Importing necessary libraries

In [1]:
```
import numpy as np
import pandas as pd
import matplotlib.pyplot as plt
import seaborn as sns
import warnings
warnings.filterwarnings('ignore')
```

PROJECT TASK: WEEK 1

1. Import and aggregate data:

a. Collect information related to flights, airports (e.g., type of airport and elevation), and runways (e.g., length_ft, width_ft, surface, and number of runways). Gather all fields you believe might cause avoidable delays in one dataset. Hint: In this case, you would have to determine the keys to join the tables. A data description will be useful.

In [2]:
```
airport = pd.read_excel('airports.xlsx')
airlines = pd.read_excel('Airlines.xlsx')
runways = pd.read_excel('runways.xlsx')
```

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

Out[3]:

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

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

Out[4]:
```
(73805, 18)
```

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

Out[5]:

	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 [6]:
```
airlines.shape
```

Out[6]:
```
(518556, 9)
```

In [7]:
```
runways.head()
```

Out[7]:

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

In [8]:
```
runways.shape
```

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

lets drop the columns that will not play an important role in the model building

In [9]:
```
runways.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 43977 entries, 0 to 43976
Data columns (total 20 columns):
 #   Column                  Non-Null Count  Dtype  
---  ------                  --------------  -----  
 0   id                      43977 non-null  int64  
 1   airport_ref             43977 non-null  int64  
 2   airport_ident           43977 non-null  object 
 3   length_ft               43753 non-null  float64
 4   width_ft                41088 non-null  float64
 5   surface                 43520 non-null  object 
 6   lighted                 43977 non-null  int64  
 7   closed                  43977 non-null  int64  
 8   le_ident                43793 non-null  object 
 9   le_latitude_deg         15016 non-null  float64
 10  le_longitude_deg        15000 non-null  float64
 11  le_elevation_ft         12781 non-null  float64
 12  le_heading_degT         14624 non-null  float64
 13  le_displaced_threshold_ft  2883 non-null   float64
 14  he_ident                37332 non-null  object 
 15  he_latitude_deg         14971 non-null  float64
 16  he_longitude_deg        14973 non-null  float64
 17  he_elevation_ft         12620 non-null  float64
 18  he_heading_degT         16428 non-null  float64
 19  he_displaced_threshold_ft  3176 non-null   float64
dtypes: float64(12), int64(4), object(4)
memory usage: 6.7+ MB
```

In [10]:
```
runways.drop(['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_displaced_threshold_ft'], axis = 1,inplace=True)
```

In [11]:
```
runways.head()
```

Out[11]:

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

In [12]:
```
airport.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 73805 entries, 0 to 73804
Data columns (total 18 columns):
 #   Column            Non-Null Count  Dtype  
---  ------            --------------  -----  
 0   id                73805 non-null  int64  
 1   ident             73805 non-null  object 
 2   type              73805 non-null  object 
 3   name              73805 non-null  object 
 4   latitude_deg      73805 non-null  float64
 5   longitude_deg     73805 non-null  float64
 6   elevation_ft      59683 non-null  float64
 7   continent         38086 non-null  object 
 8   iso_country       73546 non-null  object 
 9   iso_region        73805 non-null  object 
 10  municipality      68739 non-null  object 
 11  scheduled_service 73805 non-null  object 
 12  gps_code          42996 non-null  object 
 13  iata_code         9160 non-null   object 
 14  local_code        32975 non-null  object 
 15  home_link         3492 non-null   object 
 16  wikipedia_link    10705 non-null  object 
 17  keywords          13951 non-null  object 
dtypes: float64(3), int64(1), object(14)
memory usage: 10.1+ MB
```

In [13]:
```
airport.drop(['continent', 'iso_country', 'iso_region','municipality', 'gps_code','local_code', 'home_li
            'wikipedia_link', 'keywords'], axis=1, inplace=True)
airport
```

Out[13]:

	id	ident	type	name	latitude_deg	longitude_deg	elevation_ft	scheduled_service	iata_code
0	6523	00A	heliport	Total Rf Heliport	40.070801	-74.933601	11.0	no	NaN
1	323361	00AA	small_airport	Aero B Ranch Airport	38.704022	-101.473911	3435.0	no	NaN
2	6524	00AK	small_airport	Lowell Field	59.947733	-151.692524	450.0	no	NaN
3	6525	00AL	small_airport	Epps Airpark	34.864799	-86.770302	820.0	no	NaN
4	6526	00AR	closed	Newport Hospital & Clinic Heliport	35.608700	-91.254898	237.0	no	NaN
...	...	...	...	...	...	...	...	...	...
73800	46378	ZZ-0001	heliport	Sealand Helipad	51.894444	1.482500	40.0	no	NaN
73801	307326	ZZ-0002	small_airport	Glorioso Islands Airstrip	-11.584278	47.296389	11.0	no	NaN
73802	346788	ZZ-0003	small_airport	Fainting Goat Airport	32.110587	-97.356312	690.0	no	NaN
73803	342102	ZZZW	closed	Scandium City Heliport	69.355287	-138.939310	4.0	no	ZYW
73804	313629	ZZZZ	small_airport	Satsuma I≈çjima Airport	30.784722	130.270556	338.0	no	NaN

73805 rows × 9 columns

merge the runways and airport data.

In [14]:
```
airport_runway = pd.merge(airport, runways, left_on = "ident", right_on = "airport_ident")
```

In [15]:
```
airport_runway.drop(['id_x', 'id_y'], axis=1, inplace=True)
```

In [16]:
```
airport_runway
```

Out[16]:

	ident	type	name	latitude_deg	longitude_deg	elevation_ft	scheduled_service	iata_code	airpor
0	00A	heliport	Total Rf Heliport	40.070801	-74.933601	11.0	no	NaN	
1	00AK	small_airport	Lowell Field	59.947733	-151.692524	450.0	no	NaN	
2	00AL	small_airport	Epps Airpark	34.864799	-86.770302	820.0	no	NaN	
3	00AR	closed	Newport Hospital & Clinic Heliport	35.608700	-91.254898	237.0	no	NaN	
4	00AS	small_airport	Fulton Airport	34.942803	-97.818019	1100.0	no	NaN	32
...	...	...	...	...	...	...	...	...	
43972	ZYTX	large_airport	Shenyang Taoxian International Airport	41.639801	123.483002	198.0	yes	SHE	2
43973	ZYYJ	medium_airport	Yanji Chaoyangchuan Airport	42.882801	129.451004	624.0	yes	YNJ	2
43974	ZYYK	medium_airport	Yingkou Lanqi Airport	40.542524	122.358600	NaN	yes	YKH	31
43975	ZZ-0003	small_airport	Fainting Goat Airport	32.110587	-97.356312	690.0	no	NaN	34
43976	ZZZZ	small_airport	Satsuma I≈çjima Airport	30.784722	130.270556	338.0	no	NaN	31

43977 rows × 15 columns

merge the final column airline.

In [17]:
```
final_df = pd.merge(airlines,airport_runway,how = "inner", left_on = "AirportFrom", right_on = "iata_cod
```

In [18]:
```
final_df.drop_duplicates(subset=['id'], keep='first', inplace=True)
final_df
```

Out[18]:

	id	Airline	Flight	AirportFrom	AirportTo	DayOfWeek	Time	Length	Delay	ident	...	elevation_ft	sched
0	1	CO	269	SFO	IAH	3	15	205	1	KSFO	...	13.0	
4	4	AA	2466	SFO	DFW	3	20	195	1	KSFO	...	13.0	
8	9	DL	2606	SFO	MSP	3	35	216	1	KSFO	...	13.0	
12	129	DL	1580	SFO	DTW	3	345	270	0	KSFO	...	13.0	
16	150	UA	756	SFO	DEN	3	348	158	0	KSFO	...	13.0	
...	...	...	...	...	...	...	...	...	...	...	...	...	
2160266	451344	CO	2	GUM	HNL	1	400	430	1	PGUM	...	298.0	
2160268	469866	CO	2	GUM	HNL	2	400	430	1	PGUM	...	298.0	
2160270	488365	CO	2	GUM	HNL	3	400	430	0	PGUM	...	298.0	
2160272	506855	CO	2	GUM	HNL	4	400	430	1	PGUM	...	298.0	
2160274	525138	CO	2	GUM	HNL	5	400	430	1	PGUM	...	298.0	

518525 rows × 24 columns

b. When it comes to on-time arrivals, different airlines perform differently based on the amount of experience they have. The major airlines in this field include US Airways Express (founded in 1967) Continental Airlines (founded in 1934), and Express Jet (founded in 19860. Pull such information specific to various airlines from the Wikipedia page link given below.https://en.wikipedia.org/wiki/List_of_airlines_of_the_United_States.

Hint: Here, you should use web scraping to learn how long an airline has been operating.

In [19]:
```
url = "https://en.wikipedia.org/wiki/List_of_airlines_of_the_United_States"
tables = pd.read_html(url)
```

