Importing Required Library

In [1]:
```
import pandas as pd
import numpy as np
import matplotlib.pyplot as plt
import seaborn as sns
import pickle
import datetime
pd.set_option('Display.max_columns', None)
from sklearn.preprocessing import StandardScaler, LabelEncoder
from sklearn.model_selection import train_test_split
%matplotlib inline

import warnings
warnings.filterwarnings('ignore')
```

Reading Data

In [2]:
```
df = pd.read_excel(r"C:\Users\Kushal Arya\Desktop\csv file\Flight_Ticket_Particip
df.head()
```

Out[2]:

	Airline	Date_of_Journey	Source	Destination	Route	Dep_Time	Arrival_Time	Duration	Total
0	Jet Airways	6/06/2019	Delhi	Cochin	DEL → BOM → COK	17:30	04:25 07 Jun	10h 55m	
1	IndiGo	12/05/2019	Kolkata	Banglore	CCU → MAA → BLR	06:20	10:20	4h	
2	Jet Airways	21/05/2019	Delhi	Cochin	DEL → BOM → COK	19:15	19:00 22 May	23h 45m	
3	Multiple carriers	21/05/2019	Delhi	Cochin	DEL → BOM → COK	08:00	21:00	13h	
4	Air Asia	24/06/2019	Banglore	Delhi	BLR → DEL	23:55	02:45 25 Jun	2h 50m	n

Check no of row and column

In [3]:
```
print('No of Rows and Columns ----->', df.shape )
```

```
No of Rows and Columns -----> (2671, 10)
```

Checking for Null values

In [4]:
```
print('================================\n')
print(df.isnull().sum())
print('\n================================')
```

```
================================

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

================================
```

There is no null value

Information about dataset

In [5]:
```
print('=====================================================\n')
print(df.info())
print('=====================================================')
```

```
=====================================================

<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
None
=====================================================
```

