:25 07 Jun	10h 55m	1 stop	No info
1	IndiGo	12/05/2019	Kolkata	Banglore	CCU → MAA → BLR	06:20	10:20	4h	1 stop	No info
2	Jet Airways	21/05/2019	Delhi	Cochin	DEL → BOM → COK	19:15	19:00 22 May	23h 45m	1 stop	In-flight meal not included
3	Multiple carriers	21/05/2019	Delhi	Cochin	DEL → BOM → COK	08:00	21:00	13h	1 stop	No info
4	Air Asia	24/06/2019	Banglore	Delhi	BLR → DEL	23:55	02:45 25 Jun	2h 50m	non-stop	No info
...	...	...	...	...	...	...	...	...	...	...
2666	Air India	6/06/2019	Kolkata	Banglore	CCU → DEL → BLR	20:30	20:25 07 Jun	23h 55m	1 stop	No info
2667	IndiGo	27/03/2019	Kolkata	Banglore	CCU → BLR	14:20	16:55	2h 35m	non-stop	No info
2668	Jet Airways	6/03/2019	Delhi	Cochin	DEL → BOM → COK	21:50	04:25 07 Mar	6h 35m	1 stop	No info
2669	Air India	6/03/2019	Delhi	Cochin	DEL → BOM → COK	04:00	19:15	15h 15m	1 stop	No info
2670	Multiple carriers	15/06/2019	Delhi	Cochin	DEL → BOM → COK	04:55	19:15	14h 20m	1 stop	No info

2671 rows × 10 columns

Data Collection and Preprocessing

In [4]:
```
traindf.head()
```

Out[4]:

	Airline	Date_of_Journey	Source	Destination	Route	Dep_Time	Arrival_Time	Duration	Total_Stops	Additional_Info	Price
0	IndiGo	24/03/2019	Banglore	New Delhi	BLR → DEL	22:20	01:10 22 Mar	2h 50m	non-stop	No info	3897
1	Air India	1/05/2019	Kolkata	Banglore	CCU → IXR → BBI → BLR	05:50	13:15	7h 25m	2 stops	No info	7662
2	Jet Airways	9/06/2019	Delhi	Cochin	DEL → LKO → BOM → COK	09:25	04:25 10 Jun	19h	2 stops	No info	13882
3	IndiGo	12/05/2019	Kolkata	Banglore	CCU → NAG → BLR	18:05	23:30	5h 25m	1 stop	No info	6218
4	IndiGo	01/03/2019	Banglore	New Delhi	BLR → NAG → DEL	16:50	21:35	4h 45m	1 stop	No info	13302

In [5]:
```
testdf.head()
```

Out[5]:

	Airline	Date_of_Journey	Source	Destination	Route	Dep_Time	Arrival_Time	Duration	Total_Stops	Additional_Info
0	Jet Airways	6/06/2019	Delhi	Cochin	DEL → BOM → COK	17:30	04:25 07 Jun	10h 55m	1 stop	No info
1	IndiGo	12/05/2019	Kolkata	Banglore	CCU → MAA → BLR	06:20	10:20	4h	1 stop	No info
2	Jet Airways	21/05/2019	Delhi	Cochin	DEL → BOM → COK	19:15	19:00 22 May	23h 45m	1 stop	In-flight meal not included
3	Multiple carriers	21/05/2019	Delhi	Cochin	DEL → BOM → COK	08:00	21:00	13h	1 stop	No info
4	Air Asia	24/06/2019	Banglore	Delhi	BLR → DEL	23:55	02:45 25 Jun	2h 50m	non-stop	No info

In [6]:
```
traindf.tail()
```

Out[6]:

	Airline	Date_of_Journey	Source	Destination	Route	Dep_Time	Arrival_Time	Duration	Total_Stops	Additional_Info	Price
10678	Air Asia	9/04/2019	Kolkata	Banglore	CCU → BLR	19:55	22:25	2h 30m	non-stop	No info	4107
10679	Air India	27/04/2019	Kolkata	Banglore	CCU → BLR	20:45	23:20	2h 35m	non-stop	No info	4145
10680	Jet Airways	27/04/2019	Banglore	Delhi	BLR → DEL	08:20	11:20	3h	non-stop	No info	7229
10681	Vistara	01/03/2019	Banglore	New Delhi	BLR → DEL	11:30	14:10	2h 40m	non-stop	No info	12648
10682	Air India	9/05/2019	Delhi	Cochin	DEL → GOI → BOM → COK	10:55	19:15	8h 20m	2 stops	No info	11753

In [7]:
```
testdf.tail()
```

Out[7]:

	Airline	Date_of_Journey	Source	Destination	Route	Dep_Time	Arrival_Time	Duration	Total_Stops	Additional_Info
2666	Air India	6/06/2019	Kolkata	Banglore	CCU → DEL → BLR	20:30	20:25 07 Jun	23h 55m	1 stop	No info
2667	IndiGo	27/03/2019	Kolkata	Banglore	CCU → BLR	14:20	16:55	2h 35m	non-stop	No info
2668	Jet Airways	6/03/2019	Delhi	Cochin	DEL → BOM → COK	21:50	04:25 07 Mar	6h 35m	1 stop	No info
2669	Air India	6/03/2019	Delhi	Cochin	DEL → BOM → COK	04:00	19:15	15h 15m	1 stop	No info
2670	Multiple carriers	15/06/2019	Delhi	Cochin	DEL → BOM → COK	04:55	19:15	14h 20m	1 stop	No info