In [20]:
```
print(tables)
```

```
[    0                                                  1
0 NaN  This article does not cite any sources. Please...,                 Airline  Image IATA ICAO
Callsign  \
0        Alaska Airlines    NaN   AS  ASA           ALASKA
1          Allegiant Air    NaN   G4  AAY        ALLEGIANT
2      American Airlines    NaN   AA  AAL         AMERICAN
3         Avelo Airlines    NaN   XP  VXP            AVELO
4         Breeze Airways    NaN   MX  MXY             MOXY
5        Delta Air Lines    NaN   DL  DAL            DELTA
6       Eastern Airlines    NaN   2D  EAL          EASTERN
7      Frontier Airlines    NaN   F9  FFT  FRONTIER FLIGHT
8      Hawaiian Airlines    NaN   HA  HAL         HAWAIIAN
9                JetBlue    NaN   B6  JBU          JETBLUE
10    Southwest Airlines    NaN   WN  SWA        SOUTHWEST
11       Spirit Airlines    NaN   NK  NKS     SPIRIT WINGS
12  Sun Country Airlines    NaN   SY  SCX      SUN COUNTRY
13       United Airlines    NaN   UA  UAL           UNITED

                         Primary hubs, Secondary hubs  Founded  \
0   Seattle/TacomaAnchoragePortland (OR)San Franci...     1932
1   Las VegasCincinnatiFort Walton BeachIndianapol...     1997
2   Dallas/Fort WorthCharlotteChicago-O'HareLos An...     1926
3                            BurbankNew HavenOrlando     1987
4      CharlestonHartfordNew OrleansNorfolkProvoTampa     2018
5   AtlantaBostonDetroitLos AngelesMinneapolis/St....     1924
6                                  MiamiNew York-JFK     2010
7   DenverAtlantaChicago-O'HareCincinnatiCleveland...     1994
8                                   HonoluluKahului     1929
9   New York-JFKBostonLos AngelesFort LauderdaleOr...     1998
10  Dallas-LoveAtlantaBaltimoreChicago-MidwayDenve...     1967
11  Atlantic CityDetroitLas VegasFort LauderdaleCh...     1980
12     Minneapolis/St. PaulDallas/Fort WorthLas Vegas     1982
13  Chicago-O'HareDenverGuamHouston-Intercontinent...     1926

                                              Notes
0   Founded as McGee Airways and commenced operati...
1   Founded as WestJet Express and commenced opera...
2   Founded as American Airways and commenced oper...
3   First did business as Casino Express Airlines ...
4                                                 NaN
5   Founded as Huff Daland Dusters and commenced o...
6                                                 NaN
7                                                 NaN
8   Founded as Inter-Island Airways in early 1929 ...
9   Founded as New Air and commenced operations in...
10  Founded as Air Southwest and commenced operati...
11                          Founded as Charter One.
12  Commenced operations in 1983.Operates some Ama...
13  Founded as Varney Air Lines and commenced oper...  ,              Airline  Image IATA ICAO      Cal
lsign  \
0       Air Wisconsin    NaN   ZW  AWI     WISCONSIN
1            Cape Air    NaN   9K  KAP          CAIR
2           CommutAir    NaN   C5  UCA     COMMUTAIR
3    Contour Airlines    NaN   LF  VTE     VOLUNTEER
4       Elite Airways    NaN   7Q  MNU        MAINER
5        Endeavor Air    NaN   9E  EDV      ENDEAVOR
6           Envoy Air    NaN   MQ  ENY         ENVOY
7      GoJet Airlines    NaN   G7  GJS     LINDBERGH
8         Horizon Air    NaN   QX  QXE       HORIZON
9       Mesa Airlines    NaN   YV  ASH   AIR SHUTTLE
10  Piedmont Airlines    NaN   PT  PDT      PIEDMONT
11       PSA Airlines    NaN   OH  JIA   BLUE STREAK
12   Republic Airways    NaN   YX  RPA     BRICKYARD
13     Silver Airways    NaN   3M  SIL  SILVER WINGS
14   SkyWest Airlines    NaN   OO  SKW       SKYWEST

                         Primary Hubs, Secondary Hubs  Founded  \
0   AppletonChicago-O'HareColumbiaMilwaukeeWashing...     1965
1   HyannisBillingsBostonNantucketSt. LouisSan Jua...     1988
2                      DenverNewarkWashington-Dulles     1989
3                                        Smyrna (TN)     1982
4             Melbourne/OrlandoNewarkPortland (Maine)     2006
5   Minneapolis/St. PaulAtlanta CincinnatiDetroitN...     1985
6               Dallas/Fort WorthChicago-O'Hare Miami     1984
7                                 Chicago-O'HareDenver     2004
8                           Seattle/TacomaPortland (OR)     1981
9   As American Eagle:Phoenix-Sky HarborDallas/For...     1980
10           CharlottePhiladelphiaWashington-National     1961
```

```
11          CharlottePhiladelphiaWashington-National     1979
12  As American Eagle:IndianapolisColumbus (OH)Kan...     1998
13                        Fort LauderdaleOrlandoTampa     2011
14  As Delta Connection:AtlantaBoiseColorado Sprin...     1972

                                                Notes
0                         Operates as United Express
1                                                NaN
2                        Operates as United Express.
3                                                NaN
4                        Commenced operations in 2014.
5   Founded as Express Airlines I. Operates as Del...
6   Founded as American Eagle Airlines. Operates a...
7   Commenced operations in 2005. Operates as Unit...
8                       Operates as Alaska Airlines.
9   Founded as Mesa Air Shuttle. All but one aircr...
10  Founded as Henson Aviation and commenced opera...
11  Founded as Vee Neal Airlines. Operates as Amer...
12  Commenced operations in 2005. Operates as Amer...
13                                               NaN
14  Operates as Delta Connection, United Express, ...  ,                         Airline  Image IATA IC
AO     Callsign  \
0                 Advanced Air    NaN   AN  WSN      WINGSPAN
1                 Air Sunshine    NaN   YI  RSI  AIR SUNSHINE
2                   Bering Air    NaN   8E  BRG    BERING AIR
3                 Boutique Air    NaN   4B  BTQ      BOUTIQUE
4                   Everts Air    NaN   5V  VTS        EVERTS
5                      Gem Air    NaN  NaN  NaN           NaN
6          Grand Canyon Airlines    NaN   YR  CVU   CANYON VIEW
7   Grand Canyon Scenic Airlines    NaN   YR  SCE        SCENIC
8                Grant Aviation    NaN   GV  GUN          HOOT
9       Griffing Flying Service    NaN  NaN  NaN           NaN
10               Island Airways    NaN  NaN  NaN           NaN
11                          JSX    NaN   XE  JSX     BIGSTRIPE
12                  Kenmore Air    NaN   M5  KEN       KENMORE
13                 Key Lime Air    NaN   KG  LYM      KEY LIME
14            Mokulele Airlines    NaN   MW  MHO        MAHALO
15          New England Airlines    NaN   EJ  NEA   NEW ENGLAND
16          Penobscot Island Air    NaN  NaN  NaN           NaN
17                  Reliant Air    NaN  NaN  RLI       RELIANT
18            San Juan Airlines    NaN  NaN  NaN      SKYFERRY
19                  Servant Air    NaN   8D  NaN           NaN
20      Southern Airways Express    NaN   9X  FDY      FRIENDLY
21                     Surf Air    NaN  NaN   UF       SURFAIR
22                   Taquan Air    NaN   K3  TQN        TAQUAN
23           Tradewind Aviation    NaN   TJ  GPD     GOODSPEED
24          Ultimate Air Shuttle    NaN   UE  UJC      ULTIMATE
25                 Utah Airways    NaN  NaN  NaN           NaN
26      Warbelow's Air Ventures    NaN   4W  WAV      WARBELOW
27           Wright Air Service    NaN   8V  WRF  WRIGHT FLYER

                      Primary Hubs, Secondary Hubs  Founded  \
0                                        Hawthorne     2005
1                                         San Juan     1982
2                            NomeKotzebueUnalakleet     1979
3          Dallas/Fort WorthDenverPhoenix-Sky Harbor     2007
4                               FairbanksAnchorage     1978
5                                           Salmon     2014
6                     Boulder CityGrand CanyonPage     1927
7                                     Grand Canyon     1967
8   AnchorageBethelCold BayDillinghamEmmonakKenaiK...     1971
9                                     Port Clinton     1937
10                                      Charlevoix     1945
11     BurbankOaklandLas VegasSanta AnaPhoenixConcord     2016
12           KenmoreSeattle-Lake UnionSeattle-Boeing     1946
13  Denver-CentennialDenverDenver-Rocky MountainGr...     1997
14                              Kailua-KonaKahului     1994
15                                        Westerly     1970
16                                        Rockland     2004
17                                         Danbury     1988
18                                      Bellingham     2002
19                                          Kodiak     2003
20          MemphisDestinPittsburghWashington-Dulles     2013
21     HawthorneOaklandSan CarlosSanta BarbaraTruckee     2012
22                                 Ketchikan Harbor     1977
23                  Oxford (CT)San Juan White Plains     2001
24                                 Cincinnati-Lunken     2009
25                                           Ogden     2015
```

```
26                                      Fairbanks     1958
27                                      Fairbanks     1966

                                                 Notes
0   Has the EAS contract to serve Grant County Air...
1                                                  NaN
2                                                  NaN
3                                                  NaN
4                 Founded as Tatonduk Flying Service.
5                                                  NaN
6                           Founded as Scenic Airways.
7                          Founded as Scenic Airlines.
8                       Founded as Delta Air Services.
9                                                  NaN
10              Founded as McPhillips Flying Service.
11             Operator of Taos Air flights from 2022.
12                     Founded as Mines Collins Munro.
13                  Operates as Denver Air Connection.
14                 Founded as Mokulele Flight Service.
15                                                 NaN
16                                                 NaN
17                                                 NaN
18                                                 NaN
19                                                 NaN
20                                                 NaN
21                                                 NaN
22                                                 NaN
23                                                 NaN
24                                                 NaN
25                                                 NaN
26                                                 NaN
27                                                 NaN  ,                                Airline  Image IA
TA ICAO        Callsign  \
0                  Air Charter Bahamas    NaN  NaN  NaN             NaN
1                  Air Flight Charters    NaN  NaN  FLL             NaN
2                            Airshare    NaN  NaN  XSR        AIRSHARE
3                       Berry Aviation    NaN  NaN  BYA           BERRY
4                     Bighorn Airways    NaN  NaN  BHR     BIGHORN AIR
5                Charter Air Transport    NaN   VC  SRY        STINGRAY
6                      Choice Airways    NaN  NaN  CSX      CHOICE AIR
7                           ExcelAire    NaN  NaN  XLS       EXCELAIRE
8              Global Crossing Airlines    NaN   G6  GXA          GEMINI
9                       Great Lakes Air    NaN  NaN  NaN             NaN
10                    Gryphon Airlines    NaN   Y3  VOS             NaN
11                       IAero Airways    NaN   WQ  SWQ     SWIFTFLIGHT
12                         IBC Airways    NaN   II  CSQ         CHASQUI
13  L-3 Flight International Aviation    NaN  NaN  RTD         RIPTIDE
14              Liberty Jet Management    NaN  NaN  LRT     LIBERTY JET
15                              NetJets    NaN   1I  EJA         EXECJET
16              Omni Air International    NaN   X9  OAE    OMNI-EXPRESS
17                  Omni Air Transport    NaN  NaN  DRL         DRILLER
18                   Pacific Coast Jet    NaN  NaN  PXT      PACK COAST
19                  Pentastar Aviation    NaN  NaN  DCX           TANGO
20                         Phoenix Air    NaN  NaN  PHA       GRAY BIRD
21                          PlaneSense    NaN  NaN  CNS         CHRONOS
22                Presidential Airways    NaN  NaN  PRD    PRESIDENTIAL
23             Sierra Pacific Airlines    NaN   SI  SPA  SIERRA PACIFIC
24                               Skymax    NaN  NaN  SMX          SKYMAX
25                   Stampede Aviation    NaN  NaN  NaN             NaN
26                 Superior Air Charter    NaN  NaN  RSP       REDSTRIPE
27                    Superior Aviation    NaN   SO  HKA       SPEND AIR
28                  Talkeetna Air Taxi    NaN  NaN  NaN             NaN
29                Tropic Ocean Airways    NaN  NaN  NaN             NaN
30             World Atlantic Airlines    NaN   K8  WAL  WORLD ATLANTIC
31                  XOJET Aviation LLC    NaN  NaN  XOJ           XOJET

   Primary Hubs, Secondary Hubs  Founded  \
0                           NaN      NaN
1                Fort Lauderdale   1987.0
2                           NaN   2000.0
3                     San Marcos   1983.0
4                       Sheridan   1947.0
5             Cleveland-Lakefront   1997.0
6       Fort Lauderdale-Executive   2009.0
7               Long Island/Islip   1993.0
8     Atlantic CityLas VegasMiami   2019.0
9                     St. Ignace      NaN
10                          NaN      NaN
```

```
11                   Miami   1997.0
12         Fort Lauderdale   1991.0
13            Newport News   1972.0
14       Long Island/Islip   2006.0
15                Columbus   1964.0
16                   Tulsa   1993.0
17                   Tulsa      NaN
18                     NaN   2006.0
19               Waterford   1964.0
20            Cartersville   1978.0
21         Portsmouth (NH)   1992.0
22       Melbourne/Orlando      NaN
23                  Tucson   1970.0
24         Fort Lauderdale   1997.0
25         Healy/Denali NP   2011.0
26                     NaN   2006.0
27                 Lansing   1979.0
28               Talkeetna   1947.0
29         Fort Lauderdale   2009.0
30                   Miami   2002.0
31    Sacramento-McClellan   2006.0

                                                Notes
0                                                 NaN
1                                                 NaN
2                  Founded as Executive Flight Services
3                                                 NaN
4                                                 NaN
5                                                 NaN
6                                                 NaN
7                                                 NaN
8                                                 NaN
9                                                 NaN
10                                                NaN
11                                Founded as Swift Air
12                                                NaN
13                                                NaN
14                                                NaN
15                 Founded as Executive Jets Aviation.
16                                                NaN
17                                                NaN
18                                                NaN
19             Founded as Chrysler Air Transportation.
20                                                NaN
21                                                NaN
22                                                NaN
23                       Commenced operations in 1971.
24                       Commenced operations in 2013.
25                                                NaN
26                                                NaN
27                                                NaN
28                 Founded as Talkeetna Flying Service.
29                                                NaN
30  Founded as Caribbean Sun Airlines and commence...
31                                                NaN  ,                        Airline  Image IATA  IC
AO        Callsign  \
0                   21 Air    NaN   2I   CSB      CARGO SOUTH
1                  ABX Air    NaN   GB   ABX             ABEX
2       Air Cargo Carriers    NaN   2Q   SNC      NIGHT CARGO
3           AirNet Express    NaN  NaN   USC       STAR CHECK
4  Air Transport International    NaN   8C   ATN    AIR TRANSPORT
5    Alaska Central Express    NaN   KO   AER          ACE AIR
6          Aloha Air Cargo    NaN   KH   AAH            ALOHA
7       Alpine Air Express    NaN   5A   AIP       ALPINE AIR
8               Amazon Air    NaN  AFW  KAFW       AMAZON AIR
9              Ameriflight    NaN   A8   AMF         AMFLIGHT
10     Amerijet International    NaN   M6   AJT         AMERIJET
11     Ameristar Jet Charter    NaN   7Z   AJI        AMERISTAR
12     Asia Pacific Airlines    NaN   P9   MGE         MAGELLAN
13               Atlas Air    NaN   5Y   GTI            GIANT
14        Bemidji Airlines    NaN   CH   BMJ          BEMIDJI
15         Castle Aviation    NaN  NaN   CSJ           CASTLE
16           Corporate Air    NaN  NaN   CPT          AIRSPUR
17                 CSA Air    NaN  NaN   IRO         IRON AIR
18         Empire Airlines    NaN   EM   CFS           EMPIRE
19        Everts Air Cargo    NaN   5V   VTS           EVERTS
20           FedEx Express    NaN   FX   FDX            FEDEX
21   Freight Runners Express    NaN  NaN   FRG  FREIGHT RUNNERS
```

22	IFL Group	NaN	IF	IFL	EIFFEL	
23	Kalitta Air	NaN	K4	CKS	CONNIE	
24	Kalitta Charters	NaN	CB	KFS	KALITTA	
25	Lynden Air Cargo	NaN	L2	LYC	LYNDEN	
26	Martinaire	NaN	NaN	MRA	MARTEX	
27	Merlin Airways	NaN	NaN	MEI	AVALON	
28	Mountain Air Cargo	NaN	C2	MTN	MOUNTAIN	
29	National Airlines	NaN	N8	NCR	NATIONAL CARGO	
30	Northern Air Cargo	NaN	NC	NAC	YUKON	
31	Polar Air Cargo	NaN	PO	PAC	POLAR	
32	Royal Air Freight	NaN	NaN	RAX	AIR ROYAL	
33	Ryan Air Services	NaN	7S	RYA	RYAN AIR	
34	Sky Lease Cargo	NaN	GG	KYE	SKY CUBE	
35	Skyway Enterprises	NaN	KI	SKZ	SKYWAY-INC	
36	Strat Air	NaN	NaN	NaN	NaN	
37	Trans Executive Airlines	NaN	KH	MUI	RHOADES EXPRESS	
38	UPS Airlines	NaN	5X	UPS	UPS	
39	USA Jet Airlines	NaN	UJ	JUS	JET USA	
40	West Air	NaN	NaN	PCM	PAC VALLEY	
41	Western Global Airlines	NaN	KD	WGN	WESTERN GLOBAL	
42	Wiggins Airways	NaN	WG	WIG	WIGGINS AIRWAYS	

	Primary Hubs, Secondary Hubs	Founded	\
0	Miami	2014.0	
1	Wilmington (OH)CincinnatiMiami	1980.0	
2	MilwaukeeCincinnati	1986.0	
3	Columbus-Rickenbacker	1974.0	
4	Wilmington (OH)Cincinnati	1978.0	
5	Anchorage	1996.0	
6	Honolulu	1946.0	
7	ProvoBillingsSioux Falls	1971.0	
8	Fort Worth/AllianceCincinnatiLeipzig/HalleSan ...	2015.0	
9	Dallas/Fort Worth	1968.0	
10	MiamiPort of Spain	1974.0	
11	Dallas-AddisonEl PasoWillow Run	2000.0	
12	GuamHonolulu	1998.0	
13	New York-JFKAnchorageCincinnatiHoustonHuntsvil...	1992.0	
14	BemidjiMinneapolis/St. Paul	1946.0	
15	Akron/Canton	1986.0	
16	Billings	1981.0	
17	Iron Mountain	1998.0	
18	Coeur d' AleneSpokane	1977.0	
19	FairbanksAnchorage	1995.0	
20	MemphisAnchorageCologne/BonnDubaiFort WorthGre...	1971.0	
21	Milwaukee	1985.0	
22	WaterfordMiami	1983.0	
23	YpsilantiAnchorageBahrainCincinnatiHong KongNe...	1967.0	
24	Ypsilanti	NaN	
25	Anchorage	1995.0	
26	Addison	1978.0	
27	BillingsMiamiSan Juan	1983.0	
28	Kinston	1974.0	
29	Orlando/Sanford	1985.0	
30	AnchorageMiami	1956.0	
31	AnchorageCincinnatiHong KongHonoluluLos Angele...	1993.0	
32	Waterford	1961.0	
33	AnchorageAniakBethelEmmonakKotzebueNomeSt. Mar...	1953.0	
34	Miami	1969.0	
35	NaN	1981.0	
36	Miami	2018.0	
37	Honolulu	1982.0	
38	LouisvilleChicago/RockfordCologne/BonnColumbia...	1988.0	
39	YpsilantiLaredo	1994.0	
40	Las VegasOaklandOntarioSacramentoSan Diego	1988.0	
41	Miami Liege, Belgium; AnchorageFort Myers, FL	2013.0	
42	Manchester	1929.0	