Categorical data present in our data set

Checking For Duplicate

In [6]:
```
duplicate = df[df.duplicated()]
print('==========================================================================')
print("Duplicate Rows :\n\n",duplicate)
print('==========================================================================')
```

```
==========================================================================
Duplicate Rows :

                Airline Date_of_Journey    Source Destination  \
294         Jet Airways      12/06/2019     Delhi      Cochin
794         Jet Airways      12/06/2019     Delhi      Cochin
909              IndiGo      24/03/2019  Banglore   New Delhi
974           Air India      12/06/2019   Kolkata    Banglore
1011        Jet Airways       9/05/2019     Delhi      Cochin
1033  Multiple carriers      15/05/2019     Delhi      Cochin
1044              GoAir      24/03/2019  Banglore   New Delhi
1233        Jet Airways       6/06/2019     Delhi      Cochin
1504          Air India      15/06/2019     Delhi      Cochin
1537        Jet Airways       6/06/2019     Delhi      Cochin
1752  Multiple carriers      21/05/2019     Delhi      Cochin
1753        Jet Airways      18/05/2019     Delhi      Cochin
1783          Air India      12/03/2019  Banglore   New Delhi
1876          Air India       1/04/2019   Kolkata    Banglore
1962  Multiple carriers      15/06/2019     Delhi      Cochin
2007        Jet Airways      24/06/2019     Delhi      Cochin
2042          Air India      09/03/2019  Banglore   New Delhi
2083          Air India      15/06/2019     Delhi      Cochin
2095        Jet Airways       1/06/2019     Delhi      Cochin
2171        Jet Airways      21/05/2019     Delhi      Cochin
2310        Jet Airways      27/03/2019     Delhi      Cochin
2536          Air India       3/06/2019     Delhi      Cochin
2553        Jet Airways      15/06/2019     Delhi      Cochin
2560  Multiple carriers       3/06/2019     Delhi      Cochin
2582          Air India      12/05/2019   Kolkata    Banglore
2583             IndiGo      24/03/2019  Banglore   New Delhi

                      Route Dep_Time  Arrival_Time Duration Total_Stops  \
294   DEL → JAI → BOM → COK    05:30  04:25 13 Jun  22h 55m     2 stops
794   DEL → JAI → BOM → COK    05:30  04:25 13 Jun  22h 55m     2 stops
909                 BLR → DEL    20:00         22:55   2h 55m    non-stop
974   CCU → DEL → AMD → BLR    07:00  05:25 13 Jun  22h 25m     2 stops
1011  DEL → JAI → BOM → COK    05:30  04:25 10 May  22h 55m     2 stops
1033        DEL → BOM → COK    07:30         19:15  11h 45m      1 stop
1044                BLR → DEL    20:55         23:50   2h 55m    non-stop
1233  DEL → JAI → BOM → COK    05:30  04:25 07 Jun  22h 55m     2 stops
1504  DEL → GOI → BOM → COK    22:00  19:15 16 Jun  21h 15m     2 stops
1537  DEL → NAG → BOM → COK    06:45  04:25 07 Jun  21h 40m     2 stops
1752        DEL → BOM → COK    07:30         19:15  11h 45m      1 stop
1753  DEL → AMD → BOM → COK    23:05  19:00 19 May  19h 55m     2 stops
1783  BLR → CCU → GAU → DEL    05:50         22:10  16h 20m     2 stops
1876  CCU → DEL → COK → BLR    07:00  01:20 02 Apr  18h 20m     2 stops
1962        DEL → BOM → COK    10:00         21:00       11h      1 stop
2007  DEL → JAI → BOM → COK    09:40  04:25 25 Jun  18h 45m     2 stops
2042  BLR → BOM → AMD → DEL    17:25  23:55 13 Mar  30h 30m     2 stops
2083  DEL → HYD → BOM → COK    13:15  19:15 16 Jun       30h     2 stops
2095  DEL → NAG → BOM → COK    14:35  04:25 02 Jun  13h 50m     2 stops
```

```
2171  DEL → JAI → BOM → COK    09:40  12:35 22 May  26h 55m     2 stops
2310  DEL → MAA → BOM → COK    05:10  04:25 28 Mar  23h 15m     2 stops
2536  DEL → GOI → BOM → COK    22:00  19:15 04 Jun  21h 15m     2 stops
2553  DEL → JAI → BOM → COK    05:30         19:00  13h 30m     2 stops
2560        DEL → BOM → COK    13:00  01:30 04 Jun  12h 30m      1 stop
2582  CCU → BOM → GOI → BLR    16:50  05:35 13 May  12h 45m     2 stops
2583              BLR → DEL    18:55         21:45   2h 50m    non-stop

                  Additional_Info
294                      No info
794   In-flight meal not included
909                      No info
974                      No info
1011                     No info
1033                     No info
1044                     No info
1233                     No info
1504                     No info
1537  In-flight meal not included
1752                     No info
1753                     No info
1783                     No info
1876                     No info
1962                     No info
2007                     No info
2042                     No info
2083                     No info
2095  In-flight meal not included
2171                     No info
2310  In-flight meal not included
2536                     No info
2553                     No info
2560                     No info
2582                     No info
2583                     No info
================================================================================
```

Droping Duplicates

In [7]:
```
df.drop_duplicates(keep=False,inplace=True)
```

In [8]:
```
print('After removing duplicates No of Rows and Columns  ----->', df.shape )
```

```
After removing duplicates No of Rows and Columns  -----> (2619, 10)
```

Add Months Column

In [9]:
```
df['Date_of_Journey'] = pd.to_datetime(df['Date_of_Journey'])
df['Months'] = df['Date_of_Journey'].dt.month
df['Months'] = df['Months'].astype('int')
df.head(2)
```

Out[9]:

	Airline	Date_of_Journey	Source	Destination	Route	Dep_Time	Arrival_Time	Duration	Total_
0	Jet Airways	2019-06-06	Delhi	Cochin	DEL → BOM → COK	17:30	04:25 07 Jun	10h 55m	
1	IndiGo	2019-12-05	Kolkata	Banglore	CCU → MAA → BLR	06:20	10:20	4h	

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

Out[10]:
```
6     636
3     533
5     481
9     359
1     270
12    247
4      93
Name: Months, dtype: int64
```

In [11]:
```
df['Months'].dtype
```

Out[11]:
```
dtype('int32')
```

Add Day Column

In [12]:
```
df['Day'] = df['Date_of_Journey'].dt.day
df['Day'] = df['Day'].astype('int')
df.head(2)
```

