

```
In [154]: import pandas as pd
import numpy as np
import requests
from bs4 import BeautifulSoup
import matplotlib.pyplot as plt
from scipy import stats
from scipy.stats import f_oneway
import seaborn as sns
from sklearn.linear_model import SGDClassifier
from sklearn.tree import DecisionTreeClassifier
from sklearn.pipeline import Pipeline
from sklearn.model_selection import StratifiedKFold
from sklearn.metrics import accuracy_score
from sklearn.model_selection import RandomizedSearchCV
from sklearn.model_selection import KFold
from xgboost import XGBClassifier
from sklearn.model_selection import cross_val_score
```

```
In [2]: xl_file_1 = pd.ExcelFile(r"D:\Data Science\Data Science Career Readiness Program\Datasets\Flight Data\Flight Data 1.xlsx")
xl_file_2 = pd.ExcelFile(r"D:\Data Science\Data Science Career Readiness Program\Datasets\Flight Data\Flight Data 2.xlsx")
xl_file_3 = pd.ExcelFile(r"D:\Data Science\Data Science Career Readiness Program\Datasets\Flight Data\Flight Data 3.xlsx")
xl_file_4 = pd.ExcelFile(r"D:\Data Science\Data Science Career Readiness Program\Datasets\Flight Data\Flight Data 4.xlsx")
```

```
In [3]: airlines = xl_file_1.parse('Airlines')
airlines.head()
```

```
Out[3]:
```

	id	Airline	Flight	AirportFrom	AirportTo	DayOfWeek	Time	Length	Delay
0	1	CO	269	SFO	IAH	3	15	205	1
1	2	US	1558	PHX	CLT	3	15	222	1
2	3	AA	2400	LAX	DFW	3	20	165	1
3	4	AA	2466	SFO	DFW	3	20	195	1
4	5	AS	108	ANC	SEA	3	30	202	0

```
In [4]: airlines.shape
```

```
Out[4]: (518556, 9)
```

```
In [5]: airports = xl_file_2.parse('airports')
airports.head()
```

Out[5]:

	id	airport_ident	type	name	latitude_deg	longitude_deg	elevation_ft	continent
0	6523	00A	heliport	Total Rf Heliport	40.070801	-74.933601	11.0	NaN
1	323361	00AA	small_airport	Aero B Ranch Airport	38.704022	-101.473911	3435.0	NaN
2	6524	00AK	small_airport	Lowell Field	59.947733	-151.692524	450.0	NaN
3	6525	00AL	small_airport	Epps Airpark	34.864799	-86.770302	820.0	NaN
4	6526	00AR	closed	Newport Hospital & Clinic Heliport	35.608700	-91.254898	237.0	NaN

◀ ▶

In [6]: `airports.shape`

Out[6]: `(73805, 18)`

In [7]: `runways = xl_file_4.parse('runways')`
`runways.head()`

Out[7]:

	id	airport_ref	airport_ident	length_ft	width_ft	surface	lighted	closed	le_ident	le_latitude
0	269408	6523	00A	80.0	80.0	ASPH-G	1	0	H1	
1	255155	6524	00AK	2500.0	70.0	GRVL	0	0	N	
2	254165	6525	00AL	2300.0	200.0	TURF	0	0	1	
3	270932	6526	00AR	40.0	40.0	GRASS	0	0	H1	
4	322128	322127	00AS	1450.0	60.0	Turf	0	0	1	

◀ ▶

In [8]: `runways.shape`

Out[8]: `(43977, 20)`

In [70]: `merged_df = pd.merge(airlines, airports, on='id')`

In [71]: `merged_df.head()`

Out[71]:

	id	Airline	Flight	AirportFrom	AirportTo	DayOfWeek	Time	Length	Delay	Travel_Category	...
0	2	US	1558	PHX	CLT	3	15	222	1	Medium-Distance	...
1	3	AA	2400	LAX	DFW	3	20	165	1	Short-Distance	...
2	4	AA	2466	SFO	DFW	3	20	195	1	Short-Distance	...
3	5	AS	108	ANC	SEA	3	30	202	0	Short-Distance	...
4	7	DL	1768	LAX	MSP	3	30	220	0	Medium-Distance	...

5 rows × 27 columns

In [72]:

```
merged_df.shape
```

Out[72]:

```
(71076, 27)
```

In [73]:

```
df = pd.merge(merged_df, runways, on = 'airport_ident')
df.shape
```

Out[73]:

```
(42384, 46)
```

In [22]:

```
url = "https://en.wikipedia.org/wiki/List_of_airlines_of_the_United_States"
response = requests.get(url)
```

In [23]:

```
soup = BeautifulSoup(response.content, "html.parser")
```

In [24]:

```
headings = soup.find_all("h1")
```

In [25]:

```
paragraphs = soup.find_all(class_="paragraph")
```

In [26]:

```
links = soup.select("a")
```

In [27]:

```
title = soup.find("title").get_text()
```

In [28]:

```
title
```

Out[28]:

```
'List of airlines of the United States - Wikipedia'
```

In [29]:

```
soup.a
```

Out[29]:

```
<a class="mw-jump-link" href="#bodyContent">Jump to content</a>
```

In [43]:

```
links = soup.find_all('a')
```

In [38]:

```
tables = soup.find_all('table')
```

In [44]:

```
for link in links:
    print(link['href'])
```

```
#bodyContent
/wiki/Main_Page
/wiki/Wikipedia:Contents
/wiki/Portal:Current_events
/wiki/Special:Random
/wiki/Wikipedia:About
//en.wikipedia.org/wiki/Wikipedia:Contact_us
https://donate.wikimedia.org/wiki/Special:FundraiserRedirector?utm_source=donate&utm_
medium=sidebar&utm_campaign=C13_en.wikipedia.org&uselang=en
/wiki/Help:Contents
/wiki/Help:Introduction
/wiki/Wikipedia:Community_portal
/wiki/Special:RecentChanges
/wiki/Wikipedia:File_upload_wizard
/wiki/Main_Page
/wiki/Special:Search
/w/index.php?title=Special:CreateAccount&returnto=List+of+airlines+of+the+United+Stat
es
/w/index.php?title=Special:UserLogin&returnto=List+of+airlines+of+the+United+States
/w/index.php?title=Special:CreateAccount&returnto=List+of+airlines+of+the+United+Stat
es
/w/index.php?title=Special:UserLogin&returnto=List+of+airlines+of+the+United+States
/wiki/Help:Introduction
/wiki/Special:MyContributions
/wiki/Special:MyTalk
#
#Passenger_airlines
#Mainline
#Regional
#Commuter
#Charter
#Cargo_airlines
#Air_ambulances
#State-run_airlines
#See_also
#References
https://ar.wikipedia.org/wiki/%D9%82%D8%A7%D8%A6%D9%85%D8%A9_%D8%B4%D8%B1%D9%83%D8%A
7%D8%AA_%D8%A7%D9%84%D8%B7%D9%8A%D8%B1%D8%A7%D9%86_%D9%81%D9%8A_%D8%A7%D9%84%D9%88%D
9%84%D8%A7%D9%8A%D8%A7%D8%AA_%D8%A7%D9%84%D9%85%D8%AA%D8%AD%D8%AF%D8%A9
https://et.wikipedia.org/wiki/Ameerika_%C3%9Chendrikide_lennukompaniide_loend
https://es.wikipedia.org/wiki/Anexo:Aerol%C3%ADneas_de_Estados_ Unidos
https://ko.wikipedia.org/wiki/%EB%AF%B8%EA%B5%AD%EC%9D%98_%ED%95%AD%EA%B3%B5%EC%82%AC
_%EB%AA%A9%EB%A1%9D
https://ru.wikipedia.org/wiki/%D0%A1%D0%BF%D0%B8%D1%81%D0%BE%D0%BA_%D0%B0%D0% B2%D0%
8%D0%B0%D0%BA%D0%BE%D0%BC%D0%BF%D0%B0%D0%BD%D0%B8%D0%B9_%D0%A1%D0%A8%D0%90
https://tr.wikipedia.org/wiki/Amerika_Birle%C5%9Fik_Devletleri_merketli_havayolu_%C5%
9Firketleri_listesi
https://www.wikidata.org/wiki/Special:EntityPage/Q4431748#sitelinks-wikipedia
/wiki/List_of_airlines_of_the_United_ States
/wiki/Talk:List_of_airlines_of_the_United_ States
/wiki/List_of_airlines_of_the_United_ States
/w/index.php?title=List_of_airlines_of_the_United_ States&action=edit
/w/index.php?title=List_of_airlines_of_the_United_ States&action=history
/wiki/List_of_airlines_of_the_United_ States
/w/index.php?title=List_of_airlines_of_the_United_ States&action=edit
/w/index.php?title=List_of_airlines_of_the_United_ States&action=history
/wiki/Special:WhatLinksHere/List_of_airlines_of_the_United_ States
/wiki/Special:RecentChangesLinked/List_of_airlines_of_the_United_ States
/wiki/Wikipedia:File_Upload_Wizard
/wiki/Special:SpecialPages
```