	Notes
0	NaN
1	Founded as Airborne Express. Operates some Ama...
2	Commenced operations in 1980.
3	Founded as Financial Air Express.
4	Founded as US Airways and commenced operations...
5	NaN
6	Founded as Trans-Pacific Airlines and separate...
7	NaN
8	Formerly Amazon Prime Air
9	Founded as California Air Charter.

```
10                                              NaN
11                                              NaN
12                                              NaN
13  Commenced operations in 1993. Operates some Am...
14                      Commenced operations in 1947.
15                                              NaN
16                                              NaN
17                                              NaN
18                                              NaN
19                                              NaN
20  Founded as Federal Express and commenced opera...
21                                              NaN
22                     Founded as Air Contract Cargo.
23          Founded as American International Airways.
24                                              NaN
25                                              NaN
26                                              NaN
27                                              NaN
28                                              NaN
29                      Commenced operations in 1986.
30                                              NaN
31                                              NaN
32                                              NaN
33                    Founded as Unalakleet Air Taxi.
34  Founded as Wrangler Aviation and commenced ope...
35                      Commenced operations in 1983.
36                                              NaN
37                                              NaN
38                                              NaN
39                                              NaN
40                                              NaN
41                                              NaN
42                                              NaN  ,                  Airline  Image  IATA  ICAO  Ca
llsign  \
0   AirMed International    NaN   NaN   NaN       NaN
1            Air Methods    NaN   NaN   NaN       NaN
2  Critical Air Medicine    NaN   NaN   NaN       NaN
3               Lifestar    NaN   NaN   NaN       NaN
4              Life Lion    NaN   NaN   NaN       NaN

  Primary Hubs, Secondary Hubs  Founded                              Notes
0     Birmingham-Shuttlesworth   1987.0  Founded as MEDjet International.
1            Denver-Centennial   1980.0                               NaN
2                          NaN   1984.0                               NaN
3                          NaN      NaN                               NaN
4                          NaN      NaN                               NaN  ,
Airline  Image  IATA ICAO  \
0                                         Comco    NaN   NaN  NaN
1                                         Janet    NaN   NaN  WWW
2  Justice Prisoner and Alien Transportation System    NaN   NaN  JUD

  Callsign Primary Hubs, Secondary Hubs  Founded  \
0      NaN                          NaN     2002
1    JANET                    Las Vegas     1972
2  JUSTICE                Oklahoma City     1980

                          Notes
0                           NaN
1                           NaN
2  Commenced operations in 1995.  ,                                  vteLists of airlines  \
0                                  By airline codes
1                                      By continent
2                                        By country
3                           vteExpand for full list
4   A Abkhazia Afghanistan Akrotiri and Dhekelia Å...
5                                                 A
6                                                 B
7                                                 C
8                                                 D
9                                                 E
10                                                F
11                                                G
12                                                H
13                                                I
14                                                J
15                                                K
16                                                L
17                                                M
```

```
18                                                  N
19                                                  O
20                                                  P
21                                                  Q
22                                                  R
23                                                  S
24                                                  T
25  U Uganda Ukraine United Arab Emirates United K...
26                                                  U
27                                                  V
28                                                  W
29                                                  Y
30                                                  Z
31                                          See also

                                vteLists of airlines.1
0   All 0-9 A B C D E F G H I J K L M N O P Q R S ...
1                 Africa Americas Asia Europe Oceania
2   vteExpand for full listA Abkhazia Afghanistan ...
3                             vteExpand for full list
4   A Abkhazia Afghanistan Akrotiri and Dhekelia Å...
5   Abkhazia Afghanistan Akrotiri and Dhekelia Åla...
6   The Bahamas Bahrain Bangladesh Barbados Belaru...
7   Cambodia Cameroon Canada Cape Verde Cayman Isl...
8   Denmark Dhekelia Djibouti Dominica Dominican R...
9   East Timor Ecuador Egypt El Salvador Equatoria...
10  Falkland Islands Faroe Islands Fiji Finland Fr...
11  Gabon The Gambia Georgia Germany Ghana Gibralt...
12                    Haiti Honduras Hong Kong Hungary
13  Iceland India Indonesia Iran Iraq Ireland Isra...
14                         Jamaica Japan Jersey Jordan
15  Kazakhstan Kenya Kiribati North Korea South Ko...
16  Laos Latvia Lebanon Lesotho Liberia Libya Liec...
17  Macau Macedonia, Republic of Madagascar Malawi...
18  Namibia Nauru Nepal Netherlands Netherlands An...
19                                                Oman
20  Pakistan Palau Palestine Panama Papua New Guin...
21                                              Qatar
22                               Romania Russia Rwanda
23  Sahrawi Arab Democratic Republic Saint Barthél...
24  Taiwan Tajikistan Tanzania Thailand Togo Tokel...
25  U Uganda Ukraine United Arab Emirates United K...
26  Uganda Ukraine United Arab Emirates United Kin...
27  Vanuatu Vatican City Venezuela Vietnam British...
28                                    Wallis and Futuna
29                                                Yemen
30                                      Zambia Zimbabwe
31  List of airline holding companies List of airl...  ,                              vteExpand for ful
l list  \
0   A Abkhazia Afghanistan Akrotiri and Dhekelia Å...
1                                                   A
2                                                   B
3                                                   C
4                                                   D
5                                                   E
6                                                   F
7                                                   G
8                                                   H
9                                                   I
10                                                  J
11                                                  K
12                                                  L
13                                                  M
14                                                  N
15                                                  O
16                                                  P
17                                                  Q
18                                                  R
19                                                  S
20                                                  T
21  U Uganda Ukraine United Arab Emirates United K...
22                                                  U
23                                                  V
24                                                  W
25                                                  Y
26                                                  Z

                              vteExpand for full list.1
```

```
0   A Abkhazia Afghanistan Akrotiri and Dhekelia Å...
1   Abkhazia Afghanistan Akrotiri and Dhekelia Åla...
2   The Bahamas Bahrain Bangladesh Barbados Belaru...
3   Cambodia Cameroon Canada Cape Verde Cayman Isl...
4   Denmark Dhekelia Djibouti Dominica Dominican R...
5   East Timor Ecuador Egypt El Salvador Equatoria...
6   Falkland Islands Faroe Islands Fiji Finland Fr...
7   Gabon The Gambia Georgia Germany Ghana Gibralt...
8                    Haiti Honduras Hong Kong Hungary
9   Iceland India Indonesia Iran Iraq Ireland Isra...
10                        Jamaica Japan Jersey Jordan
11  Kazakhstan Kenya Kiribati North Korea South Ko...
12  Laos Latvia Lebanon Lesotho Liberia Libya Liec...
13  Macau Macedonia, Republic of Madagascar Malawi...
14  Namibia Nauru Nepal Netherlands Netherlands An...
15                                             Oman
16  Pakistan Palau Palestine Panama Papua New Guin...
17                                           Qatar
18                             Romania Russia Rwanda
19  Sahrawi Arab Democratic Republic Saint Barthél...
20  Taiwan Tajikistan Tanzania Thailand Togo Tokel...
21  U Uganda Ukraine United Arab Emirates United K...
22  Uganda Ukraine United Arab Emirates United Kin...
23  Vanuatu Vatican City Venezuela Vietnam British...
24                                  Wallis and Futuna
25                                              Yemen
26                                Zambia Zimbabwe  ,     0
1
0   A  Abkhazia Afghanistan Akrotiri and Dhekelia Åla...
1   B  The Bahamas Bahrain Bangladesh Barbados Belaru...
2   C  Cambodia Cameroon Canada Cape Verde Cayman Isl...
3   D  Denmark Dhekelia Djibouti Dominica Dominican R...
4   E  East Timor Ecuador Egypt El Salvador Equatoria...
5   F  Falkland Islands Faroe Islands Fiji Finland Fr...
6   G  Gabon The Gambia Georgia Germany Ghana Gibralt...
7   H                    Haiti Honduras Hong Kong Hungary
8   I  Iceland India Indonesia Iran Iraq Ireland Isra...
9   J                         Jamaica Japan Jersey Jordan
10  K  Kazakhstan Kenya Kiribati North Korea South Ko...
11  L  Laos Latvia Lebanon Lesotho Liberia Libya Liec...
12  M  Macau Macedonia, Republic of Madagascar Malawi...
13  N  Namibia Nauru Nepal Netherlands Netherlands An...
14  O                                              Oman
15  P  Pakistan Palau Palestine Panama Papua New Guin...
16  Q                                            Qatar
17  R                              Romania Russia Rwanda
18  S  Sahrawi Arab Democratic Republic Saint Barthél...
19  T  Taiwan Tajikistan Tanzania Thailand Togo Tokel...,    0
1
0  U  Uganda Ukraine United Arab Emirates United Kin...
1  V  Vanuatu Vatican City Venezuela Vietnam British...
2  W                                 Wallis and Futuna
3  Y                                             Yemen
4  Z                                Zambia Zimbabwe,                     vteAirlines of the United S
tates  \
0                                      Mainline
1                                      Regional
2                                    Affiliated
3                                   Independent
4                                         Cargo
5                                       Charter
6                                Air taxi and tours
7                                     Air ambulance
8                                        Government
9  List of airline holding companies List of airl...

                  vteAirlines of the United States.1
0  Alaska Airlines Allegiant Air American Airline...
1  Affiliated Air Wisconsin CommutAir Endeavor Ai...
2  Air Wisconsin CommutAir Endeavor Air Envoy Air...
3  Advanced Air Air Flamenco Air Sunshine Bering ...
4  ABX Air Air Cargo Carriers Air Transport Inter...
5  Air Charter Bahamas Airstream Jets Alerion Avi...
6  Gem Air Grand Canyon Scenic Airlines Griffing ...
7  Air Evac Lifeteam AirMed International Air Met...
8                 Comco Janet JPATS Patriot Express
9  List of airline holding companies List of airl...  ,             0
1
```

```
0   Affiliated  Air Wisconsin CommutAir Endeavor Air Envoy Air...
1  Independent  Advanced Air Air Flamenco Air Sunshine Bering ...,                            vteAirlines
of the Americas  \
0   List of active airlines of the AmericasNorth A...
1            List of active airlines of the Americas
2                                    North America
3                                 Sovereign states
4                  Dependencies andother territories
5                                    South America
6                                 Sovereign states
7                  Dependencies andother territories
8   List of defunct airlines of the AmericasNorth ...
9            List of defunct airlines of the Americas
10                                   North America
11                                Sovereign states
12                 Dependencies andother territories
13                                   South America
14                                Sovereign states
15                 Dependencies andother territories

                        vteAirlines of the Americas.1
0   List of active airlines of the AmericasNorth A...
1            List of active airlines of the Americas
2   Sovereign states Antigua and Barbuda The Baham...
3   Antigua and Barbuda The Bahamas Barbados Beliz...
4   Anguilla San Andrés, Providencia and Santa Cat...
5   Sovereign states Argentina Bolivia Brazil Chil...
6   Argentina Bolivia Brazil Chile Colombia Ecuado...
7   Bouvet Island Falkland Islands French Guiana S...
8   List of defunct airlines of the AmericasNorth ...
9            List of defunct airlines of the Americas
10  Sovereign states Antigua and Barbuda The Baham...
11  Antigua and Barbuda The Bahamas Barbados Beliz...
12  Anguilla San Andrés, Providencia and Santa Cat...
13  Sovereign states Argentina Bolivia Brazil Chil...
14  Argentina Bolivia Brazil Chile Colombia Ecuado...
15  Bouvet Island Falkland Islands French Guiana S...  ,               List of active airlines of the Am
ericas  \
0                                    North America
1                                 Sovereign states
2                  Dependencies andother territories
3                                    South America
4                                 Sovereign states
5                  Dependencies andother territories
6   List of defunct airlines of the AmericasNorth ...
7            List of defunct airlines of the Americas
8                                    North America
9                                 Sovereign states
10                 Dependencies andother territories
11                                   South America
12                                Sovereign states
13                 Dependencies andother territories

             List of active airlines of the Americas.1
0   Sovereign states Antigua and Barbuda The Baham...
1   Antigua and Barbuda The Bahamas Barbados Beliz...
2   Anguilla San Andrés, Providencia and Santa Cat...
3   Sovereign states Argentina Bolivia Brazil Chil...
4   Argentina Bolivia Brazil Chile Colombia Ecuado...
5   Bouvet Island Falkland Islands French Guiana S...
6   List of defunct airlines of the AmericasNorth ...
7            List of defunct airlines of the Americas
8   Sovereign states Antigua and Barbuda The Baham...
9   Antigua and Barbuda The Bahamas Barbados Beliz...
10  Anguilla San Andrés, Providencia and Santa Cat...
11  Sovereign states Argentina Bolivia Brazil Chil...
12  Argentina Bolivia Brazil Chile Colombia Ecuado...
13  Bouvet Island Falkland Islands French Guiana S...  ,                                    0  \
0                  Sovereign states
1  Dependencies andother territories

                                                   1
0  Antigua and Barbuda The Bahamas Barbados Beliz...
1  Anguilla San Andrés, Providencia and Santa Cat...  ,                                    0  \
0                  Sovereign states
1  Dependencies andother territories

                                                   1
```

```
0  Argentina Bolivia Brazil Chile Colombia Ecuado...
1  Bouvet Island Falkland Islands French Guiana S...  ,   List of defunct airlines of the Americas  \
0                          North America
1                       Sovereign states
2       Dependencies andother territories
3                          South America
4                       Sovereign states
5       Dependencies andother territories

         List of defunct airlines of the Americas.1
0  Sovereign states Antigua and Barbuda The Baham...
1  Antigua and Barbuda The Bahamas Barbados Beliz...
2  Anguilla San Andrés, Providencia and Santa Cat...
3  Sovereign states Argentina Bolivia Brazil Chil...
4  Argentina Bolivia Brazil Chile Colombia Ecuado...
5  Bouvet Island Falkland Islands French Guiana S...  ,                                  0  \
0                  Sovereign states
1  Dependencies andother territories

                                                   1
0  Antigua and Barbuda The Bahamas Barbados Beliz...
1  Anguilla San Andrés, Providencia and Santa Cat...  ,                                  0  \
0                  Sovereign states
1  Dependencies andother territories

                                                   1
0  Argentina Bolivia Brazil Chile Colombia Ecuado...
1  Bouvet Island Falkland Islands French Guiana S...  ,                              0
1
0  Authority control: National  Israel United States]
```

In [22]:
```
tables[1]
```

Out[22]:

	Airline	Image	IATA	ICAO	Callsign	Primary hubs, Secondary hubs	Founded	Notes
0	Alaska Airlines	NaN	AS	ASA	ALASKA	Seattle/TacomaAnchoragePortland (OR)San Franci...	1932	Founded as McGee Airways and commenced operati...
1	Allegiant Air	NaN	G4	AAY	ALLEGIANT	Las VegasCincinnatiFort Walton BeachIndianapol...	1997	Founded as WestJet Express and commenced opera...
2	American Airlines	NaN	AA	AAL	AMERICAN	Dallas/Fort WorthCharlotteChicago-O'HareLos An...	1926	Founded as American Airways and commenced oper...
3	Avelo Airlines	NaN	XP	VXP	AVELO	BurbankNew HavenOrlando	1987	First did business as Casino Express Airlines ...
4	Breeze Airways	NaN	MX	MXY	MOXY	CharlestonHartfordNew OrleansNorfolkProvoTampa	2018	NaN
5	Delta Air Lines	NaN	DL	DAL	DELTA	AtlantaBostonDetroitLos AngelesMinneapolis/St....	1924	Founded as Huff Daland Dusters and commenced o...
6	Eastern Airlines	NaN	2D	EAL	EASTERN	MiamiNew York-JFK	2010	NaN
7	Frontier Airlines	NaN	F9	FFT	FRONTIER FLIGHT	DenverAtlantaChicago-O'HareCincinnatiCleveland...	1994	NaN
8	Hawaiian Airlines	NaN	HA	HAL	HAWAIIAN	HonoluluKahului	1929	Founded as Inter-Island Airways in early 1929 ...
9	JetBlue	NaN	B6	JBU	JETBLUE	New York-JFKBostonLos AngelesFort LauderdaleOr...	1998	Founded as New Air and commenced operations in...
10	Southwest Airlines	NaN	WN	SWA	SOUTHWEST	Dallas-LoveAtlantaBaltimoreChicago-MidwayDenve...	1967	Founded as Air Southwest and commenced operati...
11	Spirit Airlines	NaN	NK	NKS	SPIRIT WINGS	Atlantic CityDetroitLas VegasFort LauderdaleCh...	1980	Founded as Charter One.
12	Sun Country Airlines	NaN	SY	SCX	SUN COUNTRY	Minneapolis/St. PaulDallas/Fort WorthLas Vegas	1982	Commenced operations in 1983.Operates some Ama...
13	United Airlines	NaN	UA	UAL	UNITED	Chicago-O'HareDenverGuamHouston-Intercontinent...	1926	Founded as Varney Air Lines and commenced oper...

In [24]:
```
tables[7]
```

Out[24]:

	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 [25]:
```
# Lets first merge all wikipedia table.
wiki_table = [tables[1],tables[2],tables[3],tables[4],tables[5],tables[6],tables[7]]
```

In [26]:
```
wiki_tables = pd.concat(wiki_table, ignore_index=True)
```

In [27]:
```
wiki_tables
```

Out[27]:

	Airline	Image	IATA	ICAO	Callsign	Primary hubs, Secondary hubs	Founded	Notes	Primary Hubs, Secondary Hubs
0	Alaska Airlines	NaN	AS	ASA	ALASKA	Seattle/TacomaAnchoragePortland (OR)San Franci...	1932.0	Founded as McGee Airways and commenced operati...	NaN
1	Allegiant Air	NaN	G4	AAY	ALLEGIANT	Las VegasCincinnatiFort Walton BeachIndianapol...	1997.0	Founded as WestJet Express and commenced opera...	NaN
2	American Airlines	NaN	AA	AAL	AMERICAN	Dallas/Fort WorthCharlotteChicago-O'HareLos An...	1926.0	Founded as American Airways and commenced oper...	NaN
3	Avelo Airlines	NaN	XP	VXP	AVELO	BurbankNew HavenOrlando	1987.0	First did business as Casino Express Airlines ...	NaN
4	Breeze Airways	NaN	MX	MXY	MOXY	CharlestonHartfordNew OrleansNorfolkProvoTampa	2018.0	NaN	NaN
...	...	...	...	...	...	...	...	...	...
135	Lifestar	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN
136	Life Lion	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN
137	Comco	NaN	NaN	NaN	NaN	NaN	2002.0	NaN	NaN
138	Janet	NaN	NaN	WWW	JANET	NaN	1972.0	NaN	Las Vegas
139	Justice Prisoner and Alien Transportation System	NaN	NaN	JUD	JUSTICE	NaN	1980.0	Commenced operations in 1995.	Oklahoma City

140 rows × 9 columns

c. You should then get all the information gathered so far in one place.