Out[12]:

	Airline	Date_of_Journey	Source	Destination	Route	Dep_Time	Arrival_Time	Duration	Total_
0	Jet Airways	2019-06-06	Delhi	Cochin	DEL → BOM → COK	17:30	04:25 07 Jun	10h 55m	
1	IndiGo	2019-12-05	Kolkata	Banglore	CCU → MAA → BLR	06:20	10:20	4h	

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

Out[13]:
```
6     545
3     374
5     370
15    257
21    253
24    247
27    218
18    202
4     153
Name: Day, dtype: int64
```

In [14]:
```
df['Day'].dtype
```

Out[14]:
```
dtype('int32')
```

Add New Arrival Column

In [15]:
```
df['Arrival_Time'] = pd.to_datetime(df['Arrival_Time'])
df['NewArrival_Time'] = df['Arrival_Time'].dt.time
df.head(2)
```

Out[15]:

rney	Source	Destination	Route	Dep_Time	Arrival_Time	Duration	Total_Stops	Additional_Info	Mo
6-06	Delhi	Cochin	DEL → BOM → COK	17:30	2021-06-07 04:25:00	10h 55m	1 stop	No info	
2-05	Kolkata	Banglore	CCU → MAA → BLR	06:20	2021-08-10 10:20:00	4h	1 stop	No info	

Add New Departure Time column

In [16]:
```
df['Dep_Time'] = pd.to_datetime(df['Dep_Time'])
df['NewDep_Time'] = df['Dep_Time'].dt.time
df.head(2)
```

Out[16]:

Destination	Route	Dep_Time	Arrival_Time	Duration	Total_Stops	Additional_Info	Months	Day	Ne
Cochin	DEL → BOM → COK	2021-08-10 17:30:00	2021-06-07 04:25:00	10h 55m	1 stop	No info	6	6	
Banglore	CCU → MAA → BLR	2021-08-10 06:20:00	2021-08-10 10:20:00	4h	1 stop	No info	12	5	

In [17]:
```
df.info()
```

```
<class 'pandas.core.frame.DataFrame'>
Int64Index: 2619 entries, 0 to 2670
Data columns (total 14 columns):
 #   Column           Non-Null Count  Dtype         
---  ------           --------------  -----         
 0   Airline          2619 non-null   object        
 1   Date_of_Journey  2619 non-null   datetime64[ns]
 2   Source           2619 non-null   object        
 3   Destination      2619 non-null   object        
 4   Route            2619 non-null   object        
 5   Dep_Time         2619 non-null   datetime64[ns]
 6   Arrival_Time     2619 non-null   datetime64[ns]
 7   Duration         2619 non-null   object        
 8   Total_Stops      2619 non-null   object        
 9   Additional_Info  2619 non-null   object        
 10  Months           2619 non-null   int32         
 11  Day              2619 non-null   int32         
 12  NewArrival_Time  2619 non-null   object        
 13  NewDep_Time      2619 non-null   object        
dtypes: datetime64[ns](3), int32(2), object(9)
memory usage: 286.5+ KB
```

Converting New Arrival Time and New Departure Time column in Minutes

In [18]:
```
df['Dep_Hours'] = df['Dep_Time'].apply(lambda x: x.hour * 3600 + x.minute * 60 +
df['Arrival_Hours'] = df['NewArrival_Time'].apply(lambda x: x.hour * 3600 + x.mir
df.head(2)
```

Out[18]:

ıe	Arrival_Time	Duration	Total_Stops	Additional_Info	Months	Day	NewArrival_Time	NewDep_T
8- 10)0	2021-06-07 04:25:00	10h 55m	1 stop	No info	6	6	04:25:00	17:3
8- 10)0	2021-08-10 10:20:00	4h	1 stop	No info	12	5	10:20:00	06:2

Split Duration column into Hours and Minutes

In [19]:
```
new = df['Duration'].str.split(' ', n = 2, expand = True)
df['Hours'] = new[0]
df['Minutes'] = new[1]
df.head(2)
```

Out[19]:

	Airline	Date_of_Journey	Source	Destination	Route	Dep_Time	Arrival_Time	Duration	Total_
0	Jet Airways	2019-06-06	Delhi	Cochin	DEL → BOM → COK	2021-08- 10 17:30:00	2021-06-07 04:25:00	10h 55m	
1	IndiGo	2019-12-05	Kolkata	Banglore	CCU → MAA → BLR	2021-08- 10 06:20:00	2021-08-10 10:20:00	4h	

In [20]:
```
df['Hours'] = new[0].str.split('h', expand = True)
df['Minutes'] = new[1].str.split('m', expand = True)
df.head(2)
```

Out[20]:

	Airline	Date_of_Journey	Source	Destination	Route	Dep_Time	Arrival_Time	Duration	Total_
0	Jet Airways	2019-06-06	Delhi	Cochin	DEL → BOM → COK	2021-08-10 17:30:00	2021-06-07 04:25:00	10h 55m	
1	IndiGo	2019-12-05	Kolkata	Banglore	CCU → MAA → BLR	2021-08-10 06:20:00	2021-08-10 10:20:00	4h	

In [21]:
```
df['Hours'] = df['Hours'].replace(['5m'],'5')
df['Hours'] =  df['Hours'].astype(np.float)
df.info()
```

```
<class 'pandas.core.frame.DataFrame'>
Int64Index: 2619 entries, 0 to 2670
Data columns (total 18 columns):
 #   Column           Non-Null Count  Dtype
---  ------           --------------  -----
 0   Airline          2619 non-null   object
 1   Date_of_Journey  2619 non-null   datetime64[ns]
 2   Source           2619 non-null   object
 3   Destination      2619 non-null   object
 4   Route            2619 non-null   object
 5   Dep_Time         2619 non-null   datetime64[ns]
 6   Arrival_Time     2619 non-null   datetime64[ns]
 7   Duration         2619 non-null   object
 8   Total_Stops      2619 non-null   object
 9   Additional_Info  2619 non-null   object
 10  Months           2619 non-null   int32
 11  Day              2619 non-null   int32
 12  NewArrival_Time  2619 non-null   object
 13  NewDep_Time      2619 non-null   object
 14  Dep_Hours        2619 non-null   float64
 15  Arrival_Hours    2619 non-null   float64
 16  Hours            2619 non-null   float64
 17  Minutes          2369 non-null   object
dtypes: datetime64[ns](3), float64(3), int32(2), object(10)
memory usage: 368.3+ KB
```

In [22]:
```
df['Minutes'] = df['Minutes'].fillna(df['Minutes'].mode()[0])
df['Minutes'] =  df['Minutes'].astype(np.float)
```

In [23]:
```
df.info()
```

```
<class 'pandas.core.frame.DataFrame'>
Int64Index: 2619 entries, 0 to 2670
Data columns (total 18 columns):
 #   Column           Non-Null Count  Dtype         
---  ------           --------------  -----         
 0   Airline          2619 non-null   object        
 1   Date_of_Journey  2619 non-null   datetime64[ns]
 2   Source           2619 non-null   object        
 3   Destination      2619 non-null   object        
 4   Route            2619 non-null   object        
 5   Dep_Time         2619 non-null   datetime64[ns]
 6   Arrival_Time     2619 non-null   datetime64[ns]
 7   Duration         2619 non-null   object        
 8   Total_Stops      2619 non-null   object        
 9   Additional_Info  2619 non-null   object        
 10  Months           2619 non-null   int32         
 11  Day              2619 non-null   int32         
 12  NewArrival_Time  2619 non-null   object        
 13  NewDep_Time      2619 non-null   object        
 14  Dep_Hours        2619 non-null   float64       
 15  Arrival_Hours    2619 non-null   float64       
 16  Hours            2619 non-null   float64       
 17  Minutes          2619 non-null   float64       
dtypes: datetime64[ns](3), float64(4), int32(2), object(9)
memory usage: 368.3+ KB
```

Adding New Duration column

In [24]:
```
df['New_Duration'] = df['Hours']*60 + df['Minutes']
df.head(2)
```

Out[24]:

	Airline	Date_of_Journey	Source	Destination	Route	Dep_Time	Arrival_Time	Duration	Total_
0	Jet Airways	2019-06-06	Delhi	Cochin	DEL → BOM → COK	2021-08-10 17:30:00	2021-06-07 04:25:00	10h 55m	
1	IndiGo	2019-12-05	Kolkata	Banglore	CCU → MAA → BLR	2021-08-10 06:20:00	2021-08-10 10:20:00	4h	

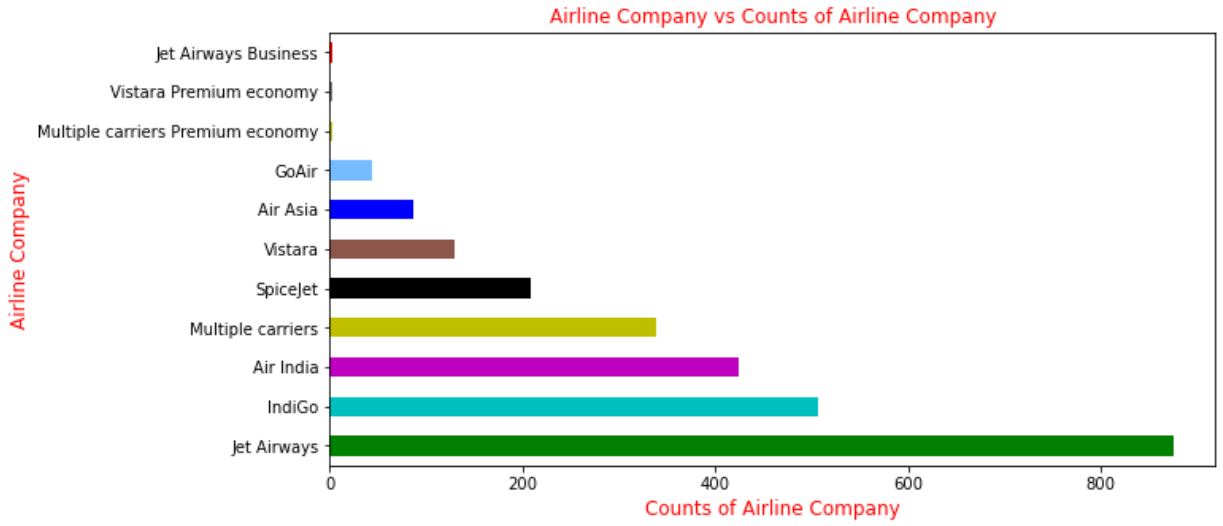
Analysis of Data

Analysis of Data

In [25]:
```
ar = df['Airline'].value_counts()
ar
```

Out[25]:
```
Jet Airways                          875
IndiGo                               507
Air India                            424
Multiple carriers                    339
SpiceJet                             208
Vistara                              129
Air Asia                              86
GoAir                                 44
Multiple carriers Premium economy      3
Vistara Premium economy                2
Jet Airways Business                   2
Name: Airline, dtype: int64
```

In [26]:
```
ar.plot.barh(figsize = (10,5), color = ['g','c', 'm', 'y','k','tab:brown','b','xk
plt.ylabel('Airline Company', c = 'r', fontsize = 12)
plt.xlabel('Counts of Airline Company', c = 'r', fontsize = 12 )
plt.title('Airline Company vs Counts of Airline Company', c = 'r', fontsize = 12)
plt.show()
```



Above plot shows Jet Airways has highest and Jet Airways Business has lowest flight counts

Deleate Unwanted Columns

In [28]:
```
col = ['Date_of_Journey','Dep_Time','Arrival_Time','Duration']
```

In [29]:
```
df = df.drop(col, axis = 1)
df.head(2)
```

Out[29]:

	Airline	Source	Destination	Route	Total_Stops	Additional_Info	Months	Day	NewArrival_Tim
0	Jet Airways	Delhi	Cochin	DEL → BOM → COK	1 stop	No info	6	6	04:25:0
1	IndiGo	Kolkata	Banglore	CCU → MAA → BLR	1 stop	No info	12	5	10:20:0