/w/index.php?title=List_of_airlines_of_the_United_States&oldid=1159036492
/w/index.php?title=List_of_airlines_of_the_United_States&action=info
/w/index.php?title=Special:CiteThisPage&page=List_of_airlines_of_the_United_States&id=1159036492&wpFormIdentifier=titleform
<https://www.wikidata.org/wiki/Special:EntityPage/Q4431748>
/w/index.php?title=Special:DownloadAsPdf&page=List_of_airlines_of_the_United_States&action=show-download-screen
/w/index.php?title=List_of_airlines_of_the_United_States&printable=yes
https://commons.wikimedia.org/wiki/Category:Airlines_of_the_United_States
/wiki/Air_operator%27s_certificate
/wiki/Federal_Aviation_Administration
/wiki/Airline_hub
/w/index.php?title=List_of_airlines_of_the_United_States&action=edit§ion=1
/w/index.php?title=List_of_airlines_of_the_United_States&action=edit§ion=2
/wiki/IATA_airline_designator
/wiki/ICAO_airline_designator
/wiki/Call_sign#Aviation
/wiki/Alaska_Airlines
/wiki/File:N615AS_Alaska_Airlines_2000_Boeing_737-790_C_N_30344_(28850996478).jpg
/wiki/Seattle-Tacoma_International_Airport
/wiki/Ted_Stevens_Anchorage_International_Airport
/wiki/Portland_International_Airport
/wiki/San_Francisco_International_Airport
/wiki/Los_Angeles_International_Airport
/wiki/Allegiant_Air
/wiki/File:N221NV_(33849198042).jpg
/wiki/McCarren_International_Airport
/wiki/Cincinnati/Northern_Kentucky_International_Airport
/wiki/Destin-Fort_Walton_Beach_Airport
/wiki/Indianapolis_International_Airport
/wiki/Orlando_Sanford_International_Airport
/wiki/Memphis_International_Airport
/wiki/Pittsburgh_International_Airport
/wiki/Bellingham_International_Airport
/wiki/Des_Moines_International_Airport
/wiki/Punta_Gorda_Airport_(Florida)
/wiki/Gerald_R._Ford_International_Airport
/wiki/American_Airlines
/wiki/File:American_Airlines_Boeing_767-300ER_N386AA_(15824909062).jpg
/wiki/Dallas/Fort_Worth_International_Airport
/wiki/Charlotte_Douglas_International_Airport
/wiki/0%27Hare_International_Airport
/wiki/Los_Angeles_International_Airport
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/wiki/LaGuardia_Airport
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/wiki/Phoenix_Sky_Harbor_International_Airport
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/wiki/Tweed_New_Haven_Airport
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/wiki/Wilmington_Airport_(Delaware)
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/wiki/Philadelphia_International_Airport
/wiki/Ronald_Reagan_Washington_National_Airport
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/wiki/Ronald_Reagan_Washington_National_Airport
/wiki/Indianapolis_International_Airport
/wiki/0%27Hare_International_Airport
/wiki/John_Glenn_Columbus_International_Airport
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/wiki/Pittsburgh_International_Airport
/wiki/Ronald_Reagan_Washington_National_Airport
/wiki/Indianapolis_International_Airport
/wiki/0%27Hare_International_Airport
/wiki/John_Glenn_Columbus_International_Airport
/wiki/LaGuardia_Airport
/wiki/American_Eagle_(airline_brand)
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/wiki/Fort_Lauderdale-Hollywood_International_Airport
/wiki/Orlando_International_Airport
/wiki/Tampa_International_Airport
/wiki/SkyWest_Airlines
/wiki/File:Embraer_ERJ-175LR_(170-200LR)_%E2%80%98N109SY%E2%80%99_United_Express_(29018738356).jpg
/wiki/Hartsfield-Jackson_Atlanta_International_Airport
/wiki/Boise_Airport
/wiki/Colorado_Springs_Airport
/wiki/Detroit_Metropolitan_Wayne_County_Airport
/wiki/Los_Angeles_International_Airport
/wiki/Minneapolis%E2%80%93Saint_Paul_International_Airport
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/wiki/Los_Angeles_International_Airport
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/wiki/American_Eagle_(airline_brand)
/wiki/Alaska_Airlines
/w/index.php?title=List_of_airlines_of_the_United_States&action=edit§ion=4
/wiki/IATA_airline_designator
/wiki/ICAO_airline_designator
/wiki/Call_sign#Aviation
/wiki/Airline_hub
/wiki/Airline_hub
/wiki/Advanced_Air
/wiki/Hawthorne_Municipal_Airport_(California)
/wiki/Grant_County_Airport_(New_Mexico)
/wiki/Air_Sunshine
/wiki/File:SJU_5-21-08_N603AB_(2527732101).jpg
/wiki/Luis_Mu%C3%B1oz_Mar%C3%ADn_International_Airport
/wiki/Bering_Air
/wiki/File:Beechcraft_1900_of_Bering_Air.jpg
/wiki/Nome_Airport
/wiki/Ralph_Wien_Memorial_Airport

/wiki/Unalakleet_Airport
/wiki/Boutique_Air
/wiki/File:BOUTIQUE_AIR_PC-12_N476SS.jpg
/wiki/Dallas/Fort_Worth_International_Airport
/wiki/Denver_International_Airport
/wiki/Phoenix_Sky_Harbor_International_Airport
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/wiki/Grand_Canyon_National_Park_Airport
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/wiki/List_of_airlines_of_Cambodia
/wiki/List_of_airlines_of_Cameroon
/wiki/List_of_airlines_of_Canada
/wiki/List_of_airlines_of_Cape_Verde
/wiki/List_of_airlines_of_Cayman_Islands
/wiki/List_of_airlines_of_the_Central_African_Republic
/wiki/List_of_airlines_of_Chad
/wiki/List_of_airlines_of_Chile
/wiki/List_of_airlines_of_China
/wiki/List_of_airlines_of_Christmas_Island
/w/index.php?title=List_of_airlines_of_Cocos_(Keeling)_Islands&action=edit&redlink=1
/wiki/List_of_airlines_of_Colombia
/wiki/List_of_airlines_of_Comoros
/wiki/List_of_airlines_of_the_Democratic_Republic_of_the_Congo
/w/index.php?title=List_of_airlines_of_Republic_of_the_Congo&action=edit&redlink=1
/wiki/List_of_airlines_of_the_Cook_Islands

/wiki/List_of_airlines_of_Costa_Rica
/wiki/List_of_airlines_of_C%C3%B4te_d%27Ivoire
/wiki/List_of_airlines_of_Croatia
/wiki/List_of_airlines_of_Cuba
/wiki/List_of_airlines_of_Cyprus
/wiki/List_of_airlines_of_Czech_Republic
/wiki/List_of_airlines_of_Denmark
/w/index.php?title=List_of_airlines_of_Akrotiri_and_Dhekelia&action=edit&redlink=1
/wiki/List_of_airlines_of_Djibouti
/w/index.php?title=List_of_airlines_of_Dominica&action=edit&redlink=1
/wiki/List_of_airlines_of_the_Dominican_Republic
/wiki/List_of_airlines_of_East_Timor
/wiki/List_of_airlines_of_Ecuador
/wiki/List_of_airlines_of_Egypt
/wiki/List_of_airlines_of_El_Salvador
/wiki/List_of_airlines_of_Equatorial_Guinea
/wiki/List_of_airlines_of_Eritrea
/wiki/List_of_airlines_of_Estonia
/wiki/List_of_airlines_of_Eswatini
/wiki/List_of_airlines_of_Ethiopia
/wiki/List_of_airlines_of_the_Falkland_Islands
/w/index.php?title=List_of_airlines_of_the_Faroe_Islands&action=edit&redlink=1
/wiki/List_of_airlines_of_Fiji
/wiki/List_of_airlines_of_Finland
/wiki/List_of_airlines_of_France
/wiki/List_of_airlines_of_French_Polynesia
/wiki/List_of_airlines_of_Gabon
/wiki/List_of_airlines_of_the_Gambia
/wiki/List_of_airlines_of_Georgia_(country)
/wiki/List_of_airlines_of_Germany
/wiki/List_of_airlines_of_Ghana
/w/index.php?title=List_of_airlines_of_Gibraltar&action=edit&redlink=1
/wiki/List_of_airlines_of_Greece
/wiki/List_of_airlines_of_Greenland
/w/index.php?title=List_of_airlines_of_Grenada&action=edit&redlink=1
/wiki/List_of_airlines_of_Guam
/wiki/List_of_airlines_of_Guatemala
/wiki/List_of_airlines_of_Guernsey
/wiki/List_of_airlines_of_Guinea
/w/index.php?title=List_of_airlines_of_Guinea-Bissau&action=edit&redlink=1
/wiki/List_of_airlines_of_Guyana
/wiki/List_of_airlines_of_Haiti
/wiki/List_of_airlines_of_Honduras
/wiki/List_of_airlines_of_Hong_Kong
/wiki/List_of_airlines_of_Hungary
/wiki/List_of_airlines_of_Iceland
/wiki/List_of_airlines_of_India
/wiki/List_of_airlines_of_Indonesia
/wiki/List_of_airlines_of_Iran
/wiki/List_of_airlines_of_Iraq
/wiki/List_of_airlines_of_the_Republic_of_Ireland
/wiki/List_of_airlines_of_Israel
/wiki/List_of_airlines_of_Italy
/wiki/List_of_airlines_of_Jamaica
/wiki/List_of_airlines_of_Japan
/w/index.php?title=List_of_airlines_of_Jersey&action=edit&redlink=1
/wiki/List_of_airlines_of_Jordan
/wiki/List_of_airlines_of_Kazakhstan
/wiki/List_of_airlines_of_Kenya
/wiki/List_of_airlines_of_Kiribati