First we got only that column from wiki pedia table that we need to merge

In [28]:
```
wiki_df = wiki_tables[['IATA', "Founded"]]
wiki_df
```

Out[28]:

	IATA	Founded
0	AS	1932.0
1	G4	1997.0
2	AA	1926.0
3	XP	1987.0
4	MX	2018.0
...	...	...
135	NaN	NaN
136	NaN	NaN
137	NaN	2002.0
138	NaN	1972.0
139	NaN	1980.0

140 rows × 2 columns

In [29]:
```
# Now we gather all the information that we got from wiki pedia link and the data that we have.
df = final_df.merge(wiki_df, left_on ='Airline', right_on = "IATA")
```

In [30]:
```
df
```

Out[30]:

	id	Airline	Flight	AirportFrom	AirportTo	DayOfWeek	Time	Length	Delay	ident	...	iata_code	airport_re
0	4	AA	2466	SFO	DFW	3	20	195	1	KSFO	...	SFO	3878
1	231	AA	526	SFO	DFW	3	360	215	0	KSFO	...	SFO	3878
2	234	AA	552	SFO	MIA	3	360	315	1	KSFO	...	SFO	3878
3	905	AA	810	SFO	ORD	3	385	255	0	KSFO	...	SFO	3878
4	1739	AA	24	SFO	JFK	3	425	325	1	KSFO	...	SFO	3878
...	...	...	...	...	...	...	...	...	...	...	...	...	...
434919	497838	9E	4292	LWB	JFK	3	890	110	1	KLWB	...	LWB	20390
434920	516333	9E	4292	LWB	JFK	4	890	110	0	KLWB	...	LWB	20390
434921	534123	9E	4292	LWB	JFK	5	890	110	0	KLWB	...	LWB	20390
434922	69058	9E	3752	ABR	MSP	7	410	76	1	KABR	...	ABR	3358
434923	189396	9E	3752	ABR	MSP	7	410	76	0	KABR	...	ABR	3358

434924 rows × 26 columns

d. The total passenger traffic may also contribute to flight delays. The term hub refers to busy commercial airports. Large hubs are airports that account for at least 1 percent of the total passenger enplanements in the United States. Airports that account for 0.25 percent to 1 percent of total passenger enplanements are considered medium hubs. Pull passenger traffic data from the Wikipedia page given below using web scraping and collate it in a table.

https://en.wikipedia.org/wiki/List_of_the_busiest_airports_in_the_United_States

In [31]:
```
# Now lets use the web scrapping to import the data frome the wikipedia.
url2 = "https://en.wikipedia.org/wiki/List_of_the_busiest_airports_in_the_United_States"
table = pd.read_html(url2)
```

In [32]:
```
table
```

Out[32]:

	Rank(2021)	Airports (large hubs)	IATACode
0	1	Hartsfield–Jackson Atlanta International Airport	ATL
1	2	Dallas/Fort Worth International Airport	DFW
2	3	Denver International Airport	DEN
3	4	O'Hare International Airport	ORD
4	5	Los Angeles International Airport	LAX
5	6	Charlotte Douglas International Airport	CLT
6	7	Orlando International Airport	MCO
7	8	Harry Reid International Airport	LAS
8	9	Phoenix Sky Harbor International Airport	PHX
9	10	Miami International Airport	MIA
10	11	Seattle–Tacoma International Airport	SEA
11	12	George Bush Intercontinental Airport	IAH
12	13	John F. Kennedy International Airport	JFK
13	14	Newark Liberty International Airport	EWR
14	15	Fort Lauderdale–Hollywood International Airport	FLL
15	16	Minneapolis–Saint Paul International Airport	MSP
16	17	San Francisco International Airport	SFO
17	18	Detroit Metropolitan Airport	DTW
18	19	Logan International Airport	BOS
19	20	Salt Lake City International Airport	SLC
20	21	Philadelphia International Airport	PHL
21	22	Baltimore/Washington International Airport	BWI
22	23	Tampa International Airport	TPA
23	24	San Diego International Airport	SAN
24	25	LaGuardia Airport	LGA
25	26	Midway International Airport	MDW
26	27	Nashville International Airport	BNA
27	28	Washington Dulles International Airport	IAD
28	29	Ronald Reagan Washington National Airport	DCA
29	30	Austin–Bergstrom International Airport	AUS

	Major cities served	State	2021[3]	2020[4]	2019[5]
0	Atlanta	GA	36676010	20559866	53505795
1	Dallas & Fort Worth	TX	30005266	18593421	35778573
2	Denver	CO	28645527	16243216	33592945
3	Chicago	IL	26350976	14606034	40871223
4	Los Angeles	CA	23663410	14055777	42939104
5	Charlotte	NC	20900875	12952869	24199688
6	Orlando	FL	19618838	10467728	24562271
7	Las Vegas	NV	19160342	10584059	24728361
8	Phoenix	AZ	18940287	10531436	22433552
9	Miami	FL	17500096	8786007	21421031
10	Seattle	WA	17430195	9462411	25001762
11	Houston	TX	16242821	8682558	21905309
12	New York City	NY	15273342	8269819	31036655
13	Newark & New York City	NJ	14514049	7985474	23160763
14	Fort Lauderdale & Hollywood	FL	13598994	8015744	17950989
15	Minneapolis & Saint Paul	MN	12211409	7069720	19192917
16	San Francisco	CA	11725347	7745057	27779230
17	Detroit	MI	11517696	6822324	18143040
18	Boston	MA	10909817	6035452	20699377
19	Salt Lake City	UT	10795906	5753239	12840841
20	Philadelphia	PA	9820222	5753239	16006389
21	Baltimore & Washington, D.C.	MD	9253561	5451355	13284687
22	Tampa	FL	8847197	4966775	10978756
23	San Diego	CA	7836360	4637856	12648692
24	New York City	NY	7827307	4147116	15393601
25	Chicago	IL	7680617	4236603	10081781
26	Nashville	TN	7594049	4013995	8935654
27	Washington, D.C.	VA	7227875	3862658	11884117
28	Washington, D.C.	VA	6731737	3573489	11595454
29	Austin	TX	6666215	3141505	8683711

	2018[6]	2017[7]	2016[8]	2015[9]	2014[10]	2013[11]	2012[12]
0	51865797	50251964	50501858	49340732	46604273	45308407	45798928
1	32821799	31816933	31283579	31589839	30804567	29038128	28022904
2	31362941	29809097	28267394	26280043	26000591	25496885	25799841
3	39873927	38593028	37589899	36305668	33843426	32317835	32171795
4	42624050	41232432	39636042	36351272	34314197	32425892	31326268
5	22281949	22011251	21511880	21913166	21537725	21346601	20033816
6	23202480	21565448	20283541	18759938	17278608	16884524	17159427
7	23795012	23364393	22833267	21857693	20620248	19946179	19959651
8	21622580	21185458	20896265	21351504	20344867	19525109	19560870
9	21021640	20709225	20875813	20986349	19471466	19420089	18987488
10	24024908	22639124	21887110	20148980	17888080	16690295	16121123
11	21157398	19603731	20062072	20595881	19772087	18952840	19039000
12	30620769	29533154	29239151	27782369	26244928	25036358	24520981

```
13  22797602  21571198  19923009  18684818  17773405  17546506  17055993
14  17612331  15817043  14263270  13061632  12031860  11538140  11445103
15  18361942  18409704  18123844  17634273  16972678  16280835  15943878
16  27790717  26900048  25707101  24190560  22770783  21704626  21284236
17  17436837  17036092  16847135  16255520  15775941  15683523  15599879
18  20006521  18759742  17759044  16290362  15507561  14810153  14293695
19  12226730  11615954  11143738  10634538  10139065   9668048   9579840
20  15292670  14271243  14564419  15101349  14792339  14727945  14589337
21  13371816  12976554  12340972  11738845  11022200  11132731  11186444
22  10368514   9548580   9194994   9150458   8531561   8267752   8218487
23  12174224  11139933  10340164   9985763   9333152   8878772   8686621
24  15058501  14614802  14762593  14319924  13535372  13372269  12818717
25  10678018  10912074  11044387  10830850  10311996   9915646   9436387
26   8017347   6902771   6338517   5715205   5396958   5050989   4797102
27  11621623  11024306  10596942  10363974  10415948  10570993  10816216
28  11367176  11506310  11470854  11242375  10057794   9838034   9462231
29   7921797   6973115   6095545   5797547   5219982   4900959   4606252  ,
    Rank(2021)                              Airports (medium hubs) IATACode  \
0           31                                  Dallas Love Field      DAL
1           32             Daniel K. Inouye International Airport      HNL
2           33                      Portland International Airport      PDX
3           34                           William P. Hobby Airport      HOU
4           35            Southwest Florida International Airport      RSW
5           36            St. Louis Lambert International Airport      STL
6           37                   Sacramento International Airport      SMF
7           38              Luis Muñoz Marín International Airport      SJU
8           39                Raleigh-Durham International Airport      RDU
9           40  Louis Armstrong New Orleans International Airport      MSY
10          41                       Oakland International Airport      OAK
11          42                                  John Wayne Airport      SNA
12          43                  Kansas City International Airport      MCI
13          44                  San Antonio International Airport      SAT
14          45    Norman Y. Mineta San José International Airport      SJC
15          46            Cleveland Hopkins International Airport      CLE
16          47                 Indianapolis International Airport      IND
17          48                   Pittsburgh International Airport      PIT
18          49  Cincinnati/Northern Kentucky International Air...      CVG
19          50                                    Kahului Airport      OGG
20          51          John Glenn Columbus International Airport      CMH
21          52                   Palm Beach International Airport      PBI
22          53                 Jacksonville International Airport      JAX
23          54                      Bradley International Airport      BDL
24          55           Milwaukee Mitchell International Airport      MKE
25          56                       Ontario International Airport      ONT
26          57        Ted Stevens Anchorage International Airport      ANC
27          58                     Charleston International Airport      CHS
28          59                           Hollywood Burbank Airport      BUR
29          60                                 Eppley Airfield      OMA
30          61                                   Boise Airport      BOI
31          62                     Memphis International Airport      MEM
32          63                   Reno–Tahoe International Airport      RNO
33          64                  Albuquerque International Sunport      ABQ
34          65                      Norfolk International Airport      ORF

              City served  State  2021[3]  2020[4]  2019[5]  2018[6]  \
0                  Dallas     TX  6487563  3669930  8408457  8134848
1                Honolulu     HI  5830928  3126391  9988678  9578505
2                Portland     OR  5759879  3455877  9797408  9940866
3                 Houston     TX  5560780  3127178  7069614  6937061
4              Fort Myers     FL  5080805  2947139  5144467  4719568
5               St. Louis     MO  5070471  3041765  7946986  7822274
6              Sacramento     CA  4760275  2710342  6454413  6031630
7                San Juan     PR  4738725  2362851  4590117  4033412
8                 Raleigh     NC  4311049  2337496  6919429  6416822
9              New Orleans     LA  4017147  2632606  6717105  6565482
10                Oakland     CA  4011953  2271294  6560230  6798321
11          Orange County     CA  3807205  1824836  5153276  5317149
12            Kansas City     MO  3795290  2167616  5759419  5935131
13            San Antonio     TX  3677643  1919958  5022980  4844427
14               San Jose     CA  3619690  2283186  7828885  7140616
15              Cleveland     OH  3552402  1990156  4894541  4836580
16           Indianapolis     IN  3487100  1989126  4709183  4695040
17             Pittsburgh     PA  3069259  1742406  4715947  4670033
18  Cincinnati & Covington  OH/KY  3050597  1729395  4413457  4269258
19                Kahului     HI  2933315  1135141  3791807  3572133
20               Columbus     OH  2825259  1577596  4172067  4054572
21         West Palm Beach     FL  2567897  1518732  3460429  3263042
22            Jacksonville     FL  2425685  1367501  3479923  3118540
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23	Hartford	CT	2273259	1150033	3323614	3330734
24	Milwaukee	WI	2231010	1263385	3374073	3548817
25	Ontario	CA	2201528	1237946	2723002	2499171
26	Anchorage	AK	2184959	1157301	2713843	2642901
27	Charleston	SC	2015277	944660	2375868	2192893
28	Burbank	CA	1942417	1056838	2988720	2680240
29	Omaha	NE	1829912	1036245	2455274	2457087
30	Boise	ID	1809000	991241	2057750	1943181
31	Memphis	TN	1793073	1015981	2318442	2213083
32	Reno	NV	1781785	976937	2162250	2048916
33	Albuquerque	NM	1688646	868922	2641450	2647269
34	Norfolk	VA	1658024	884882	1990864	1846031

	2017[7]	2016[8]	2015[9]	2014[10]	2013[11]	2012[12]
0	7876769	7554596	7040921	4522341	4023779	3902628
1	9743989	9656340	9656340	9463000	9466995	9225848
2	9435473	9071154	8340234	7878760	7452603	7142620
3	6741870	6285181	5937944	5800726	5377050	5043737
4	4461304	4350650	4231134	4025959	3788870	3634152
5	7372805	6793076	6239231	6108758	6216104	6208750
6	5460526	4969366	4816440	4384616	4255145	4357899
7	4163587	4343354	4218785	4150828	4103197	4204478
8	5851004	5401714	4954717	4673869	4482016	4490374
9	6005527	5569705	5329696	4870569	4576539	4293624
10	6530308	5934639	5506672	5069257	4770716	4926683
11	5195047	5217242	4945175	4584147	4540628	4381172
12	5744918	5391557	5135127	4982722	4836221	4866850
13	4521611	4179994	4091389	4046856	4005874	4036625
14	6225148	5321603	4885690	4621003	4315839	4077654
15	4562740	4205739	4083476	3686315	4375448	4346941
16	4376432	4216766	3889567	3605908	3535015	3586422
17	4327431	3986114	3890677	3827860	3812460	3892338
18	3926158	3269979	3036697	2874684	2776377	2937850
19	3442189	3352813	3220753	3019338	2955304	2861278
20	3765007	3567864	3312496	3115501	3063822	3095575
21	3166532	3100624	3113485	2926242	2844507	2796359
22	2759067	2799587	2716465	2589198	2549070	2579023
23	3214976	2982194	2926047	2913380	2681181	2647610
24	3452544	3383271	3229876	3228607	3214811	3710384
25	2247645	2127387	2089801	2037346	1970538	2142393
26	2556188	2563524	2525876	2381826	2325030	2249717
27	1945699	1811695	1669988	1539326	1441415	1283970
28	2402106	2077892	1973897	1928491	1918011	2027203
29	2303223	2127387	2046155	2020354	1975339	2018738
30	1777642	1633507	1487777	1378352	1313741	1307505
31	2102739	2016089	1873716	1800268	2301003	3359668
32	1953028	1771864	1669876	1611572	1671926	1685333
33	2412328	2341719	2323883	2354184	2477783	2630574
34	1694329	1602631	1515200	1488114	1560754	1651440

	Rank	Rank change	Airport name
	Rank	Rank change	Airport name
0	1	NaN	Hartsfield–Jackson Atlanta International Airport
1	2	2.0	Dallas/Fort Worth International Airport
2	3	2.0	Denver International Airport
3	4	1.0	O'Hare International Airport
4	5	3.0	Los Angeles International Airport
5	6	5.0	Charlotte Douglas International Airport
6	7	2.0	Harry Reid International Airport
7	8	5.0	Phoenix Sky Harbor International Airport
8	9	1.0	Orlando International Airport
9	10	2.0	Seattle–Tacoma International Airport
10	11	3.0	Miami International Airport
11	12	3.0	George Bush Intercontinental Airport
12	13	7.0	John F. Kennedy International Airport
13	14	5.0	Fort Lauderdale–Hollywood International Airport
14	15	8.0	San Francisco International Airport
15	16	4.0	Newark Liberty International Airport
16	17	NaN	Minneapolis–Saint Paul International Airport
17	18	NaN	Detroit Metropolitan Airport
18	19	3.0	General Edward Lawrence Logan International Ai...
19	20	3.0	Salt Lake City International Airport
20	21	1.0	Philadelphia International Airport
21	22	NaN	Baltimore/Washington International Airport
22	23	4.0	Tampa International Airport
23	24	NaN	San Diego International Airport
24	25	4.0	Chicago Midway International Airport
25	26	1.0	Washington Dulles International Airport
26	27	4.0	Nashville International Airport

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27   28         7.0                                LaGuardia Airport
28   29         4.0                                Dallas Love Field
29   30         4.0          Ronald Reagan Washington National Airport
30   31         1.0                      Portland International Airport
31   32         4.0             Daniel K. Inouye International Airport
32   33         NaN                           William P. Hobby Airport
33   34         2.0             Austin–Bergstrom International Airport
34   35         1.0            St. Louis Lambert International Airport
```

	Location	IATA Code	Traffic		Aircraft	\
	Location	IATA Code	Passengers	% chg.2019/20	Movements	
0	College Park, Georgia	ATL	42918685	61.2	NaN	
1	Irving, Texas	DFW	39364990	47.6	NaN	
2	Denver, Colorado	DEN	33741129	51.1	NaN	
3	Chicago, Illinois	ORD	30860251	63.5	NaN	
4	Los Angeles, California	LAX	28779527	67.3	NaN	
5	Charlotte, North Carolina	CLT	27205082	45.8	NaN	
6	Paradise, Nevada	LAS	22201479	56.9	NaN	
7	Phoenix, Arizona	PHX	21978708	52.5	NaN	
8	Orlando, Florida	MCO	21617803	57.3	NaN	
9	SeaTac, Washington	SEA	20061507	61.3	NaN	
10	Miami, Florida	MIA	18663858	59.4	NaN	
11	Houston, Texas	IAH	18213571	59.8	NaN	
12	Queens, New York	JFK	16630642	73.4	NaN	
13	Fort Lauderdale, Florida	FLL	16484132	55.1	NaN	
14	San Mateo County, California	SFO	16409625	71.5	NaN	
15	Newark, New Jersey	EWR	15892892	65.7	NaN	
16	Minneapolis, Minnesota	MSP	14851289	59.8	NaN	
17	Romulus, Michigan	DTW	14105007	61.6	NaN	
18	Boston, Massachusetts	BOS	12618128	70.3	NaN	
19	Salt Lake City, Utah	SLC	12559026	53.2	NaN	
20	Philadelphia, Pennsylvania	PHL	11865006	64.1	NaN	
21	Linthicum Heights, Maryland	BWI	11204511	58.5	NaN	
22	Tampa, Florida	TPA	10238151	54.5	NaN	
23	San Diego, California	SAN	8991533	64.3	NaN	
24	Chicago, Illinois	MDW	8853948	57.5	NaN	
25	Dulles, Virginia	IAD	8333460	66.4	NaN	
26	Nashville, Tennessee	BNA	8284570	54.7	NaN	
27	Queens, New York	LGA	8245192	73.5	NaN	
28	Dallas, Texas	DAL	7684653	54.2	NaN	
29	Arlington, Virginia	DCA	7574966	68.4	NaN	
30	Portland, Oregon	PDX	7084543	64.4	NaN	
31	Honolulu, Hawaii	HNL	6656825	69.6	NaN	
32	Houston, Texas	HOU	6476309	55.2	NaN	
33	Austin, Texas	AUS	6472579	62.7	NaN	
34	St Louis, Missouri	STL	6302402	60.3	NaN	