In [8]:
```
traindf.describe()
```

Out[8]:

	Price
count	10683.000000
mean	9087.064121
std	4611.359167
min	1759.000000
25%	5277.000000
50%	8372.000000
75%	12373.000000
max	79512.000000

In [9]:
```
testdf.describe()
```

Out[9]:

	Airline	Date_of_Journey	Source	Destination	Route	Dep_Time	Arrival_Time	Duration	Total_Stops	Additional_Info
count	2671	2671	2671	2671	2671	2671	2671	2671	2671	2671
unique	11	44	5	6	100	199	704	320	5	6
top	Jet Airways	9/05/2019	Delhi	Cochin	DEL → BOM → COK	10:00	19:00	2h 50m	1 stop	No info
freq	897	144	1145	1145	624	62	113	122	1431	2148

In [10]:
```
traindf.shape
```

Out[10]:
```
(10683, 11)
```

In [11]:
```
testdf.shape
```

Out[11]:
```
(2671, 10)
```

In [12]:

```
traindf.columns
```

Out[12]:

```
Index(['Airline', 'Date_of_Journey', 'Source', 'Destination', 'Route',
       'Dep_Time', 'Arrival_Time', 'Duration', 'Total_Stops',
       'Additional_Info', 'Price'],
      dtype='object')
```

In [13]:

```
testdf.columns
```

Out[13]:

```
Index(['Airline', 'Date_of_Journey', 'Source', 'Destination', 'Route',
       'Dep_Time', 'Arrival_Time', 'Duration', 'Total_Stops',
       'Additional_Info'],
      dtype='object')
```

In [14]:

```
traindf.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 10683 entries, 0 to 10682
Data columns (total 11 columns):
 #   Column           Non-Null Count  Dtype 
---  ------           --------------  ----- 
 0   Airline          10683 non-null  object
 1   Date_of_Journey  10683 non-null  object
 2   Source           10683 non-null  object
 3   Destination      10683 non-null  object
 4   Route            10682 non-null  object
 5   Dep_Time         10683 non-null  object
 6   Arrival_Time     10683 non-null  object
 7   Duration         10683 non-null  object
 8   Total_Stops      10682 non-null  object
 9   Additional_Info  10683 non-null  object
 10  Price            10683 non-null  int64 
dtypes: int64(1), object(10)
memory usage: 918.2+ KB
```

In [15]:
```
testdf.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 2671 entries, 0 to 2670
Data columns (total 10 columns):
 #   Column           Non-Null Count  Dtype 
---  ------           --------------  ----- 
 0   Airline          2671 non-null   object
 1   Date_of_Journey  2671 non-null   object
 2   Source           2671 non-null   object
 3   Destination      2671 non-null   object
 4   Route            2671 non-null   object
 5   Dep_Time         2671 non-null   object
 6   Arrival_Time     2671 non-null   object
 7   Duration         2671 non-null   object
 8   Total_Stops      2671 non-null   object
 9   Additional_Info  2671 non-null   object
dtypes: object(10)
memory usage: 208.8+ KB
```

Checking whether there are any null values in the dataset

In [16]:
```
traindf.isnull().sum()
```

Out[16]:
```
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 [17]:
```
testdf.isnull().sum()
```

Out[17]:
```
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
dtype: int64
```

Removing Null Values from the dataset

In [18]:
```
traindf.dropna(inplace=True)
```

In [19]:
```
testdf.dropna(inplace=True)
```

Conversion of datatype of values from String to Numerical Values

In [20]:

```
traindf['Airline'].value_counts()
```

Out[20]:

```
Airline
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: count, dtype: int64
```

In [21]:

```
traindf['Source'].value_counts()
```

Out[21]:

```
Source
Delhi       4536
Kolkata     2871
Banglore    2197
Mumbai       697
Chennai      381
Name: count, dtype: int64
```

In [22]:

```
traindf['Destination'].value_counts()
```

Out[22]:

```
Destination
Cochin       4536
Banglore     2871
Delhi        1265
New Delhi     932
Hyderabad     697
Kolkata       381
Name: count, dtype: int64
```

In [23]:
```
traindf['Total_Stops'].value_counts()
```

Out[23]:
```
Total_Stops
1 stop      5625
non-stop    3491
2 stops     1520
3 stops       45
4 stops        1
Name: count, dtype: int64
```

In [24]:

```
flight={"Airline":{"Jet Airways":0,"IndiGo":1,"Air India":2,"Multiple carriers":3,
 "SpiceJet":4,"Vistara":5,"Air Asia":6,"GoAir":7,
 "Multiple carriers Premium economy":8,
"Jet Airways Business":9,"Vistara Premium economy":10,"Trujet":11}}
traindf=traindf.replace(flight)
traindf
```

Out[24]:

	Airline	Date_of_Journey	Source	Destination	Route	Dep_Time	Arrival_Time	Duration	Total_Stops	Additional_Info	Price
0	1	24/03/2019	Banglore	New Delhi	BLR → DEL	22:20	01:10 22 Mar	2h 50m	non-stop	No info	3897
1	2	1/05/2019	Kolkata	Banglore	CCU → IXR → BBI → BLR	05:50	13:15	7h 25m	2 stops	No info	7662
2	0	9/06/2019	Delhi	Cochin	DEL → LKO → BOM → COK	09:25	04:25 10 Jun	19h	2 stops	No info	13882
3	1	12/05/2019	Kolkata	Banglore	CCU → NAG → BLR	18:05	23:30	5h 25m	1 stop	No info	6218
4	1	01/03/2019	Banglore	New Delhi	BLR → NAG → DEL	16:50	21:35	4h 45m	1 stop	No info	13302
...	...	...	...	...	...	...	...	...	...	...	...
10678	6	9/04/2019	Kolkata	Banglore	CCU → BLR	19:55	22:25	2h 30m	non-stop	No info	4107
10679	2	27/04/2019	Kolkata	Banglore	CCU → BLR	20:45	23:20	2h 35m	non-stop	No info	4145
10680	0	27/04/2019	Banglore	Delhi	BLR → DEL	08:20	11:20	3h	non-stop	No info	7229
10681	5	01/03/2019	Banglore	New Delhi	BLR → DEL	11:30	14:10	2h 40m	non-stop	No info	12648
10682	2	9/05/2019	Delhi	Cochin	DEL → GOI → BOM → COK	10:55	19:15	8h 20m	2 stops	No info	11753

10682 rows × 11 columns

In [25]:
```
city={"Source":{"Delhi":0,"Kolkata":1,"Banglore":2,
 "Mumbai":3,"Chennai":4}}
traindf=traindf.replace(city)
traindf
```

Out[25]:

	Airline	Date_of_Journey	Source	Destination	Route	Dep_Time	Arrival_Time	Duration	Total_Stops	Additional_Info	Price
0	1	24/03/2019	2	New Delhi	BLR → DEL	22:20	01:10 22 Mar	2h 50m	non-stop	No info	3897
1	2	1/05/2019	1	Banglore	CCU → IXR → BBI → BLR	05:50	13:15	7h 25m	2 stops	No info	7662
2	0	9/06/2019	0	Cochin	DEL → LKO → BOM → COK	09:25	04:25 10 Jun	19h	2 stops	No info	13882
3	1	12/05/2019	1	Banglore	CCU → NAG → BLR	18:05	23:30	5h 25m	1 stop	No info	6218
4	1	01/03/2019	2	New Delhi	BLR → NAG → DEL	16:50	21:35	4h 45m	1 stop	No info	13302
...	...	...	...	...	...	...	...	...	...	...	...
10678	6	9/04/2019	1	Banglore	CCU → BLR	19:55	22:25	2h 30m	non-stop	No info	4107
10679	2	27/04/2019	1	Banglore	CCU → BLR	20:45	23:20	2h 35m	non-stop	No info	4145
10680	0	27/04/2019	2	Delhi	BLR → DEL	08:20	11:20	3h	non-stop	No info	7229
10681	5	01/03/2019	2	New Delhi	BLR → DEL	11:30	14:10	2h 40m	non-stop	No info	12648
10682	2	9/05/2019	0	Cochin	DEL → GOI → BOM → COK	10:55	19:15	8h 20m	2 stops	No info	11753

10682 rows × 11 columns

In [26]:

```
destination={"Destination":{"Cochin":0,"Banglore":1,"Delhi":2,
 "New Delhi":3,"Hyderabad":4,"Kolkata":5}}
traindf=traindf.replace(destination)
traindf
```

Out[26]:

	Airline	Date_of_Journey	Source	Destination	Route	Dep_Time	Arrival_Time	Duration	Total_Stops	Additional_Info	Price
0	1	24/03/2019	2	3	BLR → DEL	22:20	01:10 22 Mar	2h 50m	non-stop	No info	3897
1	2	1/05/2019	1	1	CCU → IXR → BBI → BLR	05:50	13:15	7h 25m	2 stops	No info	7662
2	0	9/06/2019	0	0	DEL → LKO → BOM → COK	09:25	04:25 10 Jun	19h	2 stops	No info	13882
3	1	12/05/2019	1	1	CCU → NAG → BLR	18:05	23:30	5h 25m	1 stop	No info	6218
4	1	01/03/2019	2	3	BLR → NAG → DEL	16:50	21:35	4h 45m	1 stop	No info	13302
...	...	...	...	...	...	...	...	...	...	...	...
10678	6	9/04/2019	1	1	CCU → BLR	19:55	22:25	2h 30m	non-stop	No info	4107
10679	2	27/04/2019	1	1	CCU → BLR	20:45	23:20	2h 35m	non-stop	No info	4145
10680	0	27/04/2019	2	2	BLR → DEL	08:20	11:20	3h	non-stop	No info	7229
10681	5	01/03/2019	2	3	BLR → DEL	11:30	14:10	2h 40m	non-stop	No info	12648
10682	2	9/05/2019	0	0	DEL → GOI → BOM → COK	10:55	19:15	8h 20m	2 stops	No info	11753

10682 rows × 11 columns

In [27]:

```
stops={"Total_Stops":{"non-stop":0,"1 stop":1,"2 stops":2,
 "3 stops":3,"4 stops":4}}
traindf=traindf.replace(stops)
traindf
```

Out[27]:

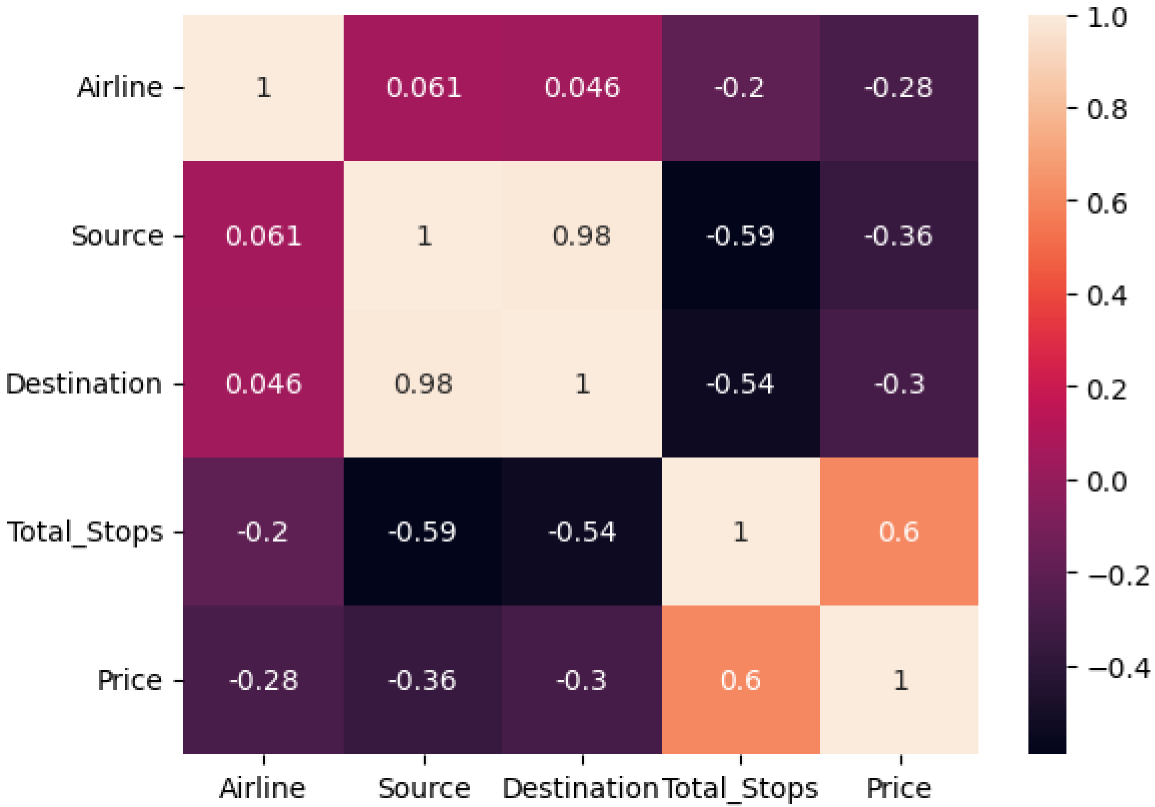
	Airline	Date_of_Journey	Source	Destination	Route	Dep_Time	Arrival_Time	Duration	Total_Stops	Additional_Info	Price
0	1	24/03/2019	2	3	BLR → DEL	22:20	01:10 22 Mar	2h 50m	0	No info	3897
1	2	1/05/2019	1	1	CCU → IXR → BBI → BLR	05:50	13:15	7h 25m	2	No info	7662
2	0	9/06/2019	0	0	DEL → LKO → BOM → COK	09:25	04:25 10 Jun	19h	2	No info	13882
3	1	12/05/2019	1	1	CCU → NAG → BLR	18:05	23:30	5h 25m	1	No info	6218
4	1	01/03/2019	2	3	BLR → NAG → DEL	16:50	21:35	4h 45m	1	No info	13302
...	...	...	...	...	...	...	...	...	...	...	...
10678	6	9/04/2019	1	1	CCU → BLR	19:55	22:25	2h 30m	0	No info	4107
10679	2	27/04/2019	1	1	CCU → BLR	20:45	23:20	2h 35m	0	No info	4145
10680	0	27/04/2019	2	2	BLR → DEL	08:20	11:20	3h	0	No info	7229
10681	5	01/03/2019	2	3	BLR → DEL	11:30	14:10	2h 40m	0	No info	12648
10682	2	9/05/2019	0	0	DEL → GOI → BOM → COK	10:55	19:15	8h 20m	2	No info	11753

10682 rows × 11 columns

Data visualization

In [28]:
```
fdf=traindf[['Airline','Source','Destination','Total_Stops','Price']]
sns.heatmap(fdf.corr(),annot=True)
```

Out[28]:
```
<Axes: >
```



Feature Scaling : To Split the data into training data and test data

In [29]:
```
x=fdf[['Airline','Source','Destination','Total_Stops']]
y=fdf['Price']
```

In [30]:

```
from sklearn.model_selection import train_test_split
X_train,X_test,y_train,y_test=train_test_split(x,y,test_size=0.3,random_state=100)
```

Linear Regression

In [31]:

```
from sklearn.linear_model import LinearRegression
regr=LinearRegression()
regr.fit(X_train,y_train)
print(regr.intercept_)
coeff_df=pd.DataFrame(regr.coef_,x.columns,columns=['coefficient'])
coeff_df
```

```
7211.098088897471
```

Out[31]:

	coefficient
Airline	-418.483922
Source	-3275.073380
Destination	2505.480291
Total_Stops	3541.798053

In [32]:

```
score=regr.score(X_test,y_test)
print(score)
```

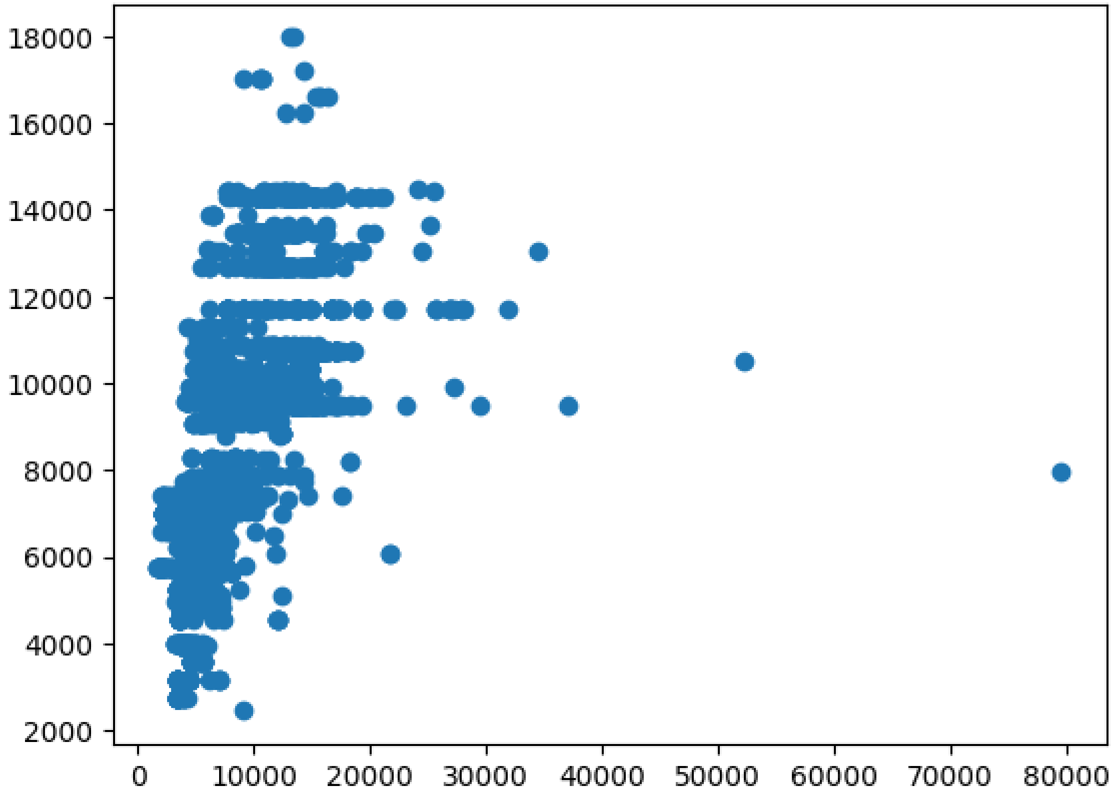
```
0.41083048909283415
```

In [33]:

```
predictions=regr.predict(X_test)
```

In [34]:
```
plt.scatter(y_test,predictions)
```

Out[34]:
```
<matplotlib.collections.PathCollection at 0x261f8aa5850>
```



In [35]:
```
x=np.array(fdf['Price']).reshape(-1,1)
y=np.array(fdf['Total_Stops']).reshape(-1,1)
fdf.dropna(inplace=True)
```

```
C:\Users\SASIDHAR ROYAL\AppData\Local\Temp\ipykernel_7940\521034954.py:3: SettingWithCopyWarning:
A value is trying to be set on a copy of a slice from a DataFrame

See the caveats in the documentation: https://pandas.pydata.org/pandas-docs/stable/user_guide/indexing.html#returnin
g-a-view-versus-a-copy (https://pandas.pydata.org/pandas-docs/stable/user_guide/indexing.html#returning-a-view-versu
s-a-copy)
  fdf.dropna(inplace=True)
```

In [36]:

```
X_train,X_test,y_train,y_test=train_test_split(x,y,test_size=0.3)
regr.fit(X_train,y_train)
regr.fit(X_train,y_train)
```

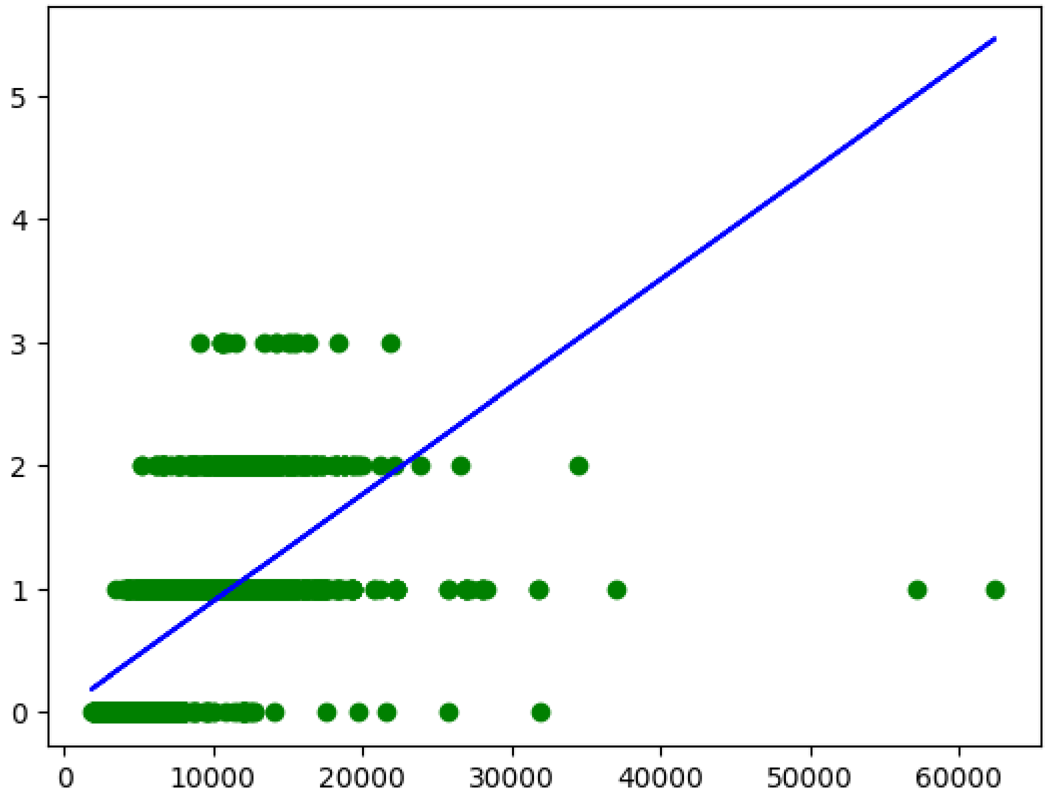
Out[36]:

```
LinearRegression()
```

In a Jupyter environment, please rerun this cell to show the HTML representation or trust the notebook.
On GitHub, the HTML representation is unable to render, please try loading this page with nbviewer.org.

In [37]:

```
y_pred=regr.predict(X_test)
plt.scatter(X_test,y_test,color='g')
plt.plot(X_test,y_pred,color='b')
plt.show()
```



Since we did not get the accuracy for LinearRegression we are going to implement Logisti Regression

Logistic Regression

In [38]:

```
#Logistic Regression
x=np.array(fdf['Price']).reshape(-1,1)
y=np.array(fdf['Total_Stops']).reshape(-1,1)
fdf.dropna(inplace=True)
x_train,x_test,y_train,y_test=train_test_split(x,y,test_size=0.3,random_state=1)
from sklearn.linear_model import LogisticRegression
lr=LogisticRegression(max_iter=10000)
```

```
C:\Users\SASIDHAR ROYAL\AppData\Local\Temp\ipykernel_7940\3604832714.py:4: SettingWithCopyWarning:
A value is trying to be set on a copy of a slice from a DataFrame

See the caveats in the documentation: https://pandas.pydata.org/pandas-docs/stable/user_guide/indexing.html#returning-a-view-versus-a-copy (https://pandas.pydata.org/pandas-docs/stable/user_guide/indexing.html#returning-a-view-versus-a-copy)
  fdf.dropna(inplace=True)
```

In [39]:

```
lr.fit(x_train,y_train)
```

```
C:\Users\SASIDHAR ROYAL\AppData\Local\Programs\Python\Python311\Lib\site-packages\sklearn\utils\validation.py:1143:
DataConversionWarning: A column-vector y was passed when a 1d array was expected. Please change the shape of y to (n_samples, ), for example using ravel().
  y = column_or_1d(y, warn=True)
```

Out[39]:

```
LogisticRegression(max_iter=10000)
```

In a Jupyter environment, please rerun this cell to show the HTML representation or trust the notebook.
On GitHub, the HTML representation is unable to render, please try loading this page with nbviewer.org.

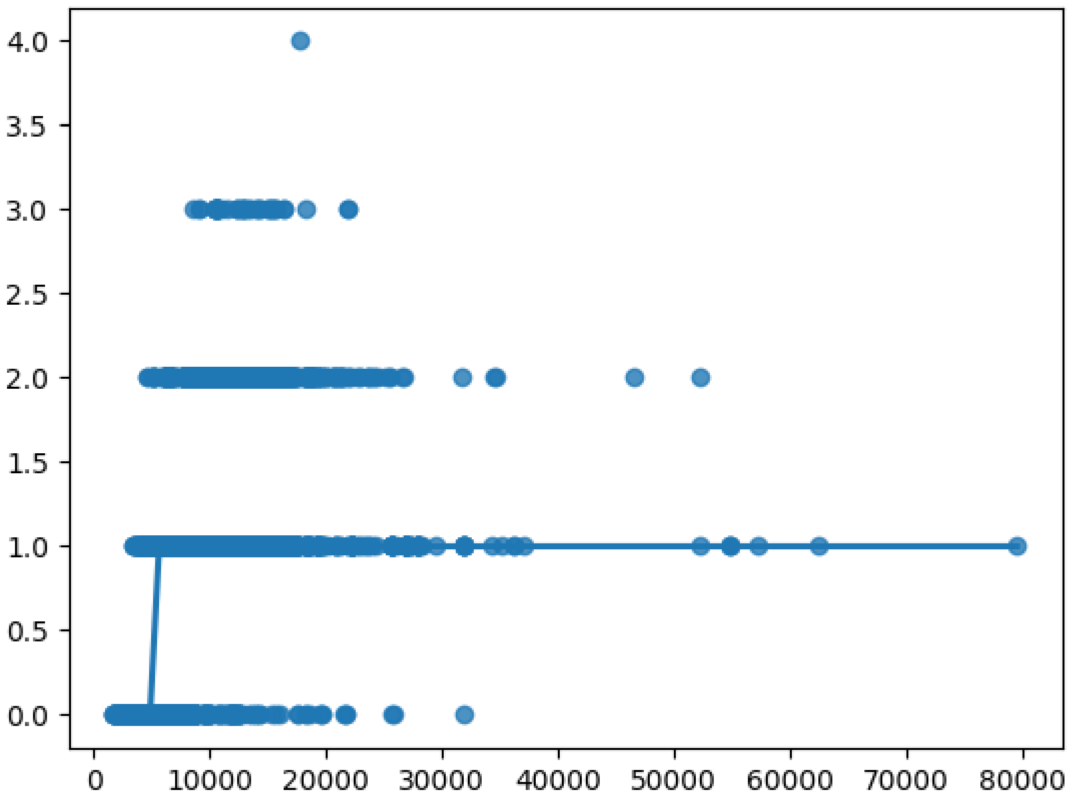
```
In [40]: score=lr.score(x_test,y_test)
         print(score)
```

```
0.7160686427457098
```

```
In [41]: sns.regplot(x=x,y=y,data=fdf,logistic=True,ci=None)
```

```
C:\Users\SASIDHAR ROYAL\AppData\Local\Programs\Python\Python311\Lib\site-packages\statsmodels\genmod\families\links.
py:198: RuntimeWarning: overflow encountered in exp
  t = np.exp(-z)
```

```
Out[41]: <Axes: >
```



Since we did not get the accuracy for Logistic Regression we are going to implement Decision Tree and Random Forest and make a comparative study for finding the best model for the dataset

Decision Tree

In [42]:

```
from sklearn.tree import DecisionTreeClassifier
clf=DecisionTreeClassifier(random_state=0)
clf.fit(x_train,y_train)
```

Out[42]:

```
DecisionTreeClassifier(random_state=0)
```

In a Jupyter environment, please rerun this cell to show the HTML representation or trust the notebook.
On GitHub, the HTML representation is unable to render, please try loading this page with nbviewer.org.

In [43]:

```
score=clf.score(x_test,y_test)
print(score)
```

```
0.9369734789391576
```

Random Forest

In [44]:

```
#Random forest classifier
from sklearn.ensemble import RandomForestClassifier
rfc=RandomForestClassifier()
rfc.fit(X_train,y_train)
```

```
C:\Users\SASIDHAR ROYAL\AppData\Local\Temp\ipykernel_7940\1232785509.py:4: DataConversionWarning: A column-vector y
was passed when a 1d array was expected. Please change the shape of y to (n_samples,), for example using ravel().
  rfc.fit(X_train,y_train)
```

Out[44]:

```
RandomForestClassifier()
```

In a Jupyter environment, please rerun this cell to show the HTML representation or trust the notebook.
On GitHub, the HTML representation is unable to render, please try loading this page with nbviewer.org.

In [45]:

```
params={'max_depth':[2,3,5,10,20],'min_samples_leaf':[5,10,20,50,100,200],'n_estimators':[10,25,30,50,100,200]}
```

In [46]:

```
from sklearn.model_selection import GridSearchCV
grid_search=GridSearchCV(estimator=rfc,param_grid=params,cv=2,scoring="accuracy")
```

In [47]:
```
grid_search.fit(X_train,y_train)
```