/wiki/List_of_airlines_of_North_Korea
/wiki/List_of_airlines_of_South_Korea
/wiki/List_of_airlines_of_Kosovo
/wiki/List_of_airlines_of_Kuwait
/wiki/List_of_airlines_of_Kyrgyzstan
/wiki/List_of_airlines_of_Laos
/wiki/List_of_airlines_of_Latvia
/wiki/List_of_airlines_of_Lebanon
/wiki/List_of_airlines_of_Lesotho
/wiki/List_of_airlines_of.Libya
/w/index.php?title=List_of_airlines_of_Liechtenstein&action=edit&redlink=1
/wiki/List_of_airlines_of_Lithuania
/wiki/List_of_airlines_of_Luxembourg
/wiki/List_of_airlines_of_Macau
/wiki/List_of_airlines_of_the_Republic_of_Macedonia
/wiki/List_of_airlines_of_Madagascar
/wiki/List_of_airlines_of_Malawi
/wiki/List_of_airlines_of_Malaysia
/wiki/List_of_airlines_of_the_Maldives
/wiki/List_of_airlines_of_Mali
/wiki/List_of_airlines_of_Malta
/wiki/List_of_airlines_of_Marshall_Islands
/wiki/List_of_airlines_of_Mauritania
/wiki/List_of_airlines_of_Mauritius
/wiki/List_of_airlines_of_Mayotte
/wiki/List_of_airlines_of_Mexico
/w/index.php?title=List_of_airlines_of_Micronesia&action=edit&redlink=1
/wiki/List_of_airlines_of_Moldova
/wiki/List_of_airlines_of_Monaco
/wiki/List_of_airlines_of_Mongolia
/wiki/List_of_airlines_of_Montenegro
/wiki/List_of_airlines_of_Montserrat
/wiki/List_of_airlines_of_Morocco
/wiki/List_of_airlines_of_Mozambique
/wiki/List_of_airlines_of_Myanmar
/wiki/List_of_airlines_of_Namibia
/wiki/List_of_airlines_of_Nauru
/wiki/List_of_airlines_of_Nepal
/wiki/List_of_airlines_of_Netherlands
/wiki/List_of_airlines_of_Netherlands_Antilles
/wiki/List_of_airlines_of_New_Caledonia
/wiki/List_of_airlines_of_New_Zealand
/wiki/List_of_airlines_of_Nicaragua
/wiki/List_of_airlines_of_Niger
/wiki/List_of_airlines_of_Nigeria
/wiki/List_of_airlines_of_Norfolk_Island
/wiki/List_of_airlines_of_Northern_Cyprus
/w/index.php?title=List_of_airlines_of_Northern_Mariana_Islands&action=edit&redlink=1
/wiki/List_of_airlines_of_Norway
/wiki/List_of_airlines_of_Oman
/wiki/List_of_airlines_of_Pakistan
/wiki/List_of_airlines_of_Palau
/wiki/List_of_airlines_of_Palestine
/wiki/List_of_airlines_of_Panama
/wiki/List_of_airlines_of_Papua_New_Guinea
/wiki/List_of_airlines_of_Paraguay
/wiki/List_of_airlines_of_Peru
/wiki/List_of_airlines_of_the_Philippines
/w/index.php?title=List_of_airlines_of_Pitcairn_Islands&action=edit&redlink=1
/wiki/List_of_airlines_of_Poland

/wiki/List_of_airlines_of_Portugal
/wiki/List_of_airlines_of_Puerto_Rico
/wiki/List_of_airlines_of_Qatar
/wiki/List_of_airlines_of_Romania
/wiki/List_of_airlines_of_Russia
/wiki/List_of_airlines_of_Rwanda
/w/index.php?title=List_of_airlines_of_the_Sahrawi_Arab_Democratic_Republic&action=edit&redlink=1
/w/index.php?title=List_of_airlines_of_Saint_Barth%C3%A9lemy&action=edit&redlink=1
/w/index.php?title=List_of_airlines_of_Saint_Helena&action=edit&redlink=1
/w/index.php?title=List_of_airlines_of_Saint_Kitts_and_Nevis&action=edit&redlink=1
/w/index.php?title=List_of_airlines_of_Saint_Lucia&action=edit&redlink=1
/w/index.php?title=List_of_airlines_of_Saint_Martin&action=edit&redlink=1
/wiki/List_of_airlines_of_Saint_Pierre_and_Miquelon
/wiki/List_of_airlines_of_Saint_Vincent_and_the_Grenadines
/wiki/List_of_airlines_of_Samoa
/w/index.php?title=List_of_airlines_of_San_Marino&action=edit&redlink=1
/wiki/List_of_airlines_of_S%C3%A3o_Tom%C3%A9_and_Pr%C3%ADncipe
/wiki/List_of_airlines_of_Saudi_Arabia
/wiki/List_of_airlines_of_Senegal
/wiki/List_of_airlines_of_Serbia
/wiki/List_of_airlines_of_Seychelles
/wiki/List_of_airlines_of_Singapore
/wiki/List_of_airlines_of_Slovakia
/wiki/List_of_airlines_of_Slovenia
/wiki/List_of_airlines_of_the_Solomon_Islands
/wiki/List_of_airlines_of_Somalia
/w/index.php?title=List_of_airlines_of_Somaliland&action=edit&redlink=1
/wiki/List_of_airlines_of_South_Africa
/w/index.php?title=List_of_airlines_of_South_Ossetia&action=edit&redlink=1
/wiki/List_of_airlines_of_South_Sudan
/wiki/List_of_airlines_of_Spain
/wiki/List_of_airlines_of_Sri_Lanka
/wiki/List_of_airlines_of_Sudan
/wiki/List_of_airlines_of_Suriname
/wiki/List_of_airlines_of_Svalbard
/wiki/List_of_airlines_of_Sweden
/wiki/List_of_airlines_of_Switzerland
/wiki/List_of_airlines_of_Syria
/wiki/List_of_airlines_of_Taiwan
/wiki/List_of_airlines_of_Tajikistan
/wiki/List_of_airlines_of_Tanzania
/wiki/List_of_airlines_of_Thailand
/wiki/List_of_airlines_of_Togo
/w/index.php?title=List_of_airlines_of_Tokelau&action=edit&redlink=1
/w/index.php?title=List_of_airlines_of_Transnistria&action=edit&redlink=1
/wiki/List_of_airlines_of_Trinidad_and_Tobago
/w/index.php?title=List_of_airlines_of_Tristan_da_Cunha&action=edit&redlink=1
/wiki/List_of_airlines_of_Tunisia
/wiki/List_of_airlines_of_Turkey
/wiki/List_of_airlines_of_Turkmenistan
/wiki/List_of_airlines_of_the_Turks_and_Caicos_Islands
/wiki/List_of_airlines_of_Uganda
/wiki/List_of_airlines_of_Ukraine
/wiki/List_of_airlines_of_the_United_Arab_Emirates
/wiki/List_of_airlines_of_the_United_Kingdom

```
-----  
KeyError Traceback (most recent call last)  
Input In [44], in <cell line: 1>()  
      1 for link in links:  
----> 2     print(link['href'])  
  
File ~\anaconda3\lib\site-packages\bs4\element.py:1519, in Tag.__getitem__(self, key)  
  1516     def __getitem__(self, key):  
  1517         """tag[key] returns the value of the 'key' attribute for the Tag,  
  1518         and throws an exception if it's not there."""  
-> 1519         return self.attrs[key]  
  
KeyError: 'href'
```

```
In [39]: dataframes = []  
for table in tables:  
    df = pd.read_html(str(table))  
    dataframes.extend(df)
```

```
In [45]: for i, df in enumerate(dataframes):  
    df.to_csv(f'dataset_{i+1}.csv', index=False)
```

```
In [47]: url = 'https://en.wikipedia.org/wiki/List_of_the_busiest_airports_in_the_United_States'  
response = requests.get(url)
```

```
In [48]: soup = BeautifulSoup(response.content, 'html.parser')
```

```
In [49]: tables = soup.find_all('table')
```

```
In [50]: dataframes = []  
for table in tables:  
    df = pd.read_html(str(table))  
    dataframes.extend(df)
```

```
In [51]: for i, df in enumerate(dataframes):  
    df.to_csv(f'dataset_{i+1}.csv', index=False)
```

```
In [13]: ontime_airlines1 = pd.read_csv(r"D:\Data Science\Data Science Career Readiness Program\ontime_airlines1.csv")  
ontime_airlines1.head()
```