	% chg.2019/20
0	0.0
1	NaN
2	NaN
3	NaN
4	NaN
5	NaN
6	NaN
7	NaN
8	NaN
9	NaN
10	NaN
11	NaN
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21	NaN
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24	NaN
25	NaN
26	NaN
27	NaN
28	NaN

```
29          NaN
30          NaN
31          NaN
32          NaN
33          NaN
34          NaN  ,
  Location of 35 busiest airports in the United States
0  .mw-parser-output .locmap .od{position:absolut...  ,
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Rank	Rank change	Airport name
Rank	Rank change	Airport name
1	NaN	Hartsfield–Jackson Atlanta International Airport
2	NaN	Los Angeles International Airport[13]
3	NaN	O'Hare International Airport
4	NaN	Dallas/Fort Worth International Airport
5	NaN	Denver International Airport
6	NaN	John F. Kennedy International Airport[14]
7	NaN	San Francisco International Airport
8	NaN	Seattle–Tacoma International Airport[15]
9	NaN	Harry Reid International Airport[16]
10	NaN	Orlando International Airport
11	NaN	Charlotte Douglas International Airport
12	NaN	Newark Liberty International Airport[17]
13	1.0	Phoenix Sky Harbor International Airport[18]
14	1.0	Miami International Airport
15	NaN	George Bush Intercontinental Airport[19]
16	NaN	General Edward Lawrence Logan International Ai...
17	NaN	Minneapolis–Saint Paul International Airport[21]
18	1.0	Detroit Metropolitan Airport[22]
19	1.0	Fort Lauderdale–Hollywood International Airpor...
20	NaN	Philadelphia International Airport
21	NaN	LaGuardia Airport[24]
22	NaN	Baltimore/Washington International Airport
23	NaN	Salt Lake City International Airport[25]
24	NaN	San Diego International Airport[26]
25	NaN	Washington Dulles International Airport
26	NaN	Ronald Reagan Washington National Airport
27	1.0	Tampa International Airport[27]
28	1.0	Daniel K. Inouye International Airport[28]
29	2.0	Chicago Midway International Airport
30	NaN	Portland International Airport[29]
31	1.0	Nashville International Airport[30]
32	1.0	Austin–Bergstrom International Airport
33	2.0	Dallas Love Field[31]
34	NaN	St. Louis Lambert International Airport[32]
35	NaN	Norman Y. Mineta San Jose International Airpor...

Location	IATA Code	Traffic		Aircraft
Location	IATA Code	Passengers	% chg.2018/19	Movements
College Park, Georgia	ATL	110531300	2.3	904301.0
Los Angeles, California	LAX	88068013	0.6	691257.0
Chicago, Illinois	ORD	84649115	1.7	919704.0
Irving, Texas	DFW	75066956	8.6	720007.0
Denver, Colorado	DEN	69015703	7.0	640098.0
Queens, New York	JFK	62551072	1.5	456060.0
San Mateo County, California	SFO	57488023	0.5	458496.0
SeaTac, Washington	SEA	51829239	4.0	450487.0
Paradise, Nevada	LAS	51537638	3.7	552962.0
Orlando, Florida	MCO	50613072	6.1	357689.0
Charlotte, North Carolina	CLT	50168783	8.0	578263.0
Newark, New Jersey	EWR	46336452	1.0	446320.0
Phoenix, Arizona	PHX	46288337	3.0	438891.0
Miami, Florida	MIA	45924466	2.0	416773.0
Houston, Texas	IAH	45264059	3.3	478070.0
Boston, Massachusetts	BOS	42522411	3.9	427176.0
Minneapolis, Minnesota	MSP	39555035	4.0	406076.0
Romulus, Michigan	DTW	36769279	4.3	396909.0
Fort Lauderdale, Florida	FLL	36747622	2.2	331447.0
Philadelphia, Pennsylvania	PHL	33018886	4.2	390321.0
Queens, New York	LGA	31084894	3.3	373356.0
Linthicum Heights, Maryland	BWI	26993896	0.6	262597.0
Salt Lake City, Utah	SLC	26808014	4.9	344715.0
San Diego, California	SAN	25216947	4.0	231354.0
Dulles, Virginia	IAD	24817677	3.1	285042.0
Arlington, Virginia	DCA	23945527	1.8	292682.0
Tampa, Florida	TPA	22497953	5.7	217360.0
Honolulu, Hawaii	HNL	21870691	4.2	326832.0
Chicago, Illinois	MDW	20844860	5.4	232084.0
Portland, Oregon	PDX	19891365	0.0	238384.0

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30          Nashville, Tennessee       BNA   18273434          14.2       NaN
31                Austin, Texas        AUS   17343729           9.6  209726.0
32                Dallas, Texas        DAL   16780158           3.4  231879.0
33            St Louis, Missouri       STL   15878527           1.6  193925.0
34          San Jose, California       SJC   15650444           9.3  207111.0


   % chg.2018/19
0            1.0
1            2.3
2            1.8
3            7.9
4            6.1
5            0.1
6            2.5
7            2.8
8            2.4
9            2.9
10           5.1
11           1.6
12           1.1
13           0.2
14           2.4
15           0.7
16           0.3
17           0.8
18           0.6
19           2.8
20           0.4
21           1.5
22           2.2
23           2.8
24           3.9
25           0.4
26           5.0
27          10.7
28           4.6
29           1.9
30           NaN
31           0.2
32           0.3
33           0.2
34          19.4  ,
   Rank Rank change                                    Airport name  \
   Rank Rank change                                    Airport name
0     1         NaN  Hartsfield–Jackson Atlanta International Airpo...
1     2         NaN              Los Angeles International Airport[35]
2     3         NaN                   O'Hare International Airport[36]
3     4         NaN        Dallas/Fort Worth International Airport[37]
4     5         NaN                   Denver International Airport[38]
5     6         NaN          John F. Kennedy International Airport[39]
6     7         NaN            San Francisco International Airport[40]
7     8         1.0           Seattle–Tacoma International Airport[41]
8     9         1.0               Harry Reid International Airport[42]
9    10         2.0                  Orlando International Airport[43]
10   11         1.0        Charlotte Douglas International Airport[44]
11   12         1.0           Newark Liberty International Airport[45]
12   13         1.0                    Miami International Airport[46]
13   14         1.0       Phoenix Sky Harbor International Airport[47]
14   15         NaN           George Bush Intercontinental Airport[48]
15   16         NaN  General Edward Lawrence Logan International Ai...
16   17         NaN   Minneapolis–Saint Paul International Airport[50]
17   18         1.0  Fort Lauderdale–Hollywood International Airpor...
18   19         1.0                  Detroit Metropolitan Airport[52]
19   20         NaN             Philadelphia International Airport[53]
20   21         NaN                              LaGuardia Airport[54]
21   22         NaN     Baltimore/Washington International Airport[55]
22   23         NaN           Salt Lake City International Airport[56]
23   24         2.0                San Diego International Airport[57]
24   25         NaN        Washington Dulles International Airport[58]
25   26         2.0      Ronald Reagan Washington National Airport[59]
26   27         NaN           Chicago Midway International Airport[60]
27   28         NaN                    Tampa International Airport[61]
28   29         NaN              Daniel K. Inouye International Airport
29   30         NaN                  Portland International Airport[62]
30   31         NaN                               Dallas Love Field[63]
31   32         1.0                Nashville International Airport[64]
32   33         1.0         Austin–Bergstrom International Airport[65]
```

```
33   34         2.0        St. Louis Lambert International Airport[66]
34   35         NaN  Norman Y. Mineta San Jose International Airpor...

                          Location IATA Code    Traffic                \
                          Location IATA Code Passengers % chg.2017/18
0             College Park, Georgia       ATL  107394029           3.3
1           Los Angeles, California       LAX   87534384           3.5
2                 Chicago, Illinois       ORD   83245472           4.3
3                     Irving, Texas       DFW   69112607           3.0
4                  Denver, Colorado       DEN   64494613           5.1
5                  Queens, New York       JFK   61909148           3.9
6   South San Francisco, California       SFO   57793313           3.5
7                SeaTac, Washington       SEA   49849520           6.2
8                 Las Vegas, Nevada       LAS   49716584           2.5
9                 Orlando, Florida       MCO   47696627           6.9
10        Charlotte, North Carolina       CLT   46444380           1.2
11               Newark, New Jersey       EWR   46065175           6.6
12                   Miami, Florida       MIA   45044312           2.2
13                 Phoenix, Arizona       PHX   44943686           2.3
14                   Houston, Texas       IAH   43807539           7.6
15            Boston, Massachusetts       BOS   40941925           6.6
16           Minneapolis, Minnesota       MSP   38037381           0.0
17         Fort Lauderdale, Florida       FLL   35963370          10.6
18                Romulus, Michigan       DTW   35236676           1.5
19       Philadelphia, Pennsylvania       PHL   31691956           7.1
20                 Queens, New York       LGA   30094074           1.8
21      Linthicum Heights, Maryland       BWI   27145831           2.9
22             Salt Lake City, Utah       SLC   25554244           5.6
23            San Diego, California       SAN   24238300           9.3
24                 Dulles, Virginia       IAD   24060709           5.1
25              Arlington, Virginia       DCA   23464618           1.8
26                Chicago, Illinois       MDW   22027737           1.9
27                   Tampa, Florida       TPA   21289390           8.5
28                Honolulu, Hawaii       HNL   20990932           1.1
29                Portland, Oregon       PDX   19882788           4.2
30                   Dallas, Texas       DAL   16229151           3.2
31             Nashville, Tennessee       BNA   15996194          13.2
32                   Austin, Texas       AUS   15819912          13.9
33              St Louis, Missouri       STL   15632586           5.9
34             San Jose, California       SJC   14319292          14.7

    Aircraft
   Movements % chg.2017/18
0     895682          01.7
1     707833          01.1
2     903747          04.2
3     667213          02.0
4     603403          03.6
5     455529          01.6
6     470164          02.1
7     438391          05.4
8     539857          00.6
9     347672          05.1
10    550013          00.4
11    458674          04.6
12    416032          00.7
13    434252          00.8
14    466738          03.6
15    424024          05.6
16    407476          02.1
17    329662          05.4
18    393681          00.4
19    379665          02.6
20    372025          00.8
21    266569          01.9
22    337276          03.1
23    225058          07.5
24    274281          03.6
25    293827          00.2
26    243322          03.2
27    206938          05.9
28    295233          5.30
29    233993          02.2
30    231110          01.6
31    216966          05.2
32    210080          05.2
33         -             -
34    173389         011.3  ,
```

	Rank	Airport name
	Rank	Airport name
0	1	Hartsfield–Jackson Atlanta International Airport
1	2	Los Angeles International Airport
2	3	O'Hare International Airport
3	4	Dallas/Fort Worth International Airport
4	5	John F. Kennedy International Airport
5	6	Denver International Airport
6	7	San Francisco International Airport
7	8	Harry Reid International Airport
8	9	Seattle–Tacoma International Airport
9	10	Miami International Airport
10	11	Charlotte Douglas International Airport
11	12	Phoenix Sky Harbor International Airport
12	13	Orlando International Airport
13	14	George Bush Intercontinental Airport
14	15	Newark Liberty International Airport
15	16	Minneapolis–Saint Paul International Airport
16	17	General Edward Lawrence Logan International Ai...
17	18	Detroit Metropolitan Airport
18	19	Philadelphia International Airport
19	20	LaGuardia Airport
20	21	Fort Lauderdale–Hollywood International Airport
21	22	Baltimore/Washington International Airport
22	23	Ronald Reagan Washington National Airport
23	24	Salt Lake City International Airport
24	25	Chicago Midway International Airport
25	26	Washington Dulles International Airport
26	27	San Diego International Airport
27	28	Honolulu International Airport
28	29	Tampa International Airport
29	30	Portland International Airport
30	31	Dallas Love Field
31	32	St. Louis Lambert International Airport
32	33	Nashville International Airport
33	34	William P. Hobby Airport
34	35	Austin–Bergstrom International Airport
35	36	Oakland International Airport

	Location	IATA Code	Traffic	
	Location	IATA Code	Passengers	% chg.2015/16
0	College Park, Georgia	ATL	104171935	02.6
1	Los Angeles, California	LAX	80921527	08.0
2	Chicago, Illinois	ORD	77960588	01.3
3	Irving, Texas	DFW	65670697	00.2
4	Queens, New York	JFK	59105513	03.9
5	Denver, Colorado	DEN	58266515	07.9
6	South San Francisco, California	SFO	53099282	06.1
7	Las Vegas, Nevada	LAS	47496614	04.5
8	SeaTac, Washington	SEA	45736700	08.0
9	Miami, Florida	MIA	44584603	00.5
10	Charlotte, North Carolina	CLT	44422022	01.0
11	Phoenix, Arizona	PHX	43302381	01.6
12	Orlando, Florida	MCO	41923399	08.0
13	Houston, Texas	IAH	41622594	03.3
14	Newark, New Jersey	EWR	40563285	08.2
15	Minneapolis, Minnesota	MSP	37413728	02.3
16	Boston, Massachusetts	BOS	36356917	08.5
17	Romulus, Michigan	DTW	34401254	02.9
18	Philadelphia, Pennsylvania	PHL	30155090	04.1
19	Queens, New York	LGA	29786769	04.7
20	Fort Lauderdale, Florida	FLL	29205002	08.4
21	Linthicum Heights, Maryland	BWI	25122651	05.4
22	Arlington, Virginia	DCA	23568586	02.4
23	Salt Lake City, Utah	SLC	23157445	04.5
24	Chicago, Illinois	MDW	22677859	02.1
25	Dulles, Virginia	IAD	21817340	01.5
26	San Diego, California	SAN	20725801	03.2
27	Honolulu, Hawaii	HNL	19878659	– 00.0
28	Tampa, Florida	TPA	18931922	00.6
29	Portland, Oregon	PDX	18352767	08.9
30	Dallas, Texas	DAL	15562738	07.3
31	St Louis, Missouri	STL	13959126	09.5
32	Nashville, Tennessee	BNA	12979803	011.2
33	Houston, Texas	HOU	12909075	06.1
34	Austin, Texas	AUS	12436849	04.5
35	Oakland, California	OAK	12070967	07.7

	Aircraft Movements	% chg.2015/16
0	898356	01.8
1	697138	06.3
2	867635	00.9
3	672748	01.3
4	452415	03.0
5	565503	04.5
6	450388	04.8
7	541428	02.1
8	412170	08.1
9	414234	00.3
10	545742	00.3
11	440643	00.1
12	316981	02.9
13	470780	06.4
14	435907	05.3
15	412872	02.0
16	372930	02.5
17	393427	03.7
18	394022	04.2
19	369987	02.7
20	290239	04.4
21	248585	00.9
22	295038	00.8
23	320137	02.7
24	253046	00.2
25	265743	01.5
26	197132	01.5
27	316154	01.1
28	—	—
29	227709	04.4
30	224193	03.7
31	190560	02.5
32	194758	05.6
33	200741	00.1
34	192032	00.4
35	222771	03.3 ,

	Rank	Airport name \
0	1	John F. Kennedy International Airport
1	2	Miami International Airport
2	3	Los Angeles International Airport
3	4	George Bush Intercontinental Airport
4	5	Newark Liberty International Airport
5	6	Dallas/Fort Worth International Airport
6	7	Hartsfield–Jackson Atlanta International Airport
7	8	O'Hare International Airport
8	9	Fort Lauderdale–Hollywood International Airport
9	10	Washington Dulles International Airport
10	11	San Francisco International Airport
11	12	General Edward Lawrence Logan International Ai...
12	13	Charlotte Douglas International Airport
13	14	Denver International Airport
14	15	Orlando International Airport
15	16	Seattle–Tacoma International Airport
16	17	Phoenix Sky Harbor International Airport
17	18	Philadelphia International Airport
18	19	Detroit Metropolitan Wayne County Airport
19	20	Harry Reid International Airport