In [30]:
```
df.info()
```

```
<class 'pandas.core.frame.DataFrame'>
Int64Index: 2619 entries, 0 to 2670
Data columns (total 15 columns):
 #   Column           Non-Null Count  Dtype  
---  ------           --------------  -----  
 0   Airline          2619 non-null   object 
 1   Source           2619 non-null   object 
 2   Destination      2619 non-null   object 
 3   Route            2619 non-null   object 
 4   Total_Stops      2619 non-null   object 
 5   Additional_Info  2619 non-null   object 
 6   Months           2619 non-null   int32  
 7   Day              2619 non-null   int32  
 8   NewArrival_Time  2619 non-null   object 
 9   NewDep_Time      2619 non-null   object 
 10  Dep_Hours        2619 non-null   float64
 11  Arrival_Hours    2619 non-null   float64
 12  Hours            2619 non-null   float64
 13  Minutes          2619 non-null   float64
 14  New_Duration     2619 non-null   float64
dtypes: float64(5), int32(2), object(8)
memory usage: 306.9+ KB
```

Encodinng Categorical columns

In [31]:
```
le = LabelEncoder()
```

In [32]:
```
df['Airline'] = le.fit_transform(df['Airline'])
df['Source'] = le.fit_transform(df['Source'])
df['Destination'] = le.fit_transform(df['Destination'])
df['Route'] = le.fit_transform(df['Route'])
df['Additional_Info'] = le.fit_transform(df['Additional_Info'])
df['NewArrival_Time'] = le.fit_transform(df['NewArrival_Time'])
df['NewDep_Time'] = le.fit_transform(df['NewDep_Time'])
df['Total_Stops'] = le.fit_transform(df['Total_Stops'])
df.info()
```

```
<class 'pandas.core.frame.DataFrame'>
Int64Index: 2619 entries, 0 to 2670
Data columns (total 15 columns):
 #   Column           Non-Null Count  Dtype
---  ------           --------------  -----
 0   Airline          2619 non-null   int32
 1   Source           2619 non-null   int32
 2   Destination      2619 non-null   int32
 3   Route            2619 non-null   int32
 4   Total_Stops      2619 non-null   int32
 5   Additional_Info  2619 non-null   int32
 6   Months           2619 non-null   int32
 7   Day              2619 non-null   int32
 8   NewArrival_Time  2619 non-null   int32
 9   NewDep_Time      2619 non-null   int32
 10  Dep_Hours        2619 non-null   float64
 11  Arrival_Hours    2619 non-null   float64
 12  Hours            2619 non-null   float64
 13  Minutes          2619 non-null   float64
 14  New_Duration     2619 non-null   float64
dtypes: float64(5), int32(10)
memory usage: 225.1 KB
```