Out[13]:	Airline	Image	IATA	ICAO	Callsign	Primary hubs, Secondary hubs	Founded	Notes
0	Alaska Airlines	NaN	AS	ASA	ALASKA	Seattle/Tacoma/Anchorage/Portland (OR)/San Francisco	1932	Founded in 1932, Airway communication company
1	Allegiant Air	NaN	G4	AAY	ALLEGIANT	Las Vegas/Cincinnati/Fort Walton Beach/Indianapolis	1997	Founded in 1997, Express communication company
2	American Airlines	NaN	AA	AAL	AMERICAN	Dallas/Fort Worth/Charlotte/Chicago-O'Hare/Los Angeles	1926	Founded in 1926, American Airway communication
3	Avelo Airlines	NaN	XP	VXP	AVELO	Burbank/New Haven/Orlando/Raleigh/Durham/Wilmington	1987	Founded in 1987, Business Class airline
4	Breeze Airways	NaN	MX	MXY	MOXY	Charleston/Hartford/New Orleans/Norfolk/Providence	2018	Founded in 2018

In [14]: `ontime_airlines1.shape`Out[14]: `(14, 8)`

```
In [15]: ontime_airlines2 = pd.read_csv(r"D:\Data Science\Data Science Career Readiness Program\ontime_airlines2.csv")
ontime_airlines2.head()
```

Out[15]:	Airline	Image	IATA	ICAO	Callsign	Primary Hubs, Secondary Hubs	Founded	Notes
0	Air Wisconsin	NaN	ZW	AWI	WISCONSIN	Chicago-O'Hare/Washington-Dulles	1965	Operated by American Eagle
1	Cape Air	NaN	9K	KAP	CAIR	Hyannis/Billings/Boston/Nantucket/St. Louis/San Juan	1988	Non-scheduled airline
2	CommutAir	NaN	C5	UCA	COMMUTAIR	Denver/Newark/Washington-Dulles	1989	Operated by United Express
3	Contour Airlines	NaN	LF	VTE	VOLUNTEER	Smyrna (TN)	1982	Non-scheduled airline
4	Elite Airways	NaN	7Q	MNU	MAINER	Melbourne/Orlando/Newark/Portland (Maine)	2006	Commonly operated in 2006

In [16]: `ontime_airlines2.shape`

Out[16]: (15, 8)

In [17]: ontime_airlines3 = pd.read_csv(r"D:\Data Science\Data Science Career Readiness Program\ontime_airlines3.csv")
ontime_airlines3.head()

Out[17]:

	Airline	Image	IATA	ICAO	Callsign	Primary Hubs, Secondary Hubs	Founded	Notes
0	Advanced Air	NaN	AN	WSN	WINGSPAN	Hawthorne	2005	Has the EAS contract to serve Grant County Air...
1	Air Sunshine	NaN	YI	RSI	AIR SUNSHINE	San Juan	1982	NaN
2	Bering Air	NaN	8E	BRG	BERING AIR	NomeKotzebueUnalakleet	1979	NaN
3	Boutique Air	NaN	4B	BTQ	BOUTIQUE	Dallas/Fort WorthDenverPhoenix-Sky Harbor	2007	NaN
4	Everts Air	NaN	5V	VTS	EVERTS	FairbanksAnchorage	1978	Founded as Tatonduk Flying Service.

In [18]: ontime_airlines4 = pd.read_csv(r"D:\Data Science\Data Science Career Readiness Program\ontime_airlines4.csv")
ontime_airlines4.head()

Out[18]:

	Airline	Image	IATA	ICAO	Callsign	Primary Hubs, Secondary Hubs	Founded	Notes
0	Air Charter Bahamas	NaN	NaN	NaN	NaN	NaN	NaN	NaN
1	Air Flight Charters	NaN	NaN	FLL	NaN	Fort Lauderdale	1987.0	NaN
2	Airshare	NaN	NaN	XSR	AIRSHARE	NaN	2000.0	Founded as Executive Flight Services
3	Berry Aviation	NaN	NaN	BYA	BERRY	San Marcos	1983.0	NaN
4	Bighorn Airways	NaN	NaN	BHR	BIGHORN AIR	Sheridan	1947.0	NaN

In [19]: ontime_airlines5 = pd.read_csv(r"D:\Data Science\Data Science Career Readiness Program\ontime_airlines5.csv")
ontime_airlines5.head()

Out[19]:

	Airline	Image	IATA	ICAO	Callsign	Primary Hubs, Secondary Hubs	Founded	Notes
0	21 Air	NaN	21	CSB	CARGO SOUTH	Miami	2014.0	NaN
1	ABX Air	NaN	GB	ABX	ABEX	Wilmington (OH)CincinnatiMiami	1980.0	Founded as Airborne Express. Operates some Ama...
2	Air Cargo Carriers	NaN	2Q	SNC	NIGHT CARGO	MilwaukeeCincinnati	1986.0	Commenced operations in 1980.
3	AirNet Express	NaN	NaN	USC	STAR CHECK	Columbus-Rickenbacker	1974.0	Founded as Financial Air Express.
4	Air Transport International	NaN	8C	ATN	AIR TRANSPORT	Wilmington (OH)Cincinnati	1978.0	Founded as US Airways and commenced operations...

In [20]:

```
ontime_airlines6 = pd.read_csv(r"D:\Data Science\Data Science Career Readiness Program\ontime_airlines6.csv")
ontime_airlines6.head()
```

Out[20]:

	Airline	Image	IATA	ICAO	Callsign	Primary Hubs, Secondary Hubs	Founded	Notes
0	AirMed International	NaN	NaN	NaN	NaN	Birmingham-Shuttlesworth	1987.0	Founded as MEDjet International.
1	Air Methods	NaN	NaN	NaN	NaN	Denver-Centennial	1980.0	NaN
2	Critical Air Medicine	NaN	NaN	NaN	NaN	NaN	1984.0	NaN
3	Lifestar	NaN	NaN	NaN	NaN	NaN	NaN	NaN
4	Life Lion	NaN	NaN	NaN	NaN	NaN	NaN	NaN

In [21]:

```
ontime_airlines7 = pd.read_csv(r"D:\Data Science\Data Science Career Readiness Program\ontime_airlines7.csv")
ontime_airlines7.head()
```

Out[21]:

	Airline	Image	IATA	ICAO	Callsign	Primary Hubs, Secondary Hubs	Founded	Notes
0	Comco	NaN	NaN	NaN	NaN	NaN	2002	NaN
1	Janet	NaN	NaN	WWW	JANET	Las Vegas	1972	NaN
2	Justice Prisoner and Alien Transportation System	NaN	NaN	JUD	JUSTICE	Oklahoma City	1980	Commenced operations in 1995.

In [22]:

```
datasets = [ontime_airlines1, ontime_airlines2, ontime_airlines3, ontime_airlines4, or
```

```
In [23]: ontime_airlines = pd.concat(datasets, axis=0)
```

```
In [24]: ontime_airlines.shape
```

```
Out[24]: (140, 9)
```

```
In [25]: ontime_airlines.columns
```

```
Out[25]: Index(['Airline', 'Image', 'IATA', 'ICAO', 'Callsign',
       'Primary hubs, Secondary hubs', 'Founded', 'Notes',
       'Primary Hubs, Secondary Hubs'],
      dtype='object')
```

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

```
Out[26]:
```

	Airline	Image	IATA	ICAO	Callsign	Primary hubs, Secondary hubs	Founded	Notes
0	Alaska Airlines	NaN	AS	ASA	ALASKA	Seattle/TacomaAnchoragePortland (OR)San Franci...	1932.0	Founded in 1932. Airway communication company.
1	Allegiant Air	NaN	G4	AY	ALLEGIANT	Las VegasCincinnatiFort Walton BeachIndianapol...	1997.0	Founded in 1997. Express communication company.
2	American Airlines	NaN	AA	AAL	AMERICAN	Dallas/Fort WorthCharlotteChicago-O'HareLos An...	1926.0	Founded in 1926. American Airway communication company.
3	Avelo Airlines	NaN	XP	VXP	AVELO	BurbankNew HavenOrlandoRaleigh/DurhamWilmington...	1987.0	Founded in 1987. Fiber business communication company.
4	Breeze Airways	NaN	MX	MXY	MOXY	CharlestonHartfordNew OrleansNorfolkProvidence...	2018.0	Airline.

```
In [27]: ontime_airlines = ontime_airlines.drop(ontime_airlines.columns[[1, 7, 8]], axis=1)
```

```
In [28]: ontime_airlines.head()
```