	Location	IATA Code	2021[68]	2020[69]	2019[70]
0	Queens, New York	JFK	12466165	8219317	33432159
1	Miami, Florida	MIA	11592445	6565834	20735658
2	Los Angeles, California	LAX	7862532	6246602	25210140
3	Houston, Texas	IAH	6458473	3491935	10764589
4	Newark, New Jersey	EWR	6250880	3688541	14087622
5	Irving, Texas	DFW	5852397	3268822	9103438
6	College Park, Georgia	ATL	5474264	3347184	12268779
7	Chicago, Illinois	ORD	5148494	3481860	13412885
8	Fort Lauderdale, Florida	FLL	4016553	2839383	8524251
9	Dulles, Virginia	IAD	3230027	1917510	7990292
10	South San Francisco, California	SFO	3139041	3210024	14357960
11	Boston, Massachusetts	BOS	2046561	1574712	7534504
12	Charlotte, North Carolina	CLT	1989704	1069001	3405907
13	Denver, Colorado	DEN	1856124	934563	3037012
14	Orlando, Florida	MCO	1837706	1525177	6957048
15	SeaTac, Washington	SEA	1393603	1273179	5392147
16	Phoenix, Arizona	PHX	1223856	750138	1958468

```
17       Philadelphia, Pennsylvania       PHL    988733    682030   3847253
18                Romulus, Michigan       DTW    966375    873744   3717775
19                 Paradise, Nevada       LAS    738257    711614   3462627  ,
  Rank                                    Airport name  \
  Rank                                    Airport name
0    1                     Memphis International Airport
1    2        Ted Stevens Anchorage International Airport
2    3      Louisville Muhammad Ali International Airport
3    4                       O'Hare International Airport
4    5                       Miami International Airport
5    6                 Los Angeles International Airport
6    7  Cincinnati/Northern Kentucky International Air...
7    8                 Indianapolis International Airport
8    9            Dallas/Fort Worth International Airport
9   10                      Ontario International Airport

                 Location IATA code        Cargo
                 Location IATA code         lbs. % chg.2017/16
0       Memphis, Tennessee       MEM  23949525780        00.35%
1        Anchorage, Alaska       ANC  17337337377        02.79%
2     Louisville, Kentucky       SDF  13403682652        04.68%
3        Chicago, Illinois       ORD  10373559593       010.84%
4           Miami, Florida       MIA   7963988407        00.82%
5  Los Angeles, California       LAX   7197930264        03.85%
6         Hebron, Kentucky       CVG   5700282994       033.32%
7    Indianapolis, Indiana       IND   5138500318       0-3.58%
8            Irving, Texas       DFW   4155362297        07.65%
9      Ontario, California       ONT   3522510318       015.81%  ,
  .mw-parser-output .navbar{display:inline;font-size:88%;font-weight:normal}.mw-parser-output .navbar-c
ollapse{float:left;text-align:left}.mw-parser-output .navbar-boxtext{word-spacing:0}.mw-parser-output .n
avbar ul{display:inline-block;white-space:nowrap;line-height:inherit}.mw-parser-output .navbar-bracket
s::before{margin-right:-0.125em;content:"[ "}.mw-parser-output .navbar-brackets::after{margin-left:-0.12
5em;content:" ]"}.mw-parser-output .navbar li{word-spacing:-0.125em}.mw-parser-output .navbar a>span,.mw
-parser-output .navbar a>abbr{text-decoration:inherit}.mw-parser-output .navbar-mini abbr{font-variant:s
mall-caps;border-bottom:none;text-decoration:none;cursor:inherit}.mw-parser-output .navbar-ct-full{font-
size:114%;margin:0 7em}.mw-parser-output .navbar-ct-mini{font-size:114%;margin:0 4em}vteMajor airports i
n the United States  \
0  Atlanta (Hartsfield–Jackson – ATL) Austin (Aus...
1                                       Statistics

  .mw-parser-output .navbar{display:inline;font-size:88%;font-weight:normal}.mw-parser-output .navbar-c
ollapse{float:left;text-align:left}.mw-parser-output .navbar-boxtext{word-spacing:0}.mw-parser-output .n
avbar ul{display:inline-block;white-space:nowrap;line-height:inherit}.mw-parser-output .navbar-bracket
s::before{margin-right:-0.125em;content:"[ "}.mw-parser-output .navbar-brackets::after{margin-left:-0.12
5em;content:" ]"}.mw-parser-output .navbar li{word-spacing:-0.125em}.mw-parser-output .navbar a>span,.mw
-parser-output .navbar a>abbr{text-decoration:inherit}.mw-parser-output .navbar-mini abbr{font-variant:s
mall-caps;border-bottom:none;text-decoration:none;cursor:inherit}.mw-parser-output .navbar-ct-full{font-
size:114%;margin:0 7em}.mw-parser-output .navbar-ct-mini{font-size:114%;margin:0 4em}vteMajor airports i
n the United States.1
0  Atlanta (Hartsfield–Jackson – ATL) Austin (Aus...
1                                       Statistics
,
  vteList of the busiest airports in North America  \
0                              Sovereign states
1           Dependencies andother territories

  vteList of the busiest airports in North America.1
0  Antigua and Barbuda Bahamas Barbados Belize Ca...
1  Anguilla Aruba Bermuda Bonaire British Virgin ...  ,
      vteLists of the busiest airports by continent  \
0  Africa Asia Europe North America Oceania South...

    vteLists of the busiest airports by continent.1
0  Africa Asia Europe North America Oceania South...  ,
                    vteAviation statistics  \
0                       Airports worldwide
1   Busiest airports by continent and country
2                                    Africa
3                                      Asia
4                                    Europe
5                             North America
6                                   Oceania
7                             South America
8                                 By region
9                                  Airlines
10                                   Routes

                          vteAviation statistics.1
```

```
0   Busiest airports by continent By aircraft move...
1   Africa Morocco South Africa Asia China (exclud...
2                              Morocco South Africa
3   China (excluding Hong Kong and Macau) India In...
4   Austria Belgium Bulgaria Croatia France German...
5   Canada Dominican Republic Mexico United States...
6                             Australia New Zealand
7   Argentina Brazil Chile Colombia Ecuador Paragu...
8   Baltic Caribbean Central America Latin America...
9   World's largest airlines Airline holding compa...
10  Busiest passenger air routes General aviation ...  ,
              0                                                   1
0        Africa                                Morocco South Africa
1          Asia  China (excluding Hong Kong and Macau) India In...
2        Europe  Austria Belgium Bulgaria Croatia France German...
3  North America  Canada Dominican Republic Mexico United States...
4       Oceania                               Australia New Zealand
5  South America  Argentina Brazil Chile Colombia Ecuador Paragu...
6     By region  Baltic Caribbean Central America Latin America...]
```

In [34]:
```
table[0]['traffic_Chg19_20'] = table[0]['2020[4]'] - table[0]['2019[5]']
```

In [35]:
```
table[0]['traffic_Chg18_19'] = table[0]['2019[5]'] - table[0]['2018[6]']
table[0]['hubs'] = str('large_hub')
```

In [36]:
```
table[0] = table[0][['IATACode', 'traffic_Chg19_20', 'traffic_Chg18_19', 'hubs']]
table[0]
```

Out[36]:

	IATACode	traffic_Chg19_20	traffic_Chg18_19	hubs
0	ATL	-32945929	1639998	large_hub
1	DFW	-17185152	2956774	large_hub
2	DEN	-17349729	2230004	large_hub
3	ORD	-26265189	997296	large_hub
4	LAX	-28883327	315054	large_hub
5	CLT	-11246819	1917739	large_hub
6	MCO	-14094543	1359791	large_hub
7	LAS	-14144302	933349	large_hub
8	PHX	-11902116	810972	large_hub
9	MIA	-12635024	399391	large_hub
10	SEA	-15539351	976854	large_hub
11	IAH	-13222751	747911	large_hub
12	JFK	-22766836	415886	large_hub
13	EWR	-15175289	363161	large_hub
14	FLL	-9935245	338658	large_hub
15	MSP	-12123197	830975	large_hub
16	SFO	-20034173	-11487	large_hub
17	DTW	-11320716	706203	large_hub
18	BOS	-14663925	692856	large_hub
19	SLC	-7087602	614111	large_hub
20	PHL	-10253150	713719	large_hub
21	BWI	-7833332	-87129	large_hub
22	TPA	-6011981	610242	large_hub
23	SAN	-8010836	474468	large_hub
24	LGA	-11246485	335100	large_hub
25	MDW	-5845178	-596237	large_hub
26	BNA	-4921659	918307	large_hub
27	IAD	-8021459	262494	large_hub
28	DCA	-8021965	228278	large_hub
29	AUS	-5542206	761914	large_hub

In [40]:
```
table[1].head()
```

Out[40]:

	Rank(2021)	Airports (medium hubs)	IATACode	City served	State	2021[3]	2020[4]	2019[5]	2018[6]	2017[7]	2016[8]	2015[9]	2
0	31	Dallas Love Field	DAL	Dallas	TX	6487563	3669930	8408457	8134848	7876769	7554596	7040921	
1	32	Daniel K. Inouye International Airport	HNL	Honolulu	HI	5830928	3126391	9988678	9578505	9743989	9656340	9656340	
2	33	Portland International Airport	PDX	Portland	OR	5759879	3455877	9797408	9940866	9435473	9071154	8340234	
3	34	William P. Hobby Airport	HOU	Houston	TX	5560780	3127178	7069614	6937061	6741870	6285181	5937944	
4	35	Southwest Florida International Airport	RSW	Fort Myers	FL	5080805	2947139	5144467	4719568	4461304	4350650	4231134	

In [42]:
```
table[1]['traffic_Chg19_20'] = table[1]['2020[4]'] - table[1]['2019[5]']
table[1]['traffic_Chg18_19'] = table[1]['2019[5]'] - table[1]['2018[6]']
table[1]['hubs'] = str('Medium_hub')
```

In [43]:
```
table[1] = table[1][['IATACode', 'traffic_Chg19_20', 'traffic_Chg18_19','hubs']]
table[1]
```

Out[43]:

	IATACode	traffic_Chg19_20	traffic_Chg18_19	hubs
0	DAL	-4738527	273609	Medium_hub
1	HNL	-6862287	410173	Medium_hub
2	PDX	-6341531	-143458	Medium_hub
3	HOU	-3942436	132553	Medium_hub
4	RSW	-2197328	424899	Medium_hub
5	STL	-4905221	124712	Medium_hub
6	SMF	-3744071	422783	Medium_hub
7	SJU	-2227266	556705	Medium_hub
8	RDU	-4581933	502607	Medium_hub
9	MSY	-4084499	151623	Medium_hub
10	OAK	-4288936	-238091	Medium_hub
11	SNA	-3328440	-163873	Medium_hub
12	MCI	-3591803	-175712	Medium_hub
13	SAT	-3103022	178553	Medium_hub
14	SJC	-5545699	688269	Medium_hub
15	CLE	-2904385	57961	Medium_hub
16	IND	-2720057	14143	Medium_hub
17	PIT	-2973541	45914	Medium_hub
18	CVG	-2684062	144199	Medium_hub
19	OGG	-2656666	219674	Medium_hub
20	CMH	-2594471	117495	Medium_hub
21	PBI	-1941697	197387	Medium_hub
22	JAX	-2112422	361383	Medium_hub
23	BDL	-2173581	-7120	Medium_hub
24	MKE	-2110688	-174744	Medium_hub
25	ONT	-1485056	223831	Medium_hub
26	ANC	-1556542	70942	Medium_hub
27	CHS	-1431208	182975	Medium_hub
28	BUR	-1931882	308480	Medium_hub
29	OMA	-1419029	-1813	Medium_hub
30	BOI	-1066509	114569	Medium_hub
31	MEM	-1302461	105359	Medium_hub
32	RNO	-1185313	113334	Medium_hub
33	ABQ	-1772528	-5819	Medium_hub
34	ORF	-1105982	144833	Medium_hub

In [44]:
```
# Lets first merge all wikipedia table.
wiki_data = [table[0],table[1]]
wiki_data = pd.concat(wiki_data, ignore_index=True)
wiki_data
```

Out[44]:

	IATACode	traffic_Chg19_20	traffic_Chg18_19	hubs
0	ATL	-32945929	1639998	large_hub
1	DFW	-17185152	2956774	large_hub
2	DEN	-17349729	2230004	large_hub
3	ORD	-26265189	997296	large_hub
4	LAX	-28883327	315054	large_hub
...	...	...	...	...
60	BOI	-1066509	114569	Medium_hub
61	MEM	-1302461	105359	Medium_hub
62	RNO	-1185313	113334	Medium_hub
63	ABQ	-1772528	-5819	Medium_hub
64	ORF	-1105982	144833	Medium_hub

65 rows × 4 columns

In [45]:
```
# Now we gather all the information that we got from wiki pedia link and the data that we have.
final_df = df.merge(wiki_data, left_on ='iata_code', right_on = "IATACode")
```

In [46]:
```
final_df
```

Out[46]:

	id	Airline	Flight	AirportFrom	AirportTo	DayOfWeek	Time	Length	Delay	ident	...	width_ft	surface	lig
0	4	AA	2466	SFO	DFW	3	20	195	1	KSFO	...	200.0	ASP	
1	231	AA	526	SFO	DFW	3	360	215	0	KSFO	...	200.0	ASP	
2	234	AA	552	SFO	MIA	3	360	315	1	KSFO	...	200.0	ASP	
3	905	AA	810	SFO	ORD	3	385	255	0	KSFO	...	200.0	ASP	
4	1739	AA	24	SFO	JFK	3	425	325	1	KSFO	...	200.0	ASP	
...	...	...	...	...	...	...	...	...	...	...	...	...	...	
364272	506267	9E	4052	DAL	MEM	4	370	90	0	KDAL	...	150.0	CON	
364273	512858	9E	3704	DAL	MEM	4	705	92	1	KDAL	...	150.0	CON	
364274	518247	9E	4060	DAL	MEM	4	990	90	0	KDAL	...	150.0	CON	
364275	524678	9E	4052	DAL	MEM	5	370	90	1	KDAL	...	150.0	CON	
364276	530841	9E	3704	DAL	MEM	5	705	92	0	KDAL	...	150.0	CON	

364277 rows × 30 columns

2. You should then examine the missing values in each field, perform missing value treatment, and justify your actions.

In [47]:
```
# Now we have the final data first we remove some column that is not useable.
final_df.info()
```

```
<class 'pandas.core.frame.DataFrame'>
Int64Index: 364277 entries, 0 to 364276
Data columns (total 30 columns):
 #   Column             Non-Null Count   Dtype  
---  ------             --------------   -----  
 0   id                 364277 non-null  int64  
 1   Airline            364277 non-null  object 
 2   Flight             364277 non-null  int64  
 3   AirportFrom        364277 non-null  object 
 4   AirportTo          364277 non-null  object 
 5   DayOfWeek          364277 non-null  int64  
 6   Time               364277 non-null  int64  
 7   Length             364277 non-null  int64  
 8   Delay              364277 non-null  int64  
 9   ident              364277 non-null  object 
 10  type               364277 non-null  object 
 11  name               364277 non-null  object 
 12  latitude_deg       364277 non-null  float64
 13  longitude_deg      364277 non-null  float64
 14  elevation_ft       364277 non-null  float64
 15  scheduled_service  364277 non-null  object 
 16  iata_code          364277 non-null  object 
 17  airport_ref        364277 non-null  int64  
 18  airport_ident      364277 non-null  object 
 19  length_ft          364277 non-null  float64
 20  width_ft           364277 non-null  float64
 21  surface            364277 non-null  object 
 22  lighted            364277 non-null  int64  
 23  closed             364277 non-null  int64  
 24  IATA               364277 non-null  object 
 25  Founded            364277 non-null  float64
 26  IATACode           364277 non-null  object 
 27  traffic_Chg19_20   364277 non-null  int64  
 28  traffic_Chg18_19   364277 non-null  int64  
 29  hubs               364277 non-null  object 
dtypes: float64(6), int64(11), object(13)
memory usage: 86.2+ MB
```

In [48]:
```
final_df.drop(['id','AirportFrom','airport_ident','iata_code','AirportTo','surface', 'ident','IATA', 'IA
```