Columns are encoded

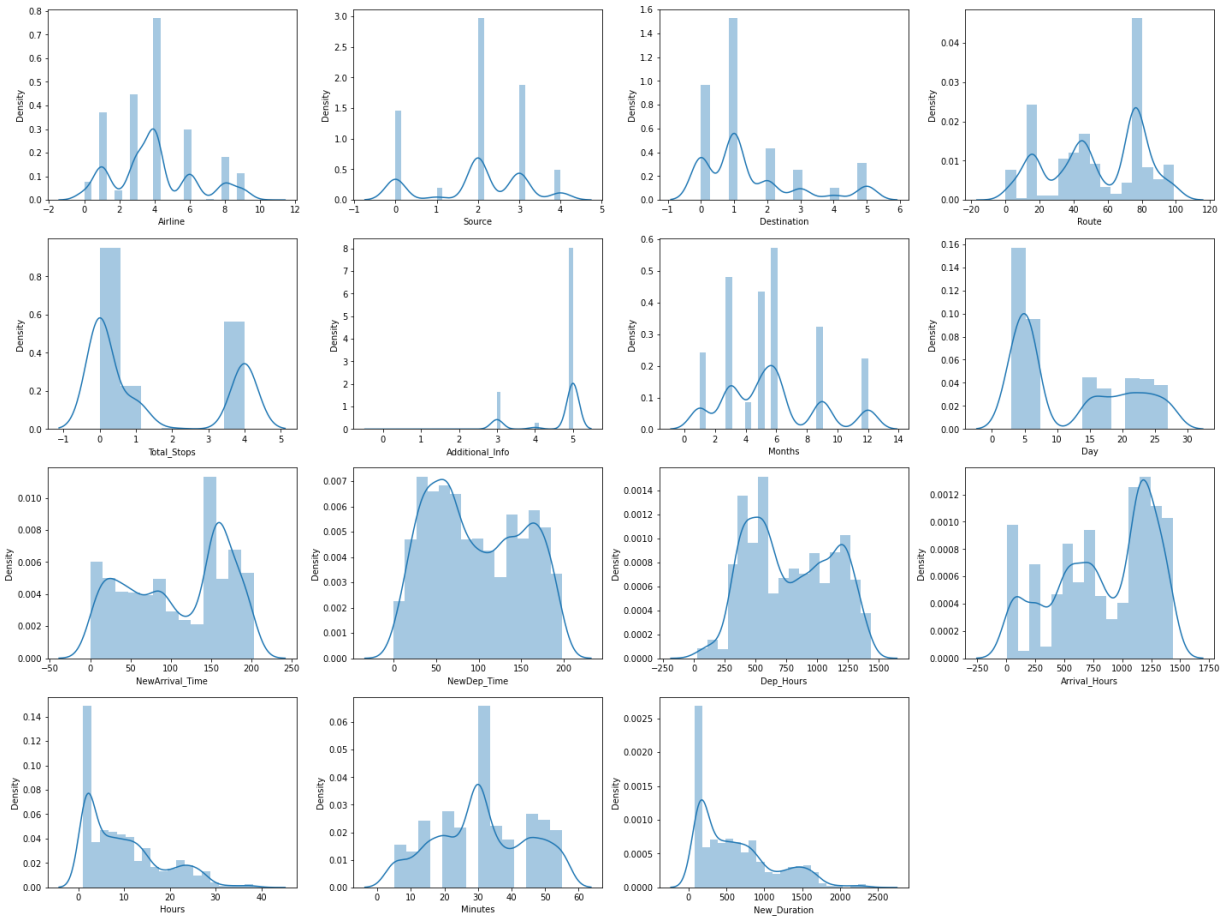
Data distribution

In [33]:
```
print('----------------------')
print('Distribution Plot :- ')
print('----------------------')

plt.figure(figsize = (20,15))
plotnumber = 1

for column in df:
    if plotnumber <=16:
        ax = plt.subplot(4,4, plotnumber)
        sns.distplot(df[column])
        plt.xlabel(column)
    plotnumber +=1
plt.tight_layout()
```

```
----------------------
Distribution Plot :-
----------------------
```



Data distribution is fine

Data Scaling

In [34]:
```
scaler = StandardScaler()
x_scaled = scaler.fit_transform(df)
x_scaled
```

Out[34]:
```
array([[ 0.00547242,  0.02859057, -0.2927839 , ..., -0.00667918,
         1.7152351 ,  0.04117166],
       [-0.42883906,  0.86992434, -0.97620727, ..., -0.72555976,
        -0.07820179, -0.72960444],
       [ 0.00547242,  0.02859057, -0.2927839 , ...,  1.55089542,
         0.99786034,  1.58272386],
       ...,
       [ 0.00547242,  0.02859057, -0.2927839 , ..., -0.4859329 ,
         0.28048559, -0.47935246],
       [-1.29746202,  0.02859057, -0.2927839 , ...,  0.59238798,
        -1.15426393,  0.56169578],
       [ 0.87409539,  0.02859057, -0.2927839 , ...,  0.47257455,
        -0.79557655,  0.45158491]])
```

Predict Flight Ticket Price

In [35]:
```
model = pickle.load(open('Flight Price Prediction Train.pickle', 'rb'))
```

In [37]:
```
price = model.predict(df)
price
```

Out[37]:
```
array([ 9740.454,  4753.524, 14383.318, ..., 14554.69 , 12073.196,
        8697.85 ], dtype=float32)
```

In [38]:
```
pred = pd.DataFrame(price)
pred
```

Out[38]:

	0
0	9740.454102
1	4753.523926
2	14383.318359
3	8538.320312
4	4594.645508
...	...
2614	8654.800781
2615	4403.861328
2616	14554.690430
2617	12073.196289
2618	8697.849609

2619 rows × 1 columns

Saving Predicted Flight Ticket Price into CSV file

In [39]:
```
pred.to_csv('Predicted Flight Ticket Price.csv', index = False)
```

In [ ]:
```

```