Out[28]:	Airline	IATA	ICAO	Callsign	Primary hubs, Secondary hubs	Founded
0	Alaska Airlines	AS	ASA	ALASKA	Seattle/TacomaAnchoragePortland (OR)San Francisco...	1932.0
1	Allegiant Air	G4	AYA	ALLEGIANT	Las VegasCincinnatiFort Walton BeachIndianapol...	1997.0
2	American Airlines	AA	AAL	AMERICAN	Dallas/Fort WorthCharlotteChicago-O'HareLos Angeles...	1926.0
3	Avelo Airlines	XP	VXP	AVELO	BurbankNew HavenOrlandoRaleigh/DurhamWilmington...	1987.0
4	Breeze Airways	MX	MXY	MOXY	CharlestonHartfordNew OrleansNorfolkProvidence...	2018.0

In [29]: `ontime_airlines.shape`Out[29]: `(140, 6)`In [30]: `xl_file6 = pd.ExcelFile(r"D:\Data Science\Data Science Career Readiness Program\2. Uni`In [31]: `largehub_airlines = xl_file6.parse('Sheet1')`
`largehub_airlines.head()`

Out[31]:	Rank	Airports	IATACode	Major cities served	State	2021	2020	2019	2018	2017
0	1	Hartsfield Jackson Atlanta International Airport	ATL	Atlanta	GA	36676010	20559866	53505795	51865797	50251964
1	2	Dallas/Fort Worth International Airport	DFW	Dallas & Fort Worth	TX	30005266	18593421	35778573	32821799	31816933
2	3	Denver International Airport	DEN	Denver	CO	28645527	16243216	33592945	31362941	29809097
3	4	O'Hare International Airport	ORD	Chicago	IL	26350976	14606034	40871223	39873927	38593028
4	5	Los Angeles International Airport	LAX	Los Angeles	CA	23663410	14055777	42939104	42624050	41232432

In [32]: `largehub_airlines.shape`Out[32]: `(30, 15)`In [33]: `xl_file5 = pd.ExcelFile(r"D:\Data Science\Data Science Career Readiness Program\2. Uni`

```
In [34]: mediumhub_airlines = xl_file5.parse('Sheet1')
mediumhub_airlines.head()
```

Out[34]:

	Rank	Airports	IATACode	Major cities served	State	2021	2020	2019	2018	2017	...
0	31	Dallas Love Field	DAL	Dallas	TX	6487563	3669930	8408457	8134848	7876769	755
1	32	Daniel K. Inouye International Airport	HNL	Honolulu	HI	5830928	3126391	9988678	9578505	9743989	965
2	33	Portland International Airport	PDX	Portland	OR	5759879	3455877	9797408	9940866	9435473	907
3	34	William P. Hobby Airport	HOU	Houston	TX	5560780	3127178	7069614	6937061	6741870	628
4	35	Southwest Florida International Airport	RSW	Fort Myers	FL	5080805	2947139	5144467	4719568	4461304	435

```
In [35]: mediumhub_airlines.shape
```

Out[35]: (35, 15)

```
In [36]: busiest_airlines = pd.concat([largehub_airlines, mediumhub_airlines], axis = 0)
```

```
In [37]: busiest_airlines.shape
```

Out[37]: (65, 15)

```
In [38]: busiest_airlines.head()
```

Out[38]:

	Rank	Airports	IATACode	Major cities served	State	2021	2020	2019	2018	2017
0	1	Hartsfield-Jackson Atlanta International Airport	ATL	Atlanta	GA	36676010	20559866	53505795	51865797	50251964
1	2	Dallas/Fort Worth International Airport	DFW	Dallas & Fort Worth	TX	30005266	18593421	35778573	32821799	31816933
2	3	Denver International Airport	DEN	Denver	CO	28645527	16243216	33592945	31362941	29809097
3	4	O'Hare International Airport	ORD	Chicago	IL	26350976	14606034	40871223	39873927	38593028
4	5	Los Angeles International Airport	LAX	Los Angeles	CA	23663410	14055777	42939104	42624050	41232432

In [39]: `busiest_airlines.isnull().sum()`

Out[39]:

```

Rank          0
Airports      0
IATACode      0
Major cities served  0
State          0
2021          0
2020          0
2019          0
2018          0
2017          0
2016          0
2015          0
2014          0
2013          0
2012          0
dtype: int64

```

In [40]: `airlines.head()`

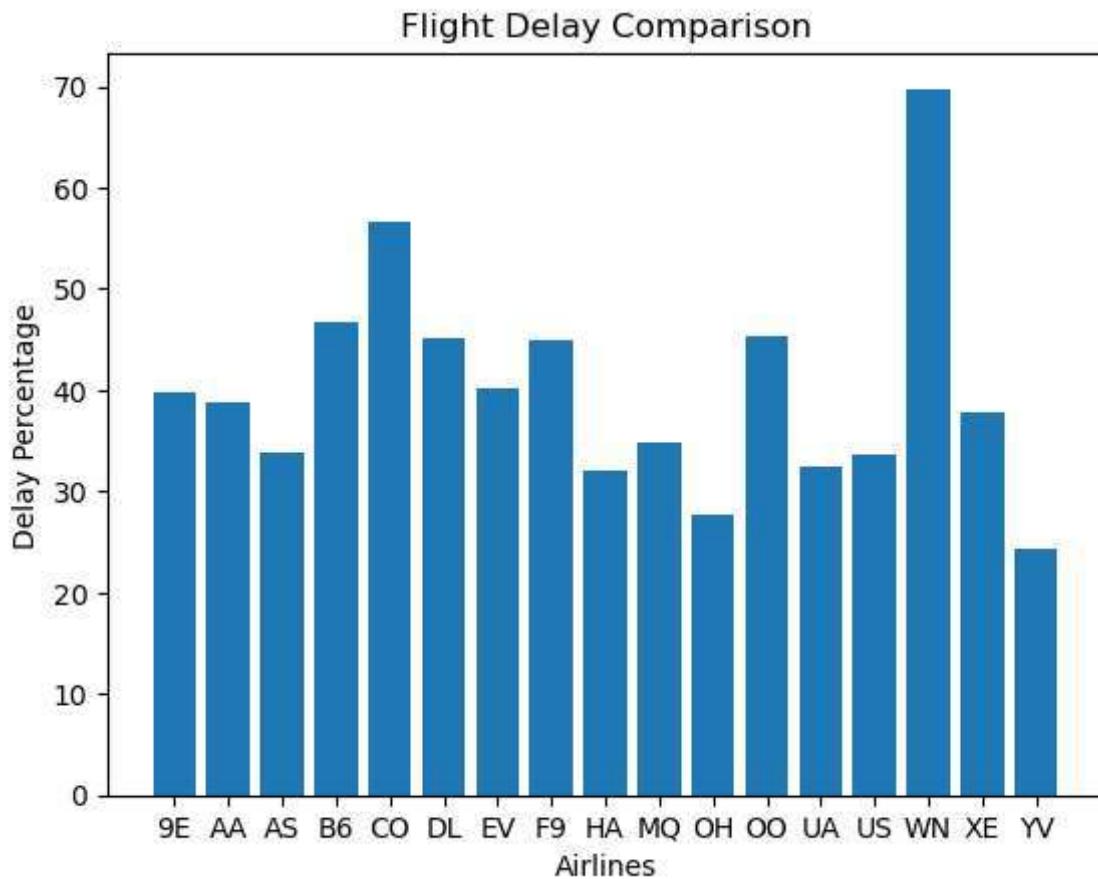
Out[40]:

	id	Airline	Flight	AirportFrom	AirportTo	DayOfWeek	Time	Length	Delay
0	1	CO	269	SFO	IAH	3	15	205	1
1	2	US	1558	PHX	CLT	3	15	222	1
2	3	AA	2400	LAX	DFW	3	20	165	1
3	4	AA	2466	SFO	DFW	3	20	195	1
4	5	AS	108	ANC	SEA	3	30	202	0

```
In [41]: delay_percentages = airlines.groupby('Airline')['Delay'].mean() * 100
```

```
In [42]: # Bar Plot
plt.bar(delay_percentages.index, delay_percentages.values)
plt.xlabel('Airlines')
plt.ylabel('Delay Percentage')
plt.title('Flight Delay Comparison')

plt.show()
```



'WN' is the symbol of SouthWest Airlines and from the above graph we can see that

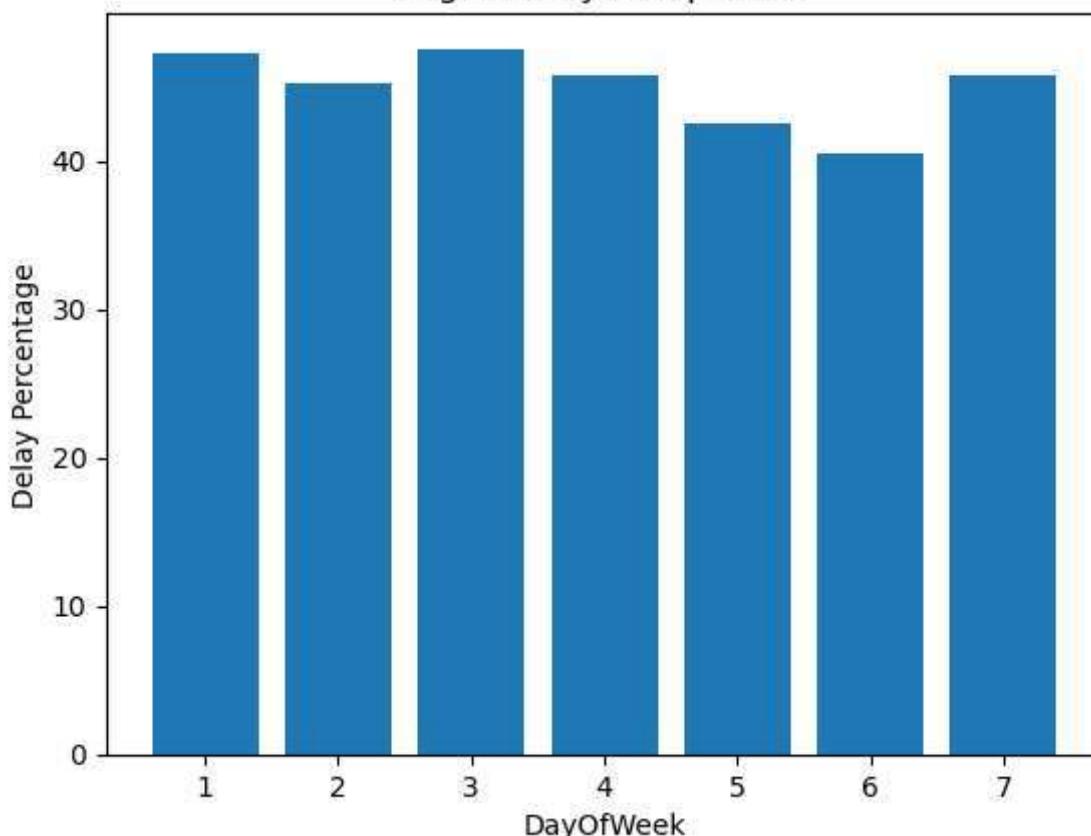
SouthWest airlines have high percentage of Delay time than other airlines

```
In [43]: delay_week_percentages = airlines.groupby('DayOfWeek')['Delay'].mean() * 100
```

```
In [44]: # Bar Plot
plt.bar(delay_week_percentages.index, delay_week_percentages.values)
plt.xlabel('DayOfWeek')
plt.ylabel('Delay Percentage')
plt.title('Flight Delay Comparison')

plt.show()
```

Flight Delay Comparison



Here, 3rd day of the week, that is Tuesday has highest delay percentage in this day the airlines are busy.

6th day of the week, that is Friday has lowest delay percentage this day is safest day for travel.

```
In [45]: airlines.Length.max()
```

```
Out[45]: 655
```

```
In [46]: airlines.Length.value_counts()
```

```
Out[46]:
```

80	13118
70	12998
65	11863
75	11615
85	11605
...	
457	2
481	2
418	2
417	2
23	1

```
Name: Length, Length: 426, dtype: int64
```

```
In [47]: short_travel = airlines[airlines['Length'] <= 218]
short_travel.shape
```

Out[47]: (459798, 9)

In [48]: short_travel.Airline.value_counts()

```
Out[48]: WN    86786
          OO    49990
          DL    49682
          MQ    36543
          AA    36171
          XE    31072
          US    28063
          EV    27973
          9E    20686
          UA    18157
          B6    14721
          CO    14603
          YV    13667
          OH    12505
          AS    8699
          F9    5905
          HA    4575
Name: Airline, dtype: int64
```

In [49]: short_distance_threshold = 218
medium_distance_threshold = 436

In [50]: airlines['Travel_Category'] = pd.cut(airlines['Length'], bins=[0, short_distance_threshold, medium_distance_threshold], labels=['Short-Distance', 'Medium-Distance', 'Long-Distance'])

In [51]: airlines['Travel_Category'].value_counts()

```
Out[51]: Short-Distance    459794
          Medium-Distance   58199
          Long-Distance      559
Name: Travel_Category, dtype: int64
```

In [52]: pd.DataFrame(airlines.groupby(['Airline', 'Travel_Category']).size())

Out[52]: 0

Airline	Travel_Category	
9E	Short-Distance	20686
	Medium-Distance	0
	Long-Distance	0
AA	Short-Distance	36171
	Medium-Distance	9336
	Long-Distance	149
AS	Short-Distance	8699
	Medium-Distance	2772
	Long-Distance	0
B6	Short-Distance	14720
	Medium-Distance	3391
	Long-Distance	0
CO	Short-Distance	14603
	Medium-Distance	6349
	Long-Distance	166
DL	Short-Distance	49682
	Medium-Distance	11149
	Long-Distance	109
EV	Short-Distance	27973
	Medium-Distance	10
	Long-Distance	0
F9	Short-Distance	5902
	Medium-Distance	551
	Long-Distance	0
HA	Short-Distance	4575
	Medium-Distance	1003
	Long-Distance	0
MQ	Short-Distance	36543
	Medium-Distance	62
	Long-Distance	0
OH	Short-Distance	12505
	Medium-Distance	125

0

Airline	Travel_Category	0
	Long-Distance	0
OO	Short-Distance	49990
	Medium-Distance	264
	Long-Distance	0
UA	Short-Distance	18157
	Medium-Distance	9327
	Long-Distance	135
US	Short-Distance	28063
	Medium-Distance	6437
	Long-Distance	0
WN	Short-Distance	86786
	Medium-Distance	7311
	Long-Distance	0
XE	Short-Distance	31072
	Medium-Distance	54
	Long-Distance	0
YV	Short-Distance	13667
	Medium-Distance	58
	Long-Distance	0

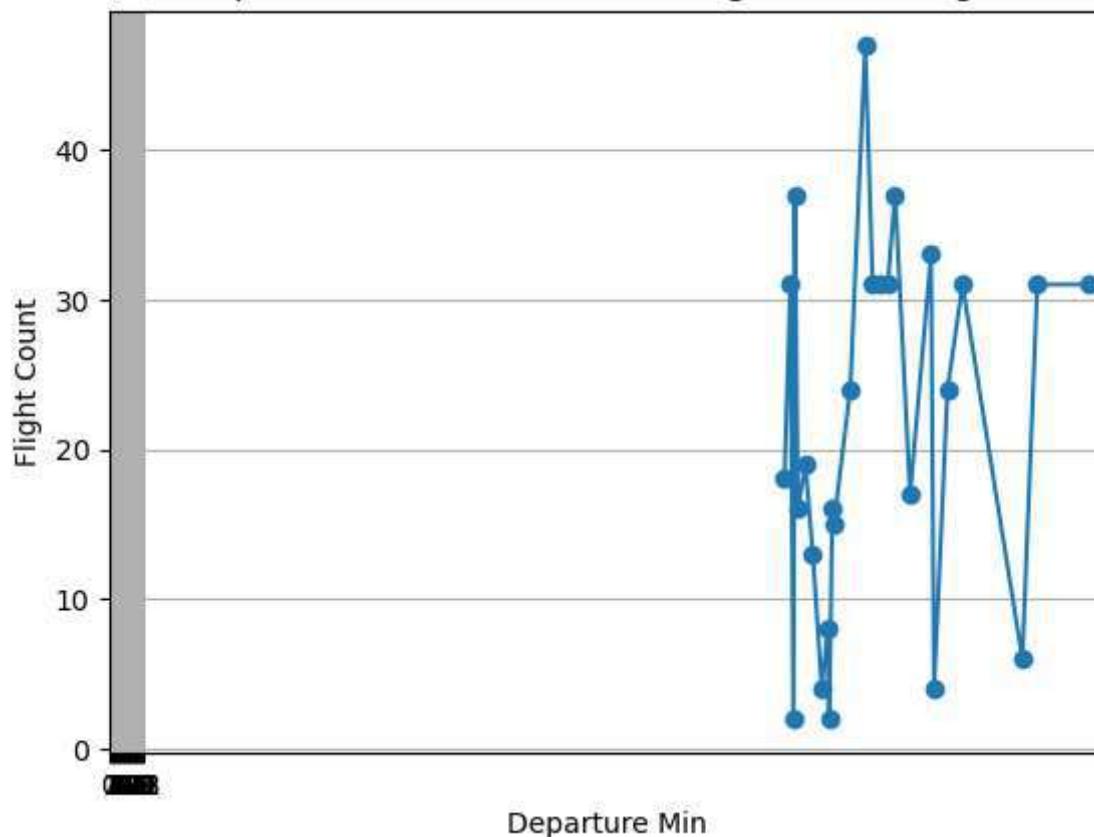
```
In [53]: Long_Duration_Flights = airlines[airlines['Travel_Category'] == 'Long-Distance']
Long_Duration_Flights.shape
```

```
Out[53]: (559, 10)
```

```
In [54]: departure_min_counts = Long_Duration_Flights['Length'].value_counts().sort_index()
```

```
In [55]: plt.plot(departure_min_counts.index, departure_min_counts.values, marker='o')
plt.xlabel('Departure Min')
plt.ylabel('Flight Count')
plt.title('Departure Time Patterns for Long-Duration Flights')
plt.xticks(range(24)) # Set x-axis ticks for each hour
plt.grid(True)
plt.show()
```

Departure Time Patterns for Long-Duration Flights



Null hypothesis (H0): The duration of a flight does not affect flight delays.

Alternative hypothesis (H1): The duration of a flight affects flight delays.

```
In [56]: short_delay = airlines[airlines['Travel_Category'] == 'Short-Distance']['Delay']
medium_delay = airlines[airlines['Travel_Category'] == 'Medium-Distance']['Delay']
long_delay = airlines[airlines['Travel_Category'] == 'Long-Distance']['Delay']
```

```
In [57]: # Perform one-way ANOVA
f_stat, p_value = f_oneway(short_delay, medium_delay, long_delay)
```

```
In [58]: print("F-Statistic: ", f_stat)
print("P-Value: ", p_value)
```

```
F-Statistic: 352.11904019127104
P-Value: 1.5149282534228687e-153
```

```
In [59]: # Interpret the results
alpha = 0.05

if p_value < alpha:
    print("Reject the null hypothesis.")
    print("There is a significant difference among the delay groups.")
else:
    print("Fail to reject the null hypothesis.")
    print("There is not enough evidence to conclude a significant difference among the")
```

Reject the null hypothesis.
There is a significant difference among the delay groups.

Null hypothesis (H0): The altitude of the airport does not affect flight delays.

Alternative hypothesis (H1): The altitude of the airport affects flight delays.

```
In [60]: t_stat, p_value = stats.ttest_ind((df['Delay']), (df['elevation_ft'].dropna()), equal_var=False)

In [61]: print("F-Statistic: ", f_stat)
print("P-Value: ", p_value)

F-Statistic: 352.11904019127104
P-Value: 0.0

In [62]: # Interpret the results
alpha = 0.05

if p_value < alpha:
    print("Reject the null hypothesis.")
    print("There is a significant difference among the delay groups.")
else:
    print("Fail to reject the null hypothesis.")
    print("There is not enough evidence to conclude a significant difference among the delay groups.")

Reject the null hypothesis.
There is a significant difference among the delay groups.
```

Null hypothesis (H0): The number of runways does not affect flight delays.

Alternative hypothesis (H1): The number of runways affects flight delays.

```
In [63]: t_stat, p_value = stats.ttest_ind((df['Delay']), (df['closed']), equal_var=False)

In [64]: print("F-Statistic: ", f_stat)
print("P-Value: ", p_value)

F-Statistic: 352.11904019127104
P-Value: 0.0

In [65]: # Interpret the results
alpha = 0.05

if p_value < alpha:
    print("Reject the null hypothesis.")
    print("There is a significant difference among the delay groups.")
else:
    print("Fail to reject the null hypothesis.")
    print("There is not enough evidence to conclude a significant difference among the delay groups.")

Reject the null hypothesis.
There is a significant difference among the delay groups.
```

Reject the null hypothesis.

There is a significant difference among the delay groups.

```
In [66]: columns_for_heatmap = ['elevation_ft', 'closed', 'Travel_Category']
```

```
In [74]: encoded_category = pd.get_dummies(df['Travel_Category'])
```

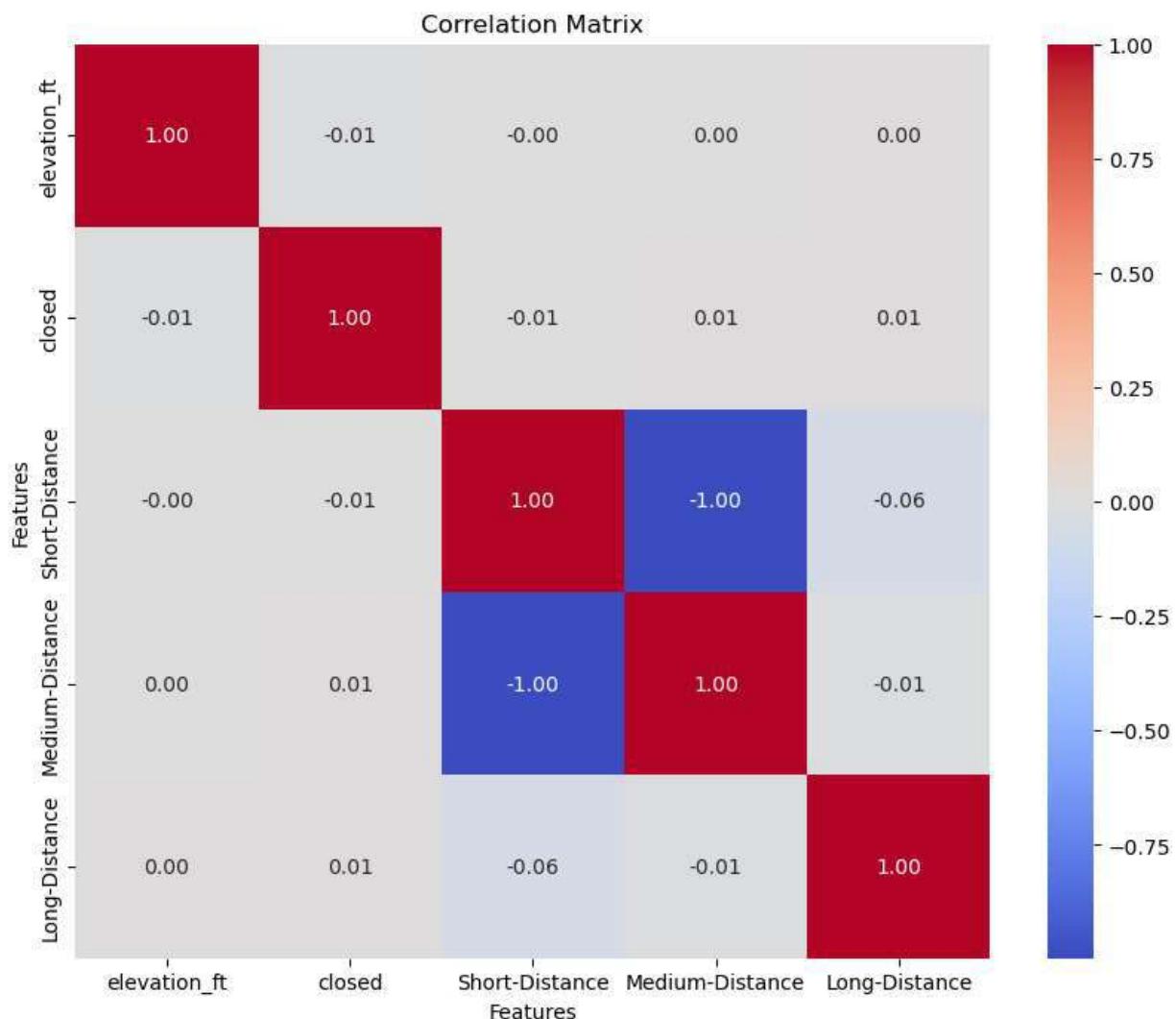
```
In [75]: heatmap_data = pd.concat([df[columns_for_heatmap[:-1]], encoded_category], axis=1)
```

```
In [76]: correlation_matrix = heatmap_data.corr()
```

```
In [77]: plt.figure(figsize=(10, 8))
sns.heatmap(correlation_matrix, annot=True, cmap='coolwarm', fmt=".2f", square=True)

plt.title('Correlation Matrix')
plt.xlabel('Features')
plt.ylabel('Features')

plt.show()
```



```
In [78]: df.head()
```

Out[78]:

	id_x	Airline	Flight	AirportFrom	AirportTo	DayOfWeek	Time	Length	Delay	Travel_Category
0	2	US	1558	PHX	CLT	3	15	222	1	Medium-Distance
1	3	AA	2400	LAX	DFW	3	20	165	1	Short-Distance
2	4	AA	2466	SFO	DFW	3	20	195	1	Short-Distance
3	5	AS	108	ANC	SEA	3	30	202	0	Short-Distance
4	7	DL	1768	LAX	MSP	3	30	220	0	Medium-Distance

5 rows × 46 columns

In [79]: `df.columns`

Out[79]:

```
Index(['id_x', 'Airline', 'Flight', 'AirportFrom', 'AirportTo', 'DayOfWeek',
       'Time', 'Length', 'Delay', 'Travel_Category', 'airport_ident', 'type',
       'name', 'latitude_deg', 'longitude_deg', 'elevation_ft', 'continent',
       'iso_country', 'iso_region', 'municipality', 'scheduled_service',
       'gps_code', 'iata_code', 'local_code', 'home_link', 'wikipedia_link',
       'keywords', 'id_y', 'airport_ref', 'length_ft', 'width_ft', 'surface',
       'lighted', 'closed', 'le_ident', 'le_latitude_deg', 'le_longitude_deg',
       'le_elevation_ft', 'le_heading_degT', 'le_displaced_threshold_ft',
       'he_ident', 'he_latitude_deg', 'he_longitude_deg', 'he_elevation_ft',
       'he_heading_degT', 'he_displaced_threshold_ft'],
      dtype='object')
```

In [108...]

```
columns_to_encode = ['Travel_Category', 'type', 'scheduled_service']
new_data = pd.get_dummies(df, columns=columns_to_encode)

new_data.head()
```

Out[108]:

	id_x	Airline	Flight	AirportFrom	AirportTo	DayOfWeek	Time	Length	Delay	airport_ident	...
0	2	US	1558	PHX	CLT	3	15	222	1	OM11	...
1	3	AA	2400	LAX	DFW	3	20	165	1	AGGH	...
2	4	AA	2466	SFO	DFW	3	20	195	1	AGGM	...
3	5	AS	108	ANC	SEA	3	30	202	0	AL-LA10	...
4	7	DL	1768	LAX	MSP	3	30	220	0	UD21	...

5 rows × 55 columns

In [109...]

```
columns_to_drop = ['Airline', 'Flight', 'AirportFrom', 'AirportTo', 'airport_ident',
new_data.drop(columns = columns_to_drop, inplace = True)
```

In [113...]

```
new_data.drop('he_ident', axis = 1, inplace = True)
```

In [117...]

```
new_data.dropna(axis = 1, inplace = True)
```

In [118]: `new_data.isnull().sum()`

Out[118]:

<code>id_x</code>	0
<code>DayOfWeek</code>	0
<code>Time</code>	0
<code>Length</code>	0
<code>Delay</code>	0
<code>latitude_deg</code>	0
<code>longitude_deg</code>	0
<code>id_y</code>	0
<code>airport_ref</code>	0
<code>lighted</code>	0
<code>closed</code>	0
<code>Travel_Category_Short-Distance</code>	0
<code>Travel_Category_Medium-Distance</code>	0
<code>Travel_Category_Long-Distance</code>	0
<code>type_balloonport</code>	0
<code>type_closed</code>	0
<code>type_heliport</code>	0
<code>type_large_airport</code>	0
<code>type_medium_airport</code>	0
<code>type_seaplane_base</code>	0
<code>type_small_airport</code>	0
<code>scheduled_service_no</code>	0
<code>scheduled_service_yes</code>	0

`dtype: int64`

In [110]: `new_data.head()`

Out[110]:

	<code>id_x</code>	<code>DayOfWeek</code>	<code>Time</code>	<code>Length</code>	<code>Delay</code>	<code>latitude_deg</code>	<code>longitude_deg</code>	<code>elevation_ft</code>	<code>id_y</code>	<code>airport</code>
0	2	3	15	222	1	24.526793	54.974812	88.0	232775	
1	3	3	20	165	1	-9.428000	160.054993	28.0	233754	
2	4	3	20	195	1	-8.327970	157.263000	10.0	233755	
3	5	3	30	202	0	40.085383	20.153890	666.0	232874	
4	7	3	30	220	0	40.294102	44.564602	4416.0	232877	

5 rows × 37 columns

In [119]: `X = new_data.drop('Delay', axis=1)`
`y = new_data['Delay']`

In [137]: `logistic_model = SGDClassifier(loss='log_loss', random_state=42)`
`logistic_model.fit(X, y)`

Out[137]:

`SGDClassifier`

`SGDClassifier(loss='log_loss', random_state=42)`

In [122]: `decision_tree_model = DecisionTreeClassifier(random_state=42)`
`decision_tree_model.fit(X, y)`

Out[122]:

DecisionTreeClassifier

DecisionTreeClassifier(random_state=42)

In [123...]

```
n_folds = 5
stratified_kfold = StratifiedKFold(n_splits=n_folds, random_state=42, shuffle=True)
logistic_scores = []
decision_tree_scores = []
```

In [128...]

```
# Perform cross-validation
for train_index, val_index in stratified_kfold.split(X, y):
    # Split the data into training and validation sets
    X_train, X_val = X.iloc[train_index], X.iloc[val_index]
    y_train, y_val = y.iloc[train_index], y.iloc[val_index]
```

In [129...]

```
# Fit the Logistic regression model
logistic_model.fit(X_train, y_train)

# Predict and calculate accuracy for logistic regression model
logistic_pred = logistic_model.predict(X_val)
logistic_accuracy = accuracy_score(y_val, logistic_pred)
logistic_scores.append(logistic_accuracy)

# Fit the decision tree model
decision_tree_model.fit(X_train, y_train)

# Predict and calculate accuracy for decision tree model
decision_tree_pred = decision_tree_model.predict(X_val)
decision_tree_accuracy = accuracy_score(y_val, decision_tree_pred)
decision_tree_scores.append(decision_tree_accuracy)
```

In [140...]

```
# Define the hyperparameter grid for Logistic regression
logistic_param_grid = {
    'alpha': [0.001, 0.01, 0.1],
    'max_iter': [100, 200, 300]
}

# Define the hyperparameter grid for decision tree
decision_tree_param_grid = {
    'max_depth': [None, 5, 10],
    'min_samples_split': [2, 5, 10]
}

# Create RandomizedSearchCV objects
logistic_search = RandomizedSearchCV(logistic_model, param_distributions=logistic_param_grid, n_iter=10, cv=5, scoring='accuracy', random_state=42)
decision_tree_search = RandomizedSearchCV(decision_tree_model, param_distributions=decision_tree_param_grid, n_iter=10, cv=5, scoring='accuracy', random_state=42)

# Fit the models with hyperparameter tuning
logistic_search.fit(X, y)
decision_tree_search.fit(X, y)

# Get the best hyperparameters for each model
best_logistic_params = logistic_search.best_params_
best_decision_tree_params = decision_tree_search.best_params_
```



```
In [139...]: # Create the SGDClassifier model
sgd_model = SGDClassifier(loss='log', random_state=42)

# Define the hyperparameter grid for SGDClassifier
sgd_param_grid = {
    'alpha': [0.0001, 0.001, 0.01],
    'penalty': ['l1', 'l2'],
    'max_iter': [100, 200, 300]
}

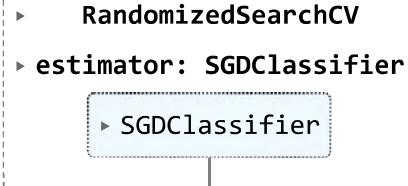
# Create the RandomizedSearchCV object for SGDClassifier
sgd_search = RandomizedSearchCV(sgd_model, param_distributions=sgd_param_grid, cv=KFold(5, shuffle=True))

# Fit the model with hyperparameter tuning
sgd_search.fit(X, y)
```



```
C:\Users\naray\anaconda3\lib\site-packages\sklearn\linear_model\_stochastic_gradient.py:173: FutureWarning: The loss 'log' was deprecated in v1.1 and will be removed in version 1.3. Use `loss='log_loss'` which is equivalent.
    warnings.warn(
C:\Users\naray\anaconda3\lib\site-packages\sklearn\linear_model\_stochastic_gradient.py:705: ConvergenceWarning: Maximum number of iteration reached before convergence. Consider increasing max_iter to improve the fit.
    warnings.warn(
```

```
Out[139]:
```



```
  ▶ RandomizedSearchCV
  ▶ estimator: SGDClassifier
    ▶ SGDClassifier
```

```
In [152]: xgb_classifier = XGBClassifier()
```

```
In [155]: n_folds = 5
stratified_kfold = StratifiedKFold(n_splits=n_folds, shuffle=True, random_state=42)

# Perform cross-validation using the XGBoost classifier
xgb_scores = cross_val_score(xgb_classifier, X, y, cv=stratified_kfold)
```

```
In [147]: best_logistic_params
```

```
Out[147]: {'max_iter': 200, 'alpha': 0.01}
```

```
In [148]: best_decision_tree_params
```

```
Out[148]: {'min_samples_split': 2, 'max_depth': None}
```

```
In [144]: best_sgd_params = sgd_search.best_params_
best_sgd_params
```

```
Out[144]: {'penalty': 'l2', 'max_iter': 100, 'alpha': 0.01}
```

```
In [150]: logistic_mean_accuracy = sum(logistic_scores) / len(logistic_scores)
decision_tree_mean_accuracy = sum(decision_tree_scores) / len(decision_tree_scores)

print("Logistic Regression Mean Accuracy:", logistic_mean_accuracy)
print("Decision Tree Mean Accuracy:", decision_tree_mean_accuracy)
```

```
Logistic Regression Mean Accuracy: 0.5807574327512978
Decision Tree Mean Accuracy: 0.6493629070316187
```

```
In [156]: print("XGBoost Classifier Mean Accuracy:", xgb_scores.mean())
```

```
XGBoost Classifier Mean Accuracy: 0.6683181451539499
```

```
In [ ]:
```