In [49]:
```
final_df.info()
```

```
<class 'pandas.core.frame.DataFrame'>
Int64Index: 364277 entries, 0 to 364276
Data columns (total 20 columns):
 #   Column             Non-Null Count   Dtype  
---  ------             --------------   -----  
 0   Airline            364277 non-null  object 
 1   Flight             364277 non-null  int64  
 2   DayOfWeek          364277 non-null  int64  
 3   Time               364277 non-null  int64  
 4   Length             364277 non-null  int64  
 5   Delay              364277 non-null  int64  
 6   type               364277 non-null  object 
 7   latitude_deg       364277 non-null  float64
 8   longitude_deg      364277 non-null  float64
 9   elevation_ft       364277 non-null  float64
 10  scheduled_service  364277 non-null  object 
 11  airport_ref        364277 non-null  int64  
 12  length_ft          364277 non-null  float64
 13  width_ft           364277 non-null  float64
 14  lighted            364277 non-null  int64  
 15  closed             364277 non-null  int64  
 16  Founded            364277 non-null  float64
 17  traffic_Chg19_20   364277 non-null  int64  
 18  traffic_Chg18_19   364277 non-null  int64  
 19  hubs               364277 non-null  object 
dtypes: float64(6), int64(10), object(4)
memory usage: 58.4+ MB
```

In [50]:
```
# Now lets check the null value and treat them.
final_df.isnull().sum()
```

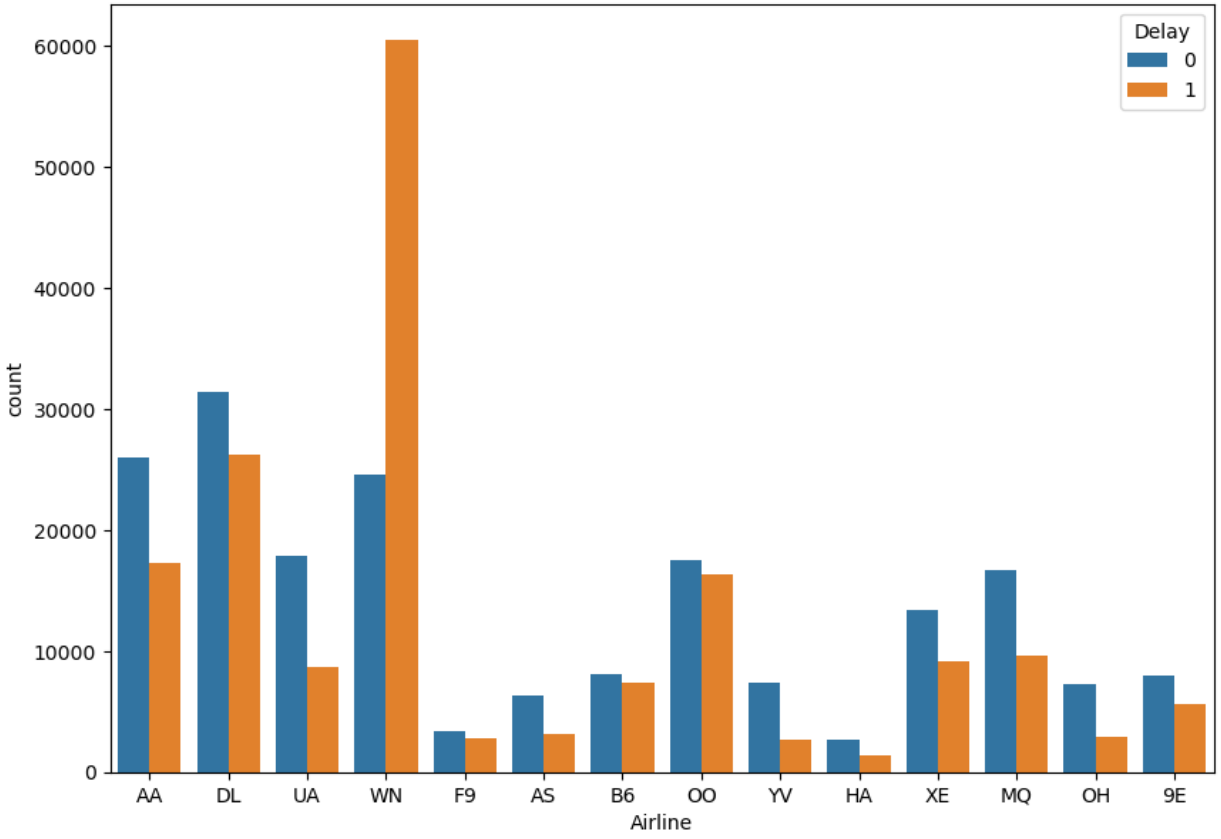
Out[50]:
```
Airline             0
Flight              0
DayOfWeek           0
Time                0
Length              0
Delay               0
type                0
latitude_deg        0
longitude_deg       0
elevation_ft        0
scheduled_service   0
airport_ref         0
length_ft           0
width_ft            0
lighted             0
closed              0
Founded             0
traffic_Chg19_20    0
traffic_Chg18_19    0
hubs                0
dtype: int64
```

3. Perform data visualization and share your insights on the following points:

a. According to the data provided, approximately 70% of Southwest Airlines flights are delayed. Visualize it to compare it with the data of other airlines.

In [51]:
```
plt.figure(figsize=(10,7))
sns.countplot(final_df['Airline'], hue= final_df['Delay'])
```

Out[51]:
```
<AxesSubplot:xlabel='Airline', ylabel='count'>
```

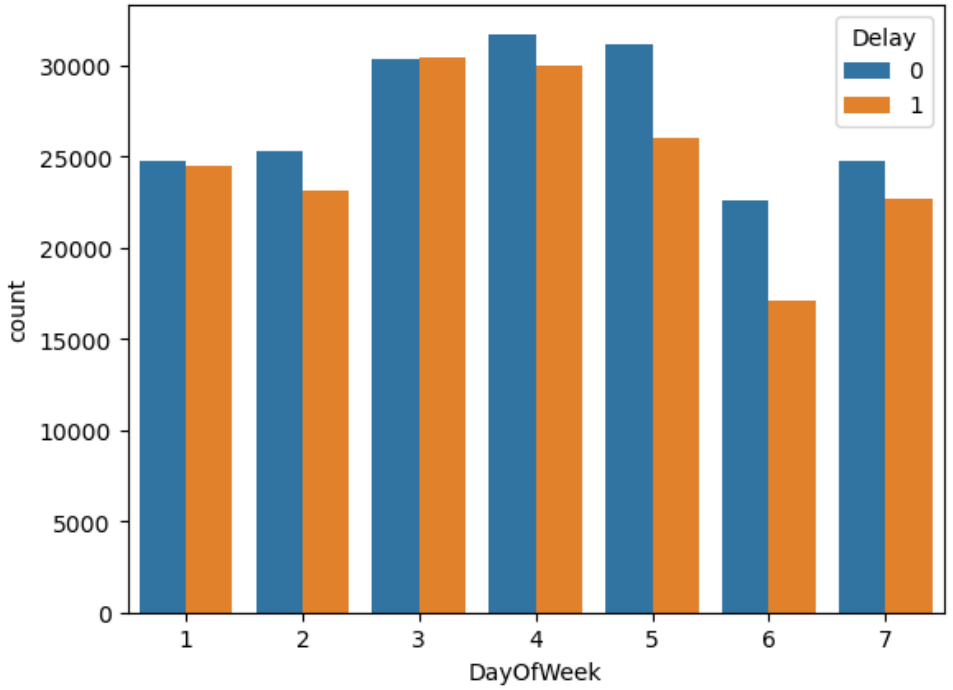


Airline code **WN** represent the **southwest airlines**. The graph clear show that **70% of flight of south west airline is delayed**

b. Flights were delayed on various weekdays. Which day of the week is the safest for travel?

In [52]:
```
sns.countplot(final_df['DayOfWeek'],hue= final_df['Delay'])
```

Out[52]:
```
<AxesSubplot:xlabel='DayOfWeek', ylabel='count'>
```



on 6th day of the week we have least delayed flight.

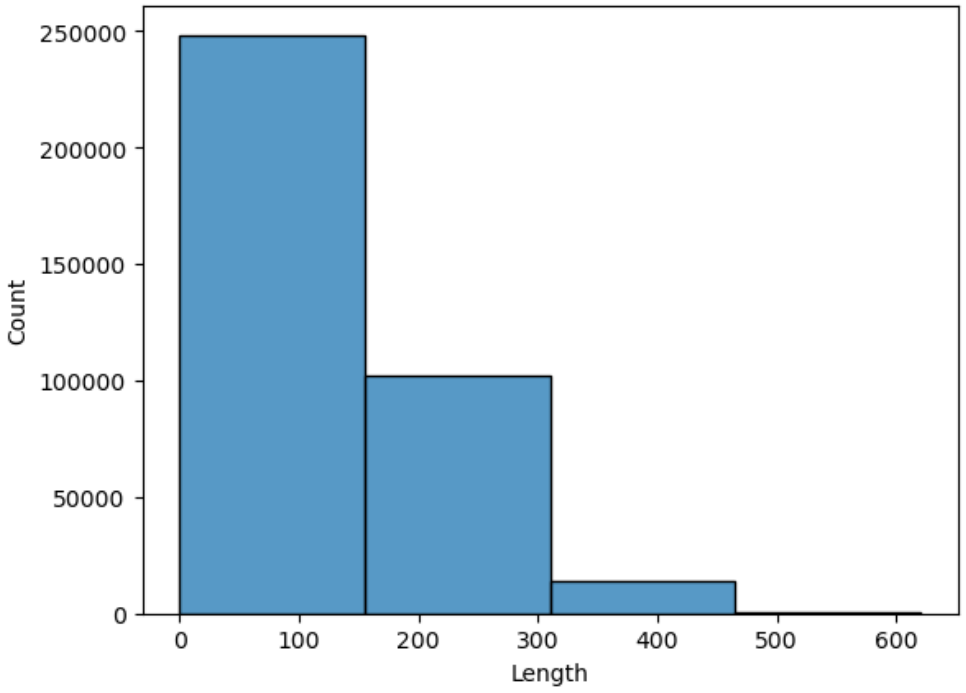
c. Which airlines should be recommended for short-, medium-, and long-distance travel?

In [53]:
```
final_df['Length'].max()
```

Out[53]:
```
620
```

In [54]:
```
sns.histplot(final_df['Length'], bins = 4)
```

Out[54]:
```
<AxesSubplot:xlabel='Length', ylabel='Count'>
```



In [55]:
```
final_df['Airline'][final_df['Length']<180].value_counts()
```

Out[55]:
```
WN    72531
DL    40149
OO    32192
MQ    25472
AA    24637
XE    21576
UA    15761
9E    13526
B6     9766
YV     9756
OH     9750
AS     5996
F9     5105
HA     3034
Name: Airline, dtype: int64
```

The above airlines are recommended for Short distance as flight last anywhere from 30 minutes to 3 hours.

In [56]:
```
final_df['Airline'][(final_df['Length']>180) & (final_df['Length']<360)].value_counts()
```

Out[56]:
```
DL    16510
AA    16112
WN    11427
UA     9385
B6     4847
AS     2822
OO     1576
F9     1075
XE      975
HA      751
MQ      604
OH      433
YV      246
9E       47
Name: Airline, dtype: int64
```

The above airlines are recommended for Medium distance as flight last anywhere from 3 hours to 6 hours.

In [57]:
```
final_df['Airline'][final_df['Length']>360].value_counts()
```

Out[57]:
```
UA    1304
AA    1081
DL     842
B6     822
AS     540
HA     252
WN      52
Name: Airline, dtype: int64
```

The above airlines are recommended for Long distance as flights are extend beyond 6 hours.

d. Do you notice any patterns in the departure times of long-duration flights?

In [58]:
```
final_df[final_df['Length']>360].describe().T
```

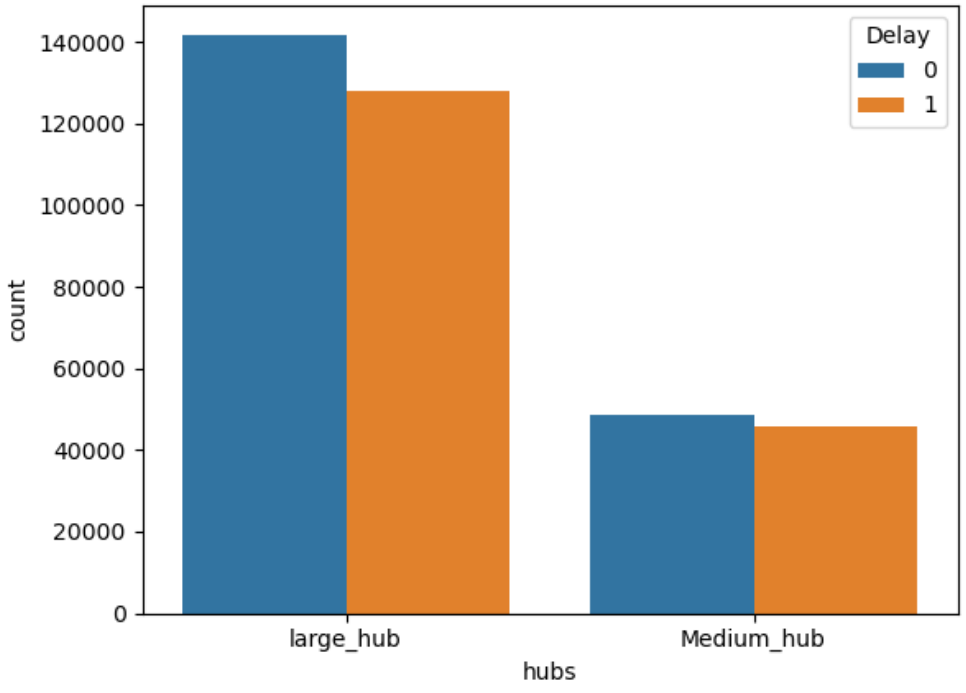
Out[58]:

	count	mean	std	min	25%	50%	75%	
Flight	4893.0	5.592187e+02	7.509137e+02	1.000000e+00	5.900000e+01	2.090000e+02	8.490000e+02	3.76000
DayOfWeek	4893.0	4.003270e+00	1.925851e+00	1.000000e+00	2.000000e+00	4.000000e+00	6.000000e+00	7.00000
Time	4893.0	8.287658e+02	2.857339e+02	1.000000e+02	5.500000e+02	8.850000e+02	1.080000e+03	1.43500
Length	4893.0	3.957466e+02	4.073634e+01	3.610000e+02	3.740000e+02	3.850000e+02	4.000000e+02	6.20000
Delay	4893.0	4.161046e-01	4.929617e-01	0.000000e+00	0.000000e+00	0.000000e+00	1.000000e+00	1.00000
latitude_deg	4893.0	3.893579e+01	6.497714e+00	1.843940e+01	3.894450e+01	4.063945e+01	4.193851e+01	6.11744
longitude_deg	4893.0	-8.828553e+01	2.515070e+01	-1.579242e+02	-9.703800e+01	-7.377932e+01	-7.377932e+01	-6.60018
elevation_ft	4893.0	2.385510e+02	7.470823e+02	8.000000e+00	1.300000e+01	1.800000e+01	1.250000e+02	5.43100
airport_ref	4893.0	3.741812e+03	4.890171e+02	3.384000e+03	3.602000e+03	3.622000e+03	3.670000e+03	6.38400
length_ft	4893.0	1.005470e+04	2.102188e+03	4.892000e+03	7.861000e+03	1.100000e+04	1.207900e+04	1.20790
width_ft	4893.0	1.716636e+02	2.506597e+01	1.000000e+02	1.500000e+02	1.500000e+02	2.000000e+02	2.00000
lighted	4893.0	9.513591e-01	2.151382e-01	0.000000e+00	1.000000e+00	1.000000e+00	1.000000e+00	1.00000
closed	4893.0	0.000000e+00	0.000000e+00	0.000000e+00	0.000000e+00	0.000000e+00	0.000000e+00	0.00000
Founded	4893.0	1.939004e+03	2.692440e+01	1.924000e+03	1.926000e+03	1.926000e+03	1.932000e+03	1.99800
traffic_Chg19_20	4893.0	-1.763080e+07	6.656975e+06	-3.294593e+07	-2.276684e+07	-1.718515e+07	-1.414430e+07	-1.55654
traffic_Chg18_19	4893.0	5.823171e+05	4.670072e+05	-1.434580e+05	4.101730e+05	4.158860e+05	6.928560e+05	2.95677

4. How many flights were delayed at large hubs compared to medium hubs? Use appropriate visualization to represent your findings

In [59]:
```
sns.countplot(final_df['hubs'], hue = final_df['Delay'])
```

Out[59]:
```
<AxesSubplot:xlabel='hubs', ylabel='count'>
```



From the large hubs its clear approx 120000 filght is delayed but from the medium hubs aprrox 40000 is delayed.