```
ape of y to (n_samples,), for example using ravel().
  estimator.fit(X_train, y_train, **fit_params)
C:\Users\SASIDHAR ROYAL\AppData\Local\Programs\Python\Python311\Lib\site-packages\sklearn\model_selection\_validat
ion.py:686: DataConversionWarning: A column-vector y was passed when a 1d array was expected. Please change the sh
ape of y to (n_samples,), for example using ravel().
  estimator.fit(X_train, y_train, **fit_params)
C:\Users\SASIDHAR ROYAL\AppData\Local\Programs\Python\Python311\Lib\site-packages\sklearn\model_selection\_validat
ion.py:686: DataConversionWarning: A column-vector y was passed when a 1d array was expected. Please change the sh
ape of y to (n_samples,), for example using ravel().
  estimator.fit(X_train, y_train, **fit_params)
C:\Users\SASIDHAR ROYAL\AppData\Local\Programs\Python\Python311\Lib\site-packages\sklearn\model_selection\_validat
ion.py:686: DataConversionWarning: A column-vector y was passed when a 1d array was expected. Please change the sh
ape of y to (n_samples,), for example using ravel().
  estimator.fit(X_train, y_train, **fit_params)
C:\Users\SASIDHAR ROYAL\AppData\Local\Programs\Python\Python311\Lib\site-packages\sklearn\model_selection\_validat
ion.py:686: DataConversionWarning: A column-vector y was passed when a 1d array was expected. Please change the sh
ape of y to (n_samples,), for example using ravel().
  estimator.fit(X_train, y_train, **fit_params)
C:\Users\SASIDHAR ROYAL\AppData\Local\Programs\Python\Python311\Lib\site-packages\sklearn\model_selection\_validat
ion.py:686: DataConversionWarning: A column-vector y was passed when a 1d array was expected. Please change the sh
```

In [48]:
```
grid_search.best_score_
```

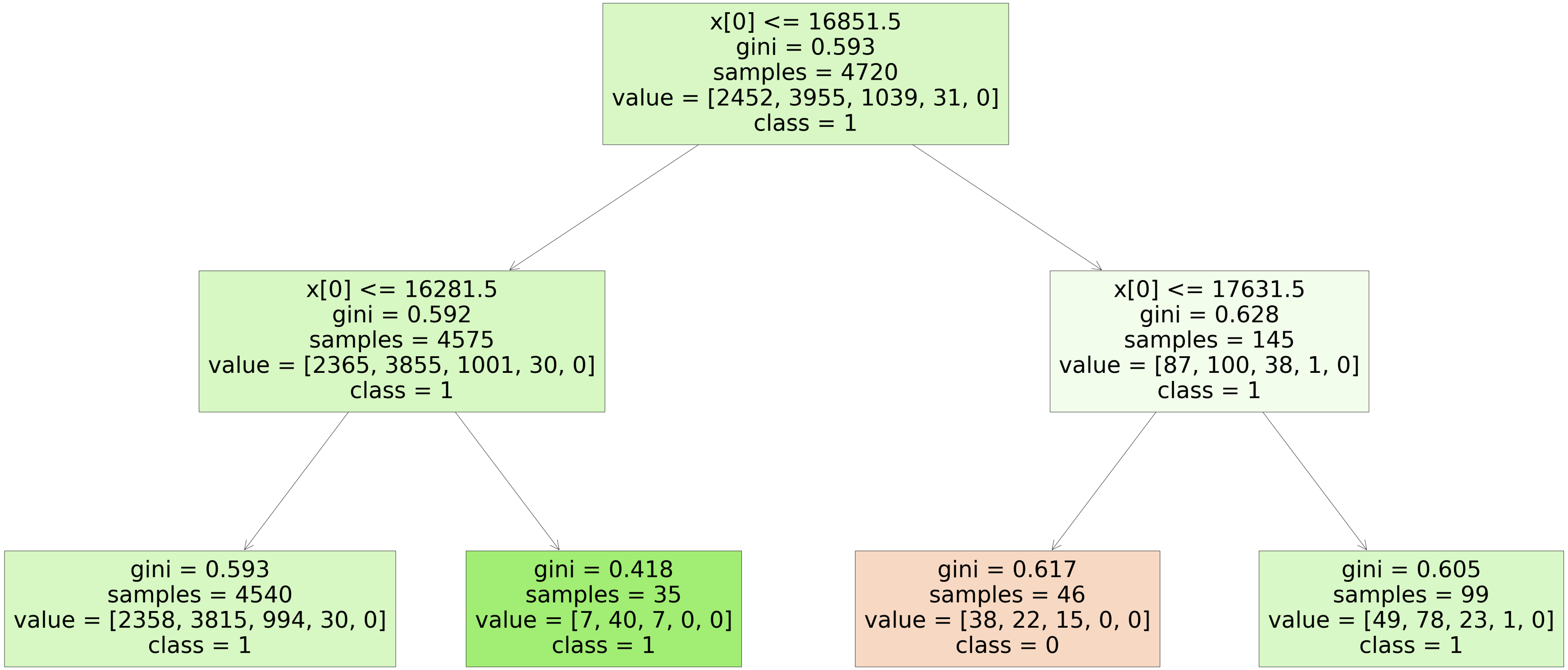
Out[48]:
```
0.523605715699528
```

In [49]:
```
rf_best=grid_search.best_estimator_
rf_best
```

Out[49]:
```
RandomForestClassifier(max_depth=2, min_samples_leaf=5, n_estimators=30)
```

In a Jupyter environment, please rerun this cell to show the HTML representation or trust the notebook.
On GitHub, the HTML representation is unable to render, please try loading this page with nbviewer.org.

In [50]:
```
from sklearn.tree import plot_tree
plt.figure(figsize=(80,40))
plot_tree(rf_best.estimators_[4],class_names=['0','1','2','3','4'],filled=True);
```



In [ ]:
```
score=rfc.score(x_test,y_test)
print(score)
```

Here when we compare between Decision Tree and Random Forest, we can confirm that Decision Tree has more accuracy than Random Forest which makesit the best model for this dataset. It makes DecisionTree to

perform better than Random Forest. But it may vary for the other datasets where in most casesRandom Forest performs better as it has reducedoverfitting and robust to outliers. ¶

CONCLUSION : Based on accuracy scores of all models that were implemented we can conclude that"Decision Tree" is the best model for the given dataset

In [ ]: