MINI PROJECT

PROBLEM STATEMENT:which model is suitable for flight price prediction

importing packages

In [1]:
```
import numpy as np
import pandas as pd
import seaborn as sns
import matplotlib.pyplot as plt
```

Read the Data

In [2]:
```
df=pd.read_csv(r"C:\Users\USER\Downloads\FlightPricePrediction_Practise\Data_Train.csv")
df
```

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

Data collection and preprocessing

In [3]:
```
df.head()
```

Out[3]:

	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 [4]:
```
df.tail()
```

Out[4]:

	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 [5]:
```
df.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 [6]:
```
df.describe()
```

Out[6]:

	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 [7]:
```
df.shape
```

Out[7]:
```
(10683, 11)
```

In [8]:
```
df.isnull().sum()
```

Out[8]:
```
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 [9]:
```
df.isna().any()
```

Out[9]:
```
Airline           False
Date_of_Journey   False
Source            False
Destination       False
Route              True
Dep_Time          False
Arrival_Time      False
Duration          False
Total_Stops        True
Additional_Info   False
Price             False
dtype: bool
```

In [10]:
```
df['Source'].value_counts()
```

Out[10]:
```
Source
Delhi       4537
Kolkata     2871
Banglore    2197
Mumbai       697
Chennai      381
Name: count, dtype: int64
```

In [11]:
```
df['Destination'].value_counts()
```

Out[11]:
```
Destination
Cochin       4537
Banglore     2871
Delhi        1265
New Delhi     932
Hyderabad     697
Kolkata       381
Name: count, dtype: int64
```

In [12]:
```
h={"Destination":{"Banglore":1,"Kolkata":2,"Delhi":3,"Cochin":4,"New Delhi":5,"Hyderabad":6}}
df=df.replace(h)
df
```

Out[12]:

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

10683 rows × 11 columns

In [13]:
```
df['Airline'].value_counts()
```

Out[13]:
```
Airline
Jet Airways                          3849
IndiGo                               2053
Air India                            1752
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 [67]:
```
h={'Airline':{'Jet Airways':1,'IndiGo':2,'Air India':3,'Multiple carriers':4,'SpiceJet':5,'Vistara':6,'Air As
                'Multiple carriers Premium economy':9,'Jet Airways Business':10,'Vistara Premium economy':11,'Tru
df=df.replace(h)
df
```

Out[67]:

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

10683 rows × 11 columns

In [15]:
```
h={'Source':{"Banglore":1,"Kolkata":2,"Delhi":3,"Mumbai":4,"Chennai":5}}
df=df.replace(h)
df
```

Out[15]:

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

10683 rows × 11 columns

In [16]:
```
df["Date_of_Journey"].value_counts()
```

Out[16]:

Date_of_Journey	
18/05/2019	504
6/06/2019	503
21/05/2019	497
9/06/2019	495
12/06/2019	493
9/05/2019	484
21/03/2019	423
15/05/2019	405
27/05/2019	382
27/06/2019	355
24/06/2019	351
1/06/2019	342
3/06/2019	333
15/06/2019	328
24/03/2019	323
6/03/2019	308
27/03/2019	299
24/05/2019	286
6/05/2019	282
1/05/2019	277
12/05/2019	259
1/04/2019	257
3/03/2019	218
9/03/2019	200
15/03/2019	162
18/03/2019	156
01/03/2019	152
12/03/2019	142
9/04/2019	125
3/04/2019	110
21/06/2019	109
18/06/2019	105
09/03/2019	102
6/04/2019	100
03/03/2019	97
06/03/2019	95
27/04/2019	94
24/04/2019	92
3/05/2019	90
15/04/2019	89
21/04/2019	82
18/04/2019	67

```
12/04/2019     63
1/03/2019      47
Name: count, dtype: int64
```

In [63]:
```
h={'Date_of_Journey':{'18/05/2019':1,'6/06/2019':2,'21/05/2019':3,'9/06/2019':4,'12/06/2019':5,'9/05/2019':6,
                      '15/05/2019':8,'24/03/2019':9,'6/03/2019':10,'27/03/2019':11,'24/05/2019':12,'6/05/2019':13
                       '12/05/2019':15,'1/04/2019':16,'3/03/2019':17,'9/03/2019':18,'15/03/2019':19 ,'18/03/2019
                      '12/03/2019':22,'9/04/2019':24,'3/04/2019':25,'21/06/2019':26,'18/06/2019':27,'09/03/2019
                       '27/04/2019':30,'24/04/2019':31,'3/05/2019':32,'15/04/2019':33,'21/04/2019':34,'18/04/201
                        '1/03/2019':36,'3/06/2019':37,'27/05/2019':38,'27/06/2019':39,'24/06/2019':40,'1/06/2019
                        '3/06/2019':42,'15/06/2019':43,'03/03/2019':44,'06/03/2019':45}}
df=df.replace(h)
df
```

Out[63]:

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

10683 rows × 11 columns

In [40]:
```
df["Total_Stops"].value_counts()
```

Out[40]:
```
Total_Stops
1 stop      5625
non-stop    3492
2 stops     1520
3 stops       45
4 stops        1
Name: count, dtype: int64
```

In [41]:
```
x=['Source','Destination']
y=['1','2','3','4','non-stop']
all_inputs=df[x]
all_classes=df["Total_Stops"]
```

Linear Regression

In [42]:
```
df.fillna(method='ffill',inplace=True)
```

In [43]:
```
x=np.array(df['Source']).reshape(-1,1)
y=np.array(df['Destination']).reshape(-1,1)
```

In [44]:
```
df.dropna(inplace=True)
```

In [45]:
```
from sklearn.model_selection import train_test_split
x_train,x_test,y_train,y_test=train_test_split(x,y,test_size=0.25)
```

In [81]:
```
from sklearn.linear_model import LinearRegression
regr=LinearRegression()
regr.fit(x_train,y_train)
print(regr.score(x_test,y_test))
```

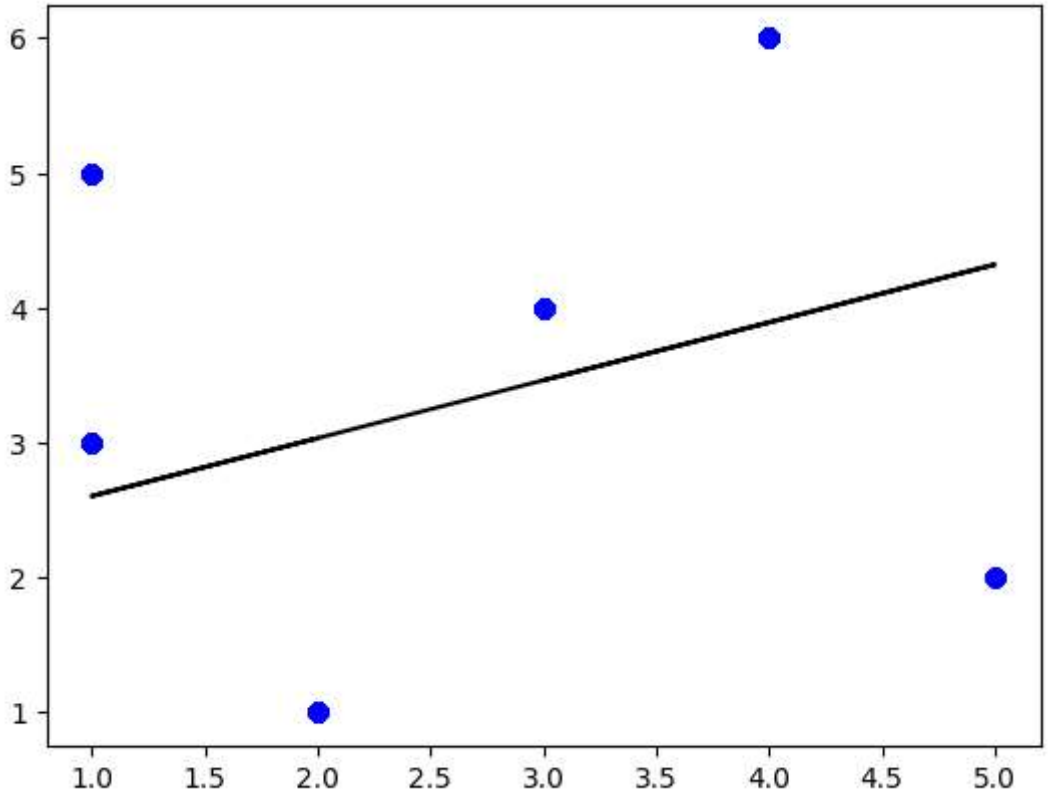
```
0.06720311887346575
```

In [82]:
```
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[82]:
```
LinearRegression()
```

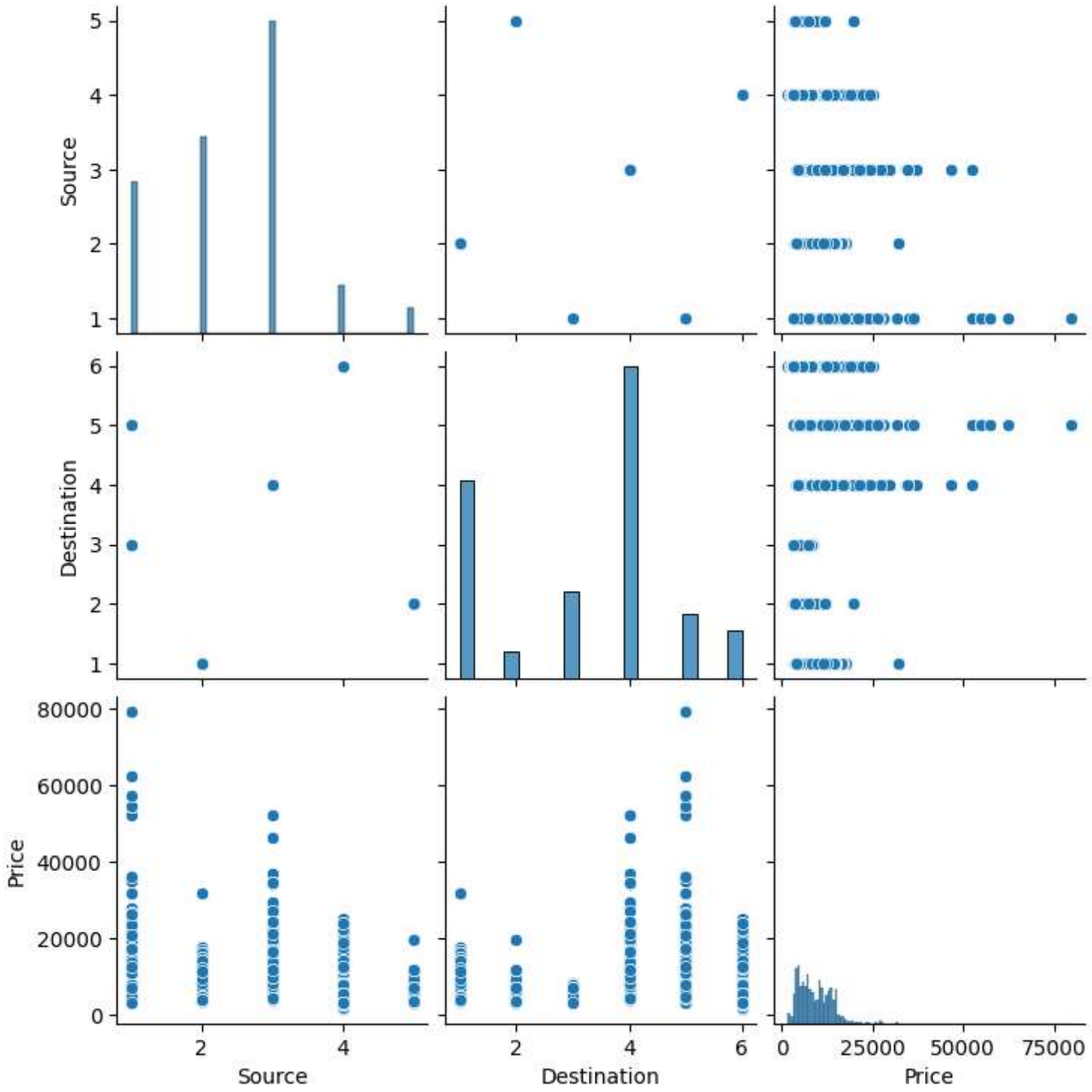
In a Jupyter environment, please rerun this cell to show the HTML representation or trust the notebook.
On GitHub, the HTML representation is unable to render, please try loading this page with nbviewer.org.

In [47]:
```
y_pred=regr.predict(x_test)
plt.scatter(x_test,y_test,color='b')
plt.plot(x_test,y_pred,color='k')
plt.show()
```



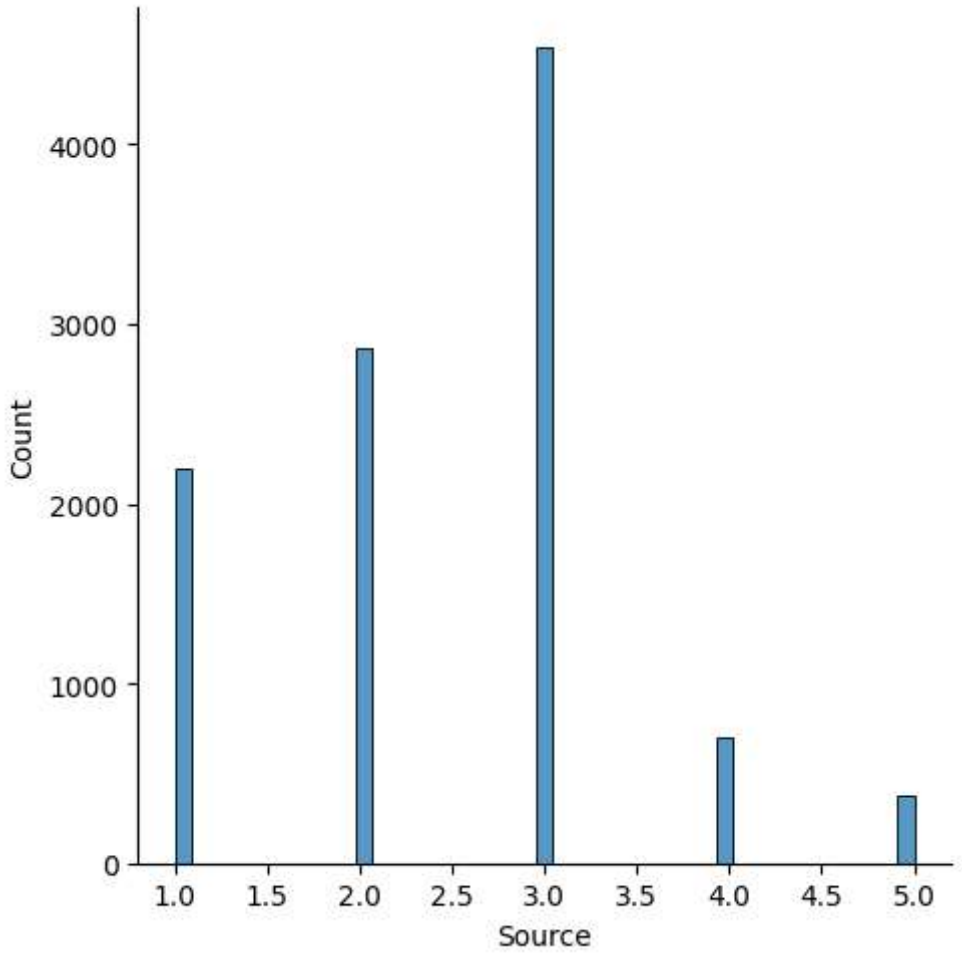
In [48]:
```
sns.pairplot(df)
```

Out[48]:
```
<seaborn.axisgrid.PairGrid at 0x1d6c2cc1090>
```


Source
Destination
Price
Source
Destination
Price

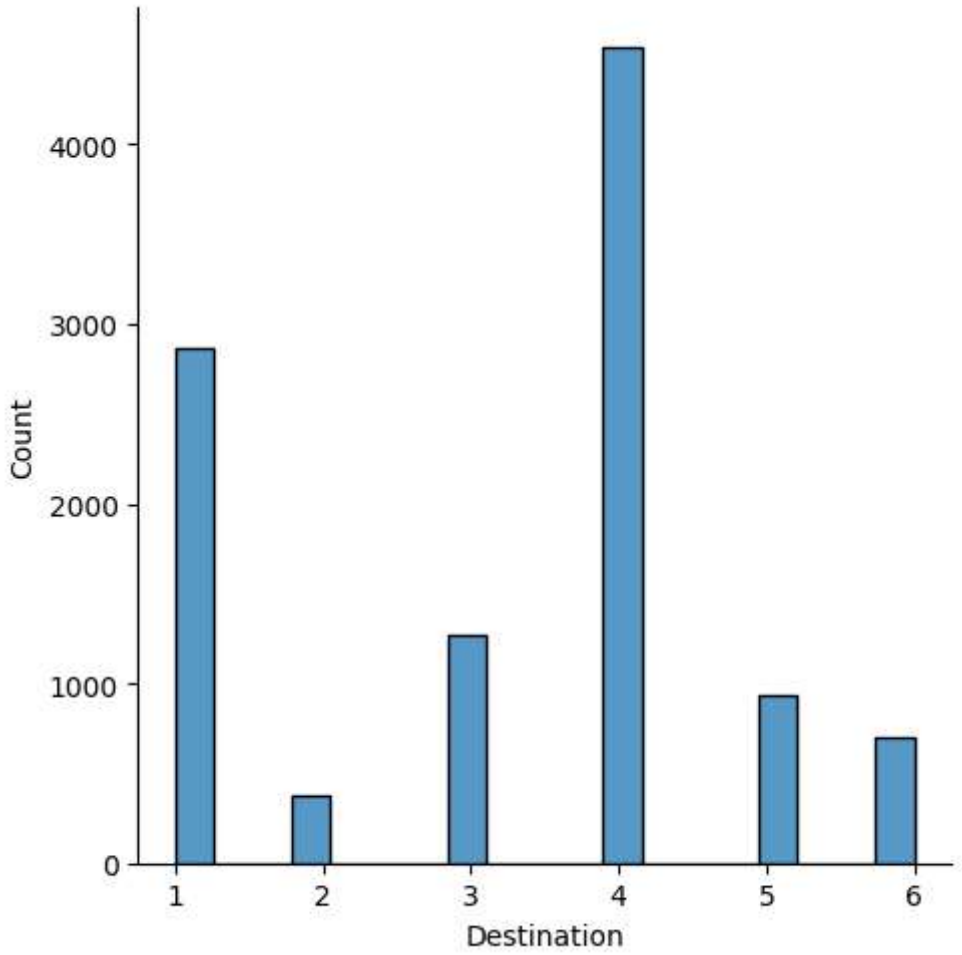
In [49]:
```
sns.displot(df['Source'])
```

Out[49]:
```
<seaborn.axisgrid.FacetGrid at 0x1d6c555c210>
```



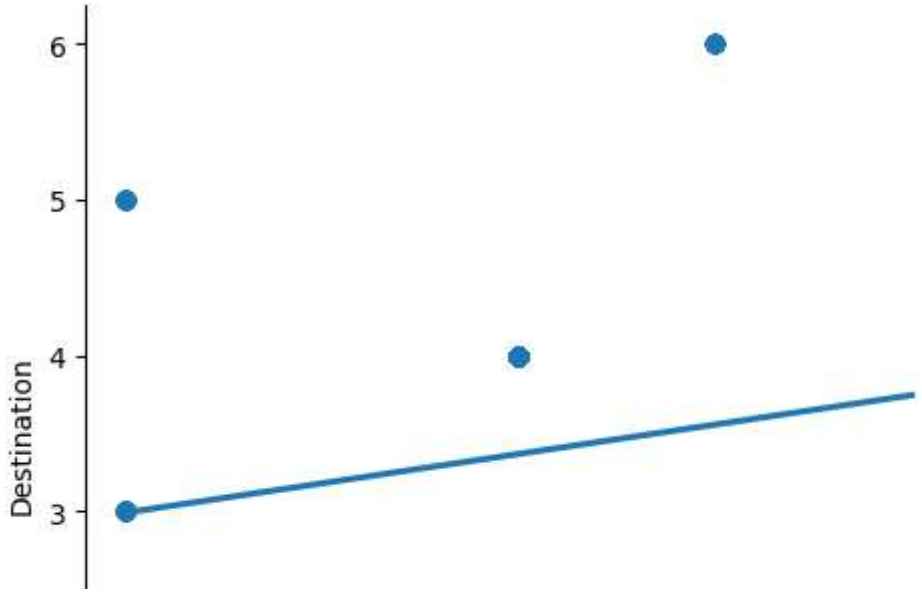
In [50]:
```
sns.displot(df['Destination'])
```

Out[50]:
```
<seaborn.axisgrid.FacetGrid at 0x1d6c55951d0>
```



In [51]:
```
df500=df[:][:500]
sns.lmplot(x="Source",y="Destination",data=df500,order=1,ci=None)
```

Out[51]: <seaborn.axisgrid.FacetGrid at 0x1d6b1a3dcd0>



In [52]:
```
df.fillna(method='ffill',inplace=True)
```

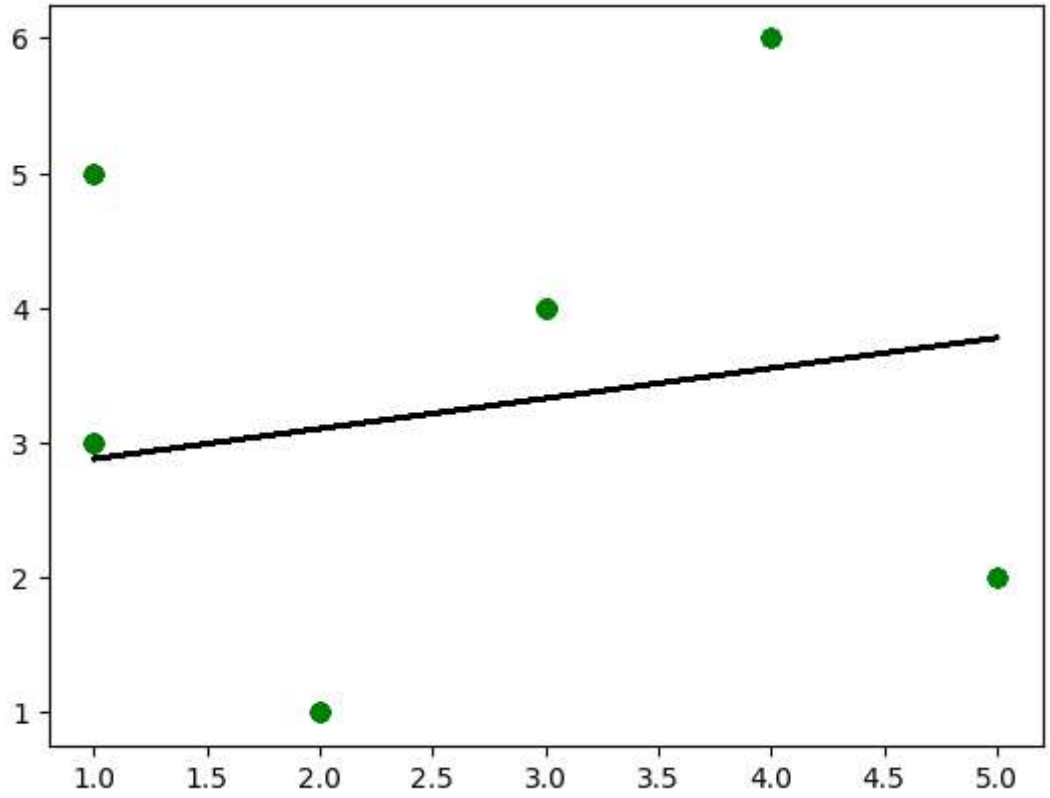
In [53]:
```
x=np.array(df500['Source']).reshape(-1,1)
y=np.array(df500['Destination']).reshape(-1,1)
```

In [54]:
```
from sklearn.model_selection import train_test_split
x_train,x_test,y_train,y_test=train_test_split(x,y,test_size=0.25)
```

In [55]:
```
from sklearn.linear_model import LinearRegression
regr=LinearRegression()
regr.fit(x_train,y_train)
print(regr.score(x_test,y_test))
```

```
-0.023780796026120488
```

In [56]:
```
y_pred=regr.predict(x_test)
plt.scatter(x_test,y_test,color='g')
plt.plot(x_test,y_pred,color='k')
plt.show()
```



In [57]:
```
from sklearn.linear_model import LinearRegression
from sklearn.metrics import r2_score
model=LinearRegression()
model.fit(x_train,y_train)
y_pred=model.predict(x_test)
r2=r2_score(y_test,y_pred)
print('r2score:',r2)
```

```
r2score: -0.023780796026120488
```

In [58]:
```
print(model.intercept_)
```

```
[2.65642869]
```

In [68]:
```
features = df.columns[0:2]
target = df.columns[-1]
#X and y values
x = df[features].values
y = df[target].values
#splot
x_train, x_test, y_train, y_test = train_test_split(x, y, test_size=0.3, random_state=17)
print("The dimension of X_train is {}".format(x_train.shape))
print("The dimension of X_test is {}".format(x_test.shape))
#Scale features
scaler = StandardScaler()
x_train = scaler.fit_transform(x_train)
x_test = scaler.transform(x_test)
```

```
The dimension of X_train is (7478, 2)
The dimension of X_test is (3205, 2)
```

In [69]:
```
lr = LinearRegression()
#Fit model
lr.fit(x_train, y_train)
#predict
#prediction = lr.predict(X_test)
#actual
actual = y_test
train_score_lr = lr.score(x_train, y_train)
test_score_lr = lr.score(x_test, y_test)
print("\nLinear Regression Model:\n")
print("The train score for lr model is {}".format(train_score_lr))
print("The test score for lr model is {}".format(test_score_lr))
#print(lr.score(y_test,prediction))
```

```
Linear Regression Model:

The train score for lr model is 0.09081762402064897
The test score for lr model is 0.06554871188661315
```

Ridge Regression

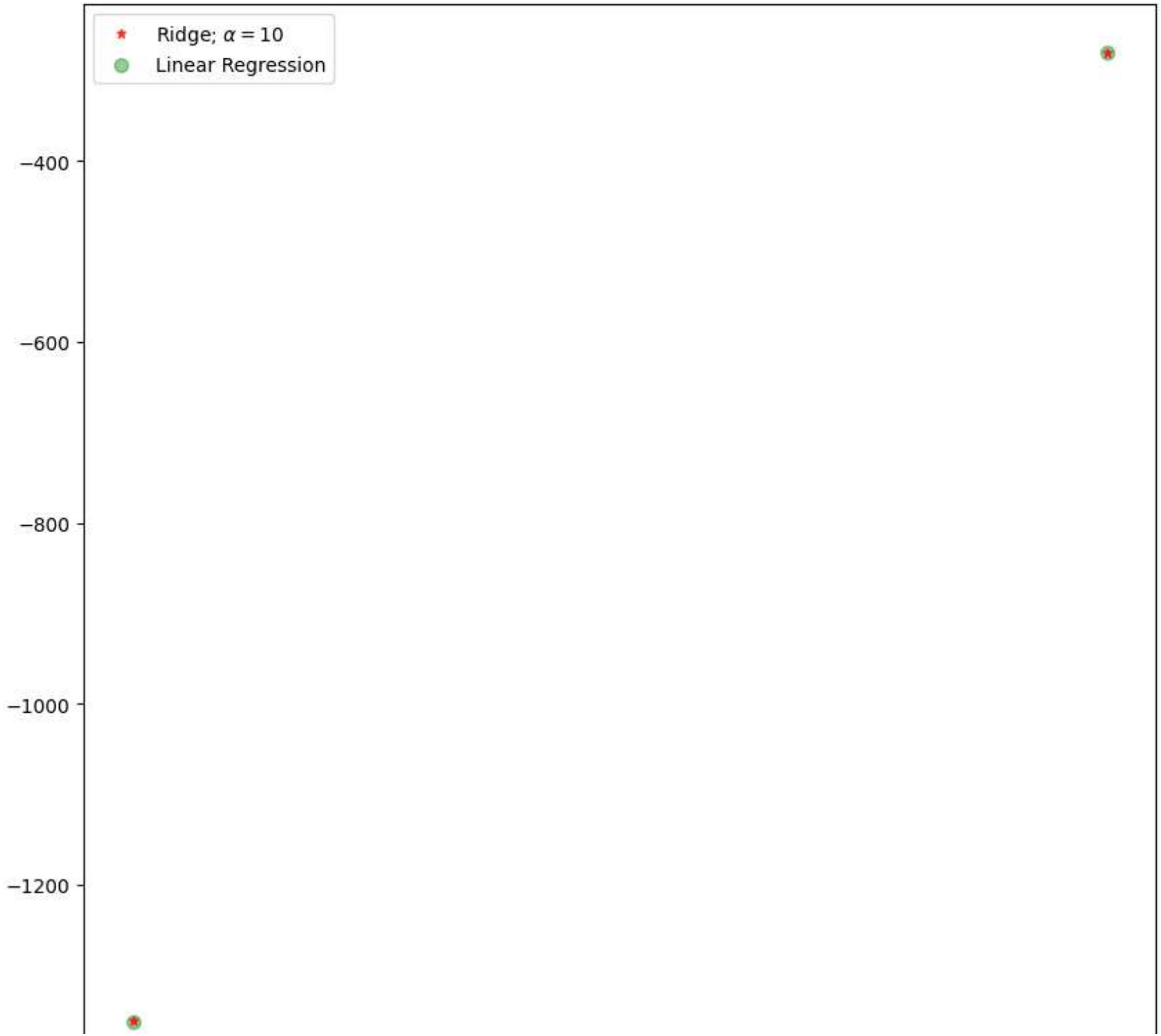
In [70]:
```
from sklearn.linear_model import Ridge,RidgeCV,Lasso
from sklearn.preprocessing import StandardScaler
```

In [71]:
```
ridgeReg=Ridge(alpha=10)
ridgeReg.fit(x_train,y_train)
train_score_ridge=ridgeReg.score(x_train,y_train)
test_score_ridge=ridgeReg.score(x_test,y_test)
print("\nRidge model:\n")
print("The train score for ridge model is {}".format(train_score_ridge))
print("The test score for ridge model is {}".format(test_score_ridge))
```

```
Ridge model:

The train score for ridge model is 0.09081746673031499
The test score for ridge model is 0.06557858312507359
```

In [72]:
```
plt.figure(figsize = (10, 10))
plt.plot(features,ridgeReg.coef_,alpha=0.7,linestyle='none',marker='*',markersize=5,color='red',label=r'Ridge
#plt.plot(rr100.coef_,alpha=0.5,linestyle='none',marker='d',markersize=6,color='blue',label=r'Ridge; $\alpha =
plt.plot(features,lr.coef_,alpha=0.4,linestyle='none',marker='o',markersize=7,color='green',label='Linear Regr
plt.xticks(rotation = 90)
plt.legend()
plt.show()
```


Ridge; $\alpha = 10$
Linear Regression
−400
−600
−800
−1000
−1200

Lasso Regression

In [73]:
```
from sklearn.linear_model import LassoCV
lasso_cv=LassoCV(alphas=[0.0001,0.001,0.01,0.1,1,10],random_state=0).fit(x_train,y_train)
print(lasso_cv.score(x_train,y_train))
print(lasso_cv.score(x_test,y_test))
```

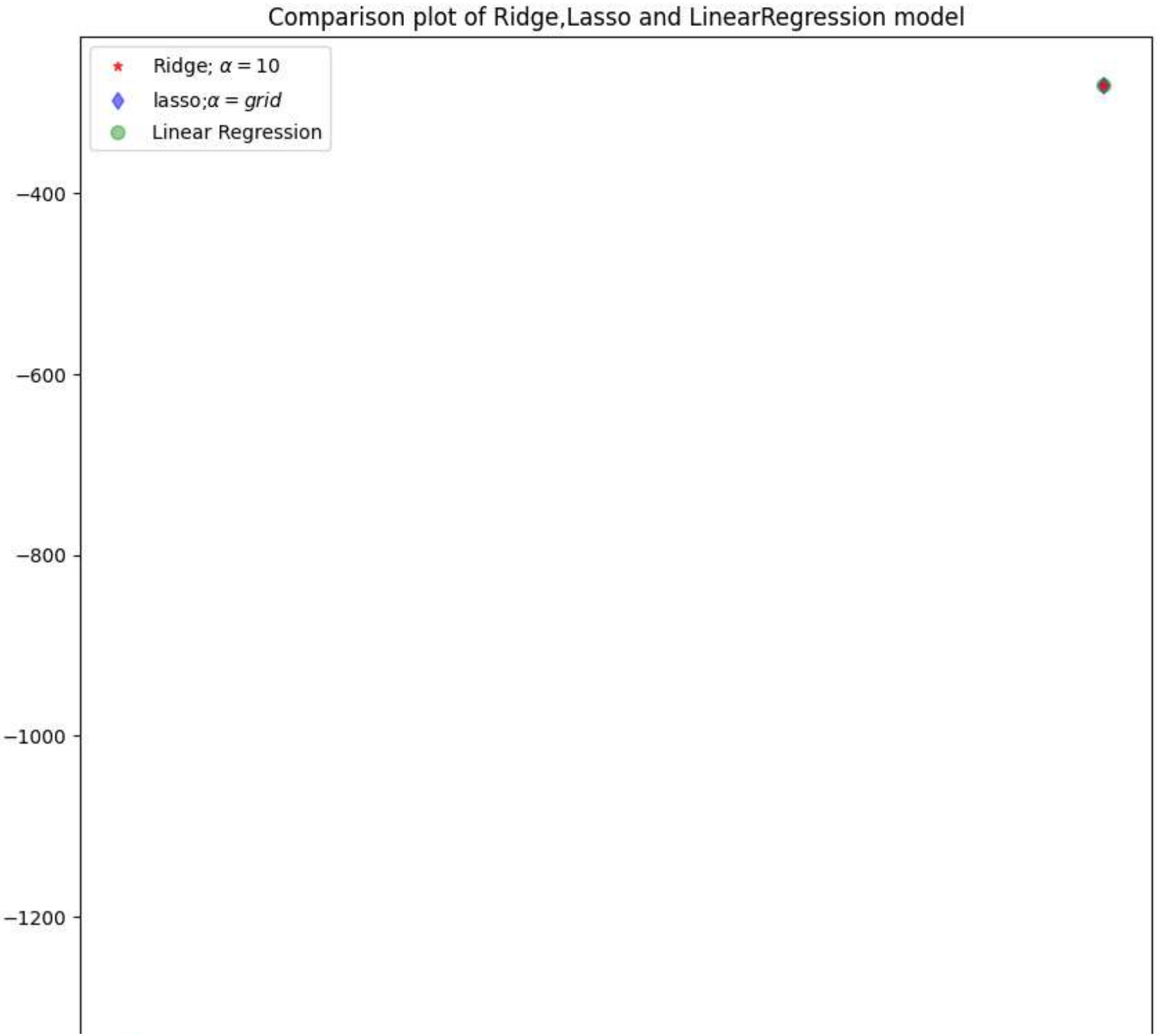
```
0.09081762402064841
0.06554871227546422
```

In [74]:
```
print("\nLasso model:\n")
lasso=Lasso(alpha=10)
lasso.fit(x_train,y_train)
train_score_ls=lasso.score(x_train,y_train)
test_score_ls=lasso.score(x_test,y_test)
print("The train score for ls model is {}".format(train_score_ls))
print("The test score for ls model is {}".format(test_score_ls))
```

```
Lasso model:

The train score for ls model is 0.09080859244797257
The test score for ls model is 0.06562448530001963
```

In [75]:
```
plt.figure(figsize=(10,10))
plt.plot(features,ridgeReg.coef_,alpha=0.7,linestyle='none',marker='*', markersize=5, color='red',label=r'Ridg
plt.plot(lasso_cv.coef_,alpha=0.5,linestyle='none',marker='d',markersize=6,color='blue',label=r'lasso;$\alpha=
plt.plot(features, lr.coef_, alpha=0.4, linestyle='none', marker='o', markersize=7, color='green',label='Linea
plt.xticks(rotation=90)
plt.legend()
plt.title('Comparison plot of Ridge,Lasso and LinearRegression model')
plt.show()
```


Comparison plot of Ridge,Lasso and LinearRegression model
Ridge; α = 10
lasso;α = grid
Linear Regression
−400
−600
−800
−1000
−1200

Elastic Net

In [76]:
```
from sklearn.linear_model import ElasticNet
regr=ElasticNet()
regr.fit(x_train,y_train)
print(regr.coef_)
print(regr.intercept_)
```

```
[-903.1071039 -198.453344 ]
9088.521396095213
```

In [77]:
```
y_pred_elastic=regr.predict(x_train)
```

In [79]:
```
mean_squared_error=np.mean((y_pred_elastic- y_train)**2)
print("mean _squared_error",mean_squared_error)
```

```
mean _squared_error 19593419.936366197
```

Logistic Regression

In [89]:
```
import re
from sklearn.linear_model import LogisticRegression
x=np.array(df['Price']).reshape(-1,1)
y=np.array(df['Total_Stops']).reshape(-1,1)
df.dropna(inplace=True)
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=1)
LogisticRegr=LogisticRegression(max_iter=10000)
```

In [90]:
```
LogisticRegr.fit(x_train,y_train)
```

```
C:\Users\USER\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[90]:
```
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 [93]:
```
score=LogisticRegr.score(x_test,y_test)
print(score)
```

```
0.7101404056162246
```

Decision Tree

In [94]:
```
from sklearn.tree import DecisionTreeClassifier
clf=DecisionTreeClassifier(random_state=0)
```

In [95]:
```
clf.fit(x_train,y_train)
```

Out[95]:
```
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 [97]:
```
score=(clf.score(x_test,y_test))
print(score)
```

```
0.9360374414976599
```

Random Forest

In [98]:
```
from sklearn.ensemble import RandomForestClassifier
rfc=RandomForestClassifier()
rfc.fit(x_train,y_train)
```