5. Use hypothesis testing strategies to discover:

a. If the airport's altitude has anything to do with flight delays for incoming and departing flights

In [60]:
```
from scipy.stats import chi2_contingency
table = [final_df['latitude_deg'],final_df['Delay']]
```

```
stat, p, dof, expected = chi2_contingency(table)
print('stat=%.3f, p=%.3f' % (stat, p))
if p > 0.05:
    print('Probably independent')
else:
    print('Probably dependent')
```

```
stat=194730.438, p=1.000
Probably independent
```

So its clear from the above hypothesis testing that altitude is nothing to do with the flight delay

b. If the number of runways at an airport affects flight delays

In [61]:
```
from scipy.stats import chi2_contingency
table = [final_df['airport_ref'],final_df['Delay']]
stat, p, dof, expected = chi2_contingency(table)
print('stat=%.3f, p=%.3f' % (stat, p))
if p > 0.05:
    print('Probably independent')
else:
    print('Probably dependent')
```

```
stat=200241.469, p=1.000
Probably independent
```

So its clear from the above hypothesis testing that no of runway is nothing to do with the flight delay

c. If the duration of a flight (length) affects flight delays

In [62]:
```
from scipy.stats import spearmanr
data1 = final_df['Length']
data2 = final_df['Delay']
stat, p = spearmanr(data1, data2)
print('stat=%.3f, p=%.3f' % (stat, p))
if p > 0.05:
    print('Probably independent')
else:
    print('Probably dependent')
```

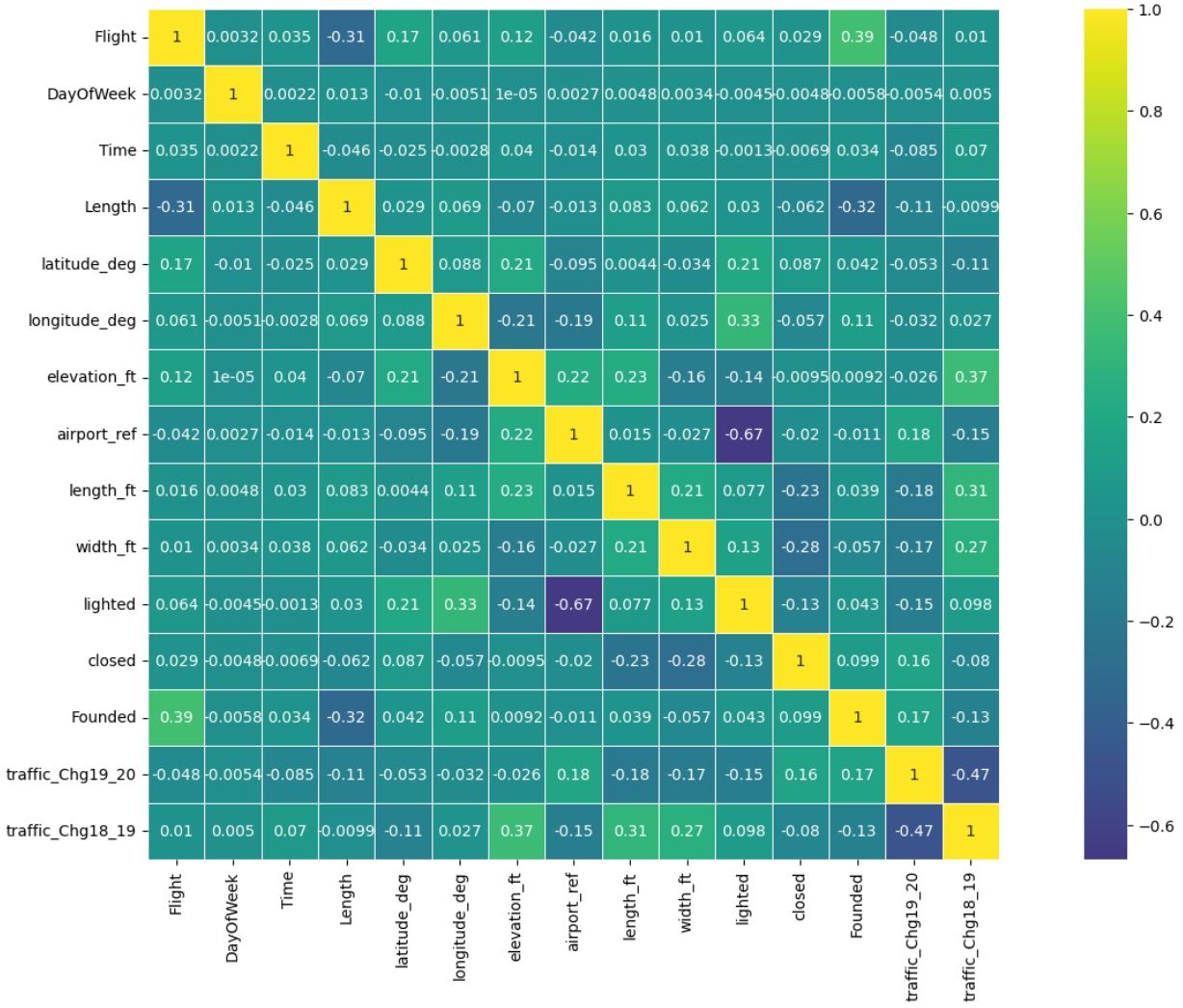
```
stat=-0.002, p=0.203
Probably independent
```

Both the variable are independent so that length of the flight is not affecting directly the delay.

6. Find the correlation matrix between the flight delay predictors, create a heatmap to visualize this, and share your findings

In [63]:
```
predictor = final_df.drop(['Delay'], axis=1)
corr = predictor.corr()
```

In [64]:
```
plt.figure(figsize=(20,10))
sns.heatmap(corr, center=0, linewidths=.5, square = True , annot = True , cmap='viridis')
plt.show()
```



Machine learning

1. Use OneHotEncoder and OrdinalEncoder to deal with categorical variables

In [65]:
```
# Before applying the one hot encodding or the label encoding first we check all feature data type.
final_df.info()
```

```
<class 'pandas.core.frame.DataFrame'>
Int64Index: 364277 entries, 0 to 364276
Data columns (total 20 columns):
 #   Column             Non-Null Count   Dtype  
---  ------             --------------   -----  
 0   Airline            364277 non-null  object 
 1   Flight             364277 non-null  int64  
 2   DayOfWeek          364277 non-null  int64  
 3   Time               364277 non-null  int64  
 4   Length             364277 non-null  int64  
 5   Delay              364277 non-null  int64  
 6   type               364277 non-null  object 
 7   latitude_deg       364277 non-null  float64
 8   longitude_deg      364277 non-null  float64
 9   elevation_ft       364277 non-null  float64
 10  scheduled_service  364277 non-null  object 
 11  airport_ref        364277 non-null  int64  
 12  length_ft          364277 non-null  float64
 13  width_ft           364277 non-null  float64
 14  lighted            364277 non-null  int64  
 15  closed             364277 non-null  int64  
 16  Founded            364277 non-null  float64
 17  traffic_Chg19_20   364277 non-null  int64  
 18  traffic_Chg18_19   364277 non-null  int64  
 19  hubs               364277 non-null  object 
dtypes: float64(6), int64(10), object(4)
memory usage: 58.4+ MB
```

In [66]:
```
final_df['Airline'].value_counts()
```

Out[66]:
```
WN    85067
DL    57720
AA    43261
OO    33843
UA    26535
MQ    26308
XE    22566
B6    15497
9E    13573
OH    10211
YV    10002
AS     9477
F9     6180
HA     4037
Name: Airline, dtype: int64
```

In [67]:
```
final_df['type'].value_counts()
```

Out[67]:
```
large_airport     342705
medium_airport     21572
Name: type, dtype: int64
```

In [68]:
```
final_df['scheduled_service'].value_counts()
```

Out[68]:
```
yes    364277
Name: scheduled_service, dtype: int64
```

In [69]:
```
final_df['hubs'].value_counts()
```

Out[69]:
```
large_hub     269953
Medium_hub     94324
Name: hubs, dtype: int64
```

The scheduled_service column throught has same value so it will not help in prediction so lets remove it and other three object column we will change through label encoder.

In [70]:
```
final_df = final_df.drop(['scheduled_service'], axis=1)
```

In [71]:
```
# Now using the ordinal encoder.
from sklearn.preprocessing import LabelEncoder
le = LabelEncoder()
```

In [72]:
```
final_df['Airline'] = le.fit_transform(final_df['Airline'])
final_df['type'] = le.fit_transform(final_df['type'])
final_df['hubs'] = le.fit_transform(final_df['hubs'])
```

In [73]:
```
final_df.head()
```

Out[73]:

	Airline	Flight	DayOfWeek	Time	Length	Delay	type	latitude_deg	longitude_deg	elevation_ft	airport_ref	length_ft
0	1	2466	3	20	195	1	0	37.618999	-122.375	13.0	3878	7500.0
1	1	526	3	360	215	0	0	37.618999	-122.375	13.0	3878	7500.0
2	1	552	3	360	315	1	0	37.618999	-122.375	13.0	3878	7500.0
3	1	810	3	385	255	0	0	37.618999	-122.375	13.0	3878	7500.0
4	1	24	3	425	325	1	0	37.618999	-122.375	13.0	3878	7500.0

2. Perform the following model building steps:

a. Apply logistic regression (use stochastic gradient descent optimizer) and decision tree models

b. Use the stratified five-fold method to build and validate the models

Note: Make sure you use standardization effectively, ensuring no data leakage and leverage pipelines to have a cleaner code

c. Use RandomizedSearchCV for hyperparameter tuning, and use k-fold for crossvalidation

d. Keep a few data points (10%) for prediction purposes to evaluate how you would make the final prediction, and do not use this data for testing or validation

Note: The final prediction will be based on the voting (majority class by 5 models created using the stratified 5-fold method)

e. Compare the results of logistic regression and decision tree classifier

In [74]:
```
# Lets first seperate the features and the target.
x = final_df.drop(['Delay'], axis= 1)
y = final_df["Delay"]
```

In [75]:
```
from sklearn import preprocessing
scaler = preprocessing.MinMaxScaler()
x = scaler.fit_transform(x)
```

In [76]:
```
# First Split the data into the training and testing set before performing the further operation.
from sklearn.model_selection import train_test_split
x_train, x_test, y_train, y_test = train_test_split(x, y, train_size=0.9, random_state=10)
```

Logistic Regression

In [77]:
```
# lets apply the logistic regression with the randomsearchcv hypermeter tunning.
from sklearn.linear_model import LogisticRegression
lr = LogisticRegression()
```

In [78]:
```
from sklearn.model_selection import RandomizedSearchCV
```

In [79]:
```
params = {"penalty": ["l1","l2"],
          'solver': ['newton-cg', 'liblinear']}

# Cross Validation
folds = 5

rscv = RandomizedSearchCV(estimator = lr,
                          param_distributions = params,
                          scoring = "accuracy",
                          verbose = 1,
                          cv= folds)

rscv.fit(x_train, y_train)
```

Out[79]:
```
Fitting 5 folds for each of 4 candidates, totalling 20 fits
RandomizedSearchCV(cv=5, estimator=LogisticRegression(),
                   param_distributions={'penalty': ['l1', 'l2'],
                                        'solver': ['newton-cg', 'liblinear']},
                   scoring='accuracy', verbose=1)
```

In [80]:
```
print(rscv.best_params_)
print(rscv.best_score_)
```

```
{'solver': 'newton-cg', 'penalty': 'l2'}
0.5950940921237212
```

In [81]:
```
lr = LogisticRegression(penalty= 'l2', solver= 'newton-cg')
lr.fit(x_train,y_train).score(x_train,y_train)
```

Out[81]:
```
0.5951215346089206
```

In [82]:
```
lr.score(x_test, y_test)
```

Out[82]:
```
0.595640715932799
```

Decision Tree Classifier

In [83]:
```
from sklearn.tree import DecisionTreeClassifier

dt = DecisionTreeClassifier()

params = {'criterion': ["gini", "entropy"],
          'min_samples_leaf' : [2,3,4,5,6,7,8,9],
         "max_depth": [2,3,4,5,6,7,8,9]}
```

```
rscv = RandomizedSearchCV(estimator = dt,
                          param_distributions= params,
                          scoring = "accuracy",
                          cv= 5,
                          verbose=1)
rscv.fit(x_train, y_train)
```

```
Fitting 5 folds for each of 10 candidates, totalling 50 fits
```

Out[83]:
```
RandomizedSearchCV(cv=5, estimator=DecisionTreeClassifier(),
                   param_distributions={'criterion': ['gini', 'entropy'],
                                        'max_depth': [2, 3, 4, 5, 6, 7, 8, 9],
                                        'min_samples_leaf': [2, 3, 4, 5, 6, 7,
                                                             8, 9]},
                   scoring='accuracy', verbose=1)
```

In [84]:
```
print(rscv.best_params_)
print(rscv.best_score_)
```

```
{'min_samples_leaf': 7, 'max_depth': 9, 'criterion': 'gini'}
0.6491830132746778
```

In [85]:
```
dtc = DecisionTreeClassifier(max_depth= 9, criterion= 'gini',min_samples_leaf= 7)
dtc.fit(x_train, y_train).score(x_train, y_train)
```

Out[85]:
```
0.6556280482783232
```

In [86]:
```
dtc.score(x_test, y_test)
```

Out[86]:
```
0.651065114746898
```

decision tree has good accuracy.

3. Use the stratified five-fold method to build and validate the models using the XGB classifier, compare all methods, and share your findings

In [87]:
```
from xgboost import XGBClassifier

# Create the parameter grid: gbm_param_grid
gbm_param_grid = {
                  'n_estimators': range(8, 20),
                  'max_depth': range(6, 10),
                  'learning_rate': [.4, .45, .5, .55, .6],
                  'colsample_bytree': [.6, .7, .8, .9, 1]
                   }

# Instantiate the regressor: gbm
gbm = XGBClassifier()

# Perform random search: grid_mse
xgb_random = RandomizedSearchCV(param_distributions=gbm_param_grid,
                                estimator = gbm, scoring = "accuracy",
                                verbose = 1, n_iter = 50, cv = 3)

# Fit randomized_mse to the data
xgb_random.fit(x_train, y_train)
```

```
Fitting 3 folds for each of 50 candidates, totalling 150 fits
```

Out[87]:
```
RandomizedSearchCV(cv=3,
                   estimator=XGBClassifier(base_score=None, booster=None,
                                           callbacks=None,
                                           colsample_bylevel=None,
                                           colsample_bynode=None,
                                           colsample_bytree=None,
                                           early_stopping_rounds=None,
                                           enable_categorical=False,
                                           eval_metric=None, gamma=None,
                                           gpu_id=None, grow_policy=None,
                                           importance_type=None,
                                           interaction_constraints=None,
                                           learning_rate=None, max_bin=None,...
                                           min_child_weight=None, missing=nan,
                                           monotone_constraints=None,
                                           n_estimators=100, n_jobs=None,
                                           num_parallel_tree=None,
                                           predictor=None, random_state=None,
                                           reg_alpha=None, reg_lambda=None, ...),
                   n_iter=50,
                   param_distributions={'colsample_bytree': [0.6, 0.7, 0.8, 0.9,
                                                             1],
                                        'learning_rate': [0.4, 0.45, 0.5, 0.55,
                                                          0.6],
                                        'max_depth': range(6, 10),
                                        'n_estimators': range(8, 20)},
                   scoring='accuracy', verbose=1)
```

In [88]:
```
print("Best parameters found: ", xgb_random.best_params_)
print("Best accuracy found: ", xgb_random.best_score_)
```

```
Best parameters found:  {'n_estimators': 15, 'max_depth': 9, 'learning_rate': 0.4, 'colsample_bytree':
0.8}
Best accuracy found:  0.6622805010843407
```

In [89]:
```
xgb = XGBClassifier(n_estimators=15, max_depth=9, learning_rate=0.4, colsample_bytree=0.8)
xgb.fit(x_train,y_train).score(x_train,y_train)
```

Out[89]:
```
0.6858553785431708
```

In [90]:
```
# Now lets compare the all method.
print(lr.score(x_test, y_test))
print(dtc.score(x_test, y_test))
print(xgb.score(x_test, y_test))
```

```
0.595640715932799
0.651065114746898
0.6627868672449764
```

The best Result is from XGBclassifer

In [91]:
```
final_df.to_excel("output.xlsx")
```

In [ ]:
```

```