```
C:\Users\USER\AppData\Local\Temp\ipykernel_3468\4250526780.py:3: DataConversionWarning: A column-vector y wa
s 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[98]:
```
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 [99]:
```
rf=RandomForestClassifier()
```

In [100]:
```
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 [101]:
```
from sklearn.model_selection import GridSearchCV
grid_search=GridSearchCV(estimator=rf,param_grid=params,cv=2,scoring='accuracy')
grid_search.fit(x_train,y_train)
```

```
C:\Users\USER\AppData\Local\Programs\Python\Python311\Lib\site-packages\sklearn\model_selection\_validatio
n.py:686: 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().
  estimator.fit(X_train, y_train, **fit_params)
C:\Users\USER\AppData\Local\Programs\Python\Python311\Lib\site-packages\sklearn\model_selection\_validatio
n.py:686: 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().
  estimator.fit(X_train, y_train, **fit_params)
C:\Users\USER\AppData\Local\Programs\Python\Python311\Lib\site-packages\sklearn\model_selection\_validatio
n.py:686: 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().
  estimator.fit(X_train, y_train, **fit_params)
C:\Users\USER\AppData\Local\Programs\Python\Python311\Lib\site-packages\sklearn\model_selection\_validatio
n.py:686: 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().
  estimator.fit(X_train, y_train, **fit_params)
C:\Users\USER\AppData\Local\Programs\Python\Python311\Lib\site-packages\sklearn\model_selection\_validatio
n.py:686: 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().
```

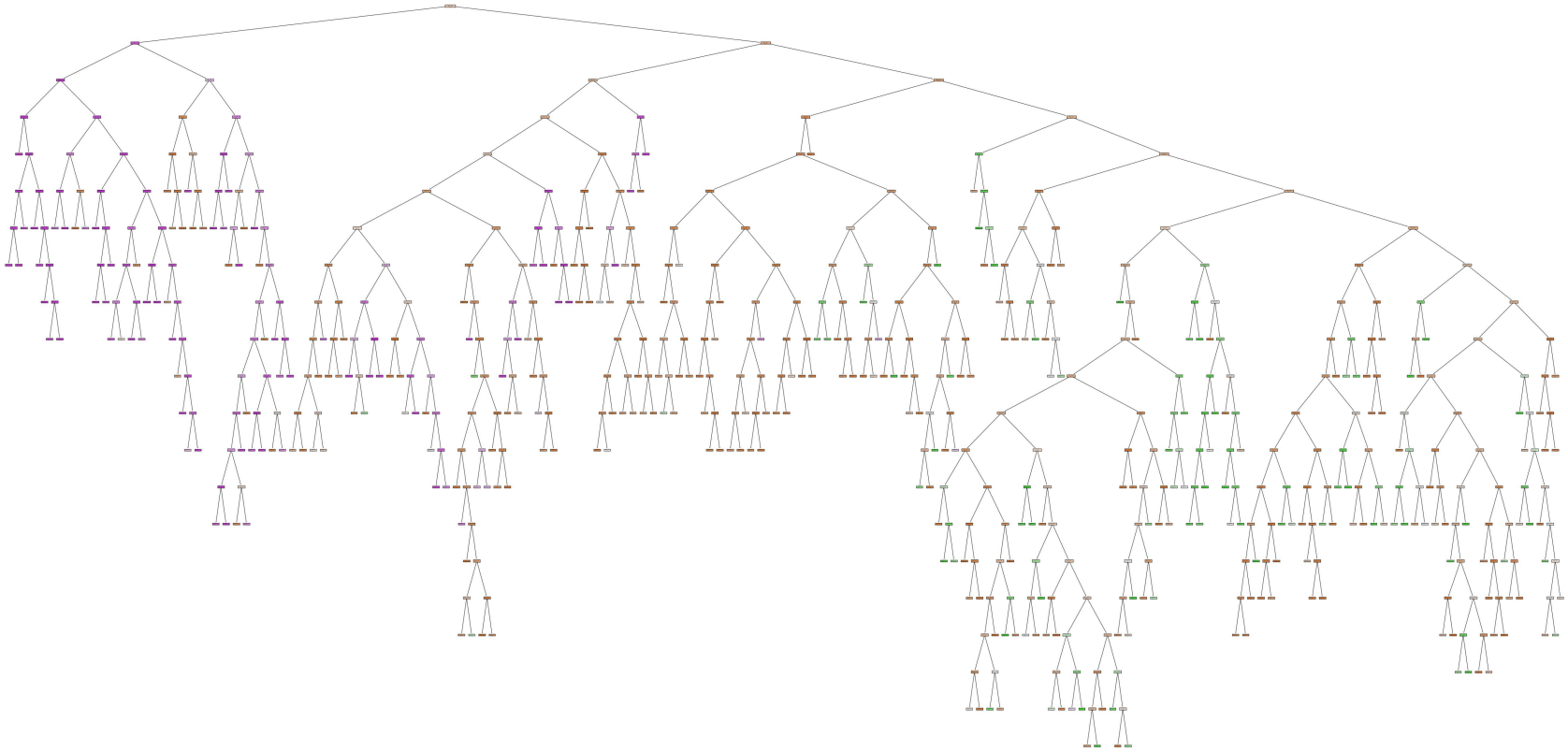
In [102]:
```
grid_search.best_score_
```

Out[102]:
```
0.8697512703931533
```

In [103]:
```
rf_best=grid_search.best_estimator_
print(rf_best)
```

```
RandomForestClassifier(max_depth=20, min_samples_leaf=5, n_estimators=30)
```

In [106]:
```
from sklearn.tree import plot_tree
plt.figure(figsize=(80,40))
plot_tree(rf_best.estimators_[5],class_names=['0','1','2','3','4'],filled=True);
```



In [109]:
```
score=rfc.score(x_test,y_test)
print(rfc)
```

```
RandomForestClassifier()
```

conclusion

for the above data set we use different types of models,for that each and every models we get differenttypes of accuracies.Based on that accuracies we can conclude which model is best fit for my ourdataset. here we get different types of accuracies for that different types of accuracies decision treeis get more accuracy among all the models.so,that we can conclude that for our model decision tree is best fit