July 16, 2021

1 Setup

```
[368]: # # Init pyspark
       # from pyspark import SparkContext
       # sc = SparkContext.getOrCreate()
       # # Init sparksql -- Only used to format the output nicely!
       # from pyspark.sql import SQLContext
       # sqlContext = SQLContext(sc)

       # rows = sc.textFile("/air_transit_2007.csv")
       # #rows = sc.textFile("/Users/abel/Downloads/spare_time/working/
        →a13544_600_spark/air_transit_2007.csv")

       # data = rows.map(lambda line: line.split(","))
       # # data.cache()

       # import findspark
       # findspark.init()
       # A simple demo for working with SparkSQL and Tweets
       from pyspark import SparkContext, SparkConf
       from pyspark.sql import HiveContext, Row
       from pyspark.sql.types import IntegerType
       import json
       import sys



       inputFile = 'air_transit_2007.csv'
       inputFile = '/Users/abel/Downloads/spare_time/working/a13544_600_spark/
        →air_transit_2007.csv'

       conf = SparkConf().setAppName("SparkSQLAirTransit")
       SparkConf().set("spark.sql.legacy.timeParserPolicy","LEGACY")

       sc = SparkContext.getOrCreate(conf=conf)
       hiveCtx = HiveContext(sc)
       print("Loading tweets from " + inputFile)
```

Loading tweets from
/Users/abel/Downloads/spare_time/working/a13544_600_spark/air_transit_2007.csv

```
[369]: input = hiveCtx.read.option("header",True).csv(inputFile,inferSchema =True)
       input.printSchema()
```

```
root
 |-- Year: integer (nullable = true)
 |-- Month: integer (nullable = true)
 |-- DayofMonth: integer (nullable = true)
 |-- DayOfWeek: integer (nullable = true)
 |-- DepTime: string (nullable = true)
 |-- CRSDepTime: integer (nullable = true)
 |-- ArrTime: string (nullable = true)
 |-- CRSArrTime: integer (nullable = true)
 |-- UniqueCarrier: string (nullable = true)
 |-- FlightNum: integer (nullable = true)
 |-- TailNum: string (nullable = true)
 |-- ActualElapsedTime: string (nullable = true)
 |-- CRSElapsedTime: string (nullable = true)
 |-- AirTime: string (nullable = true)
 |-- ArrDelay: string (nullable = true)
 |-- DepDelay: string (nullable = true)
 |-- Origin: string (nullable = true)
 |-- Dest: string (nullable = true)
 |-- Distance: integer (nullable = true)
 |-- TaxiIn: integer (nullable = true)
 |-- TaxiOut: integer (nullable = true)
 |-- Cancelled: integer (nullable = true)
 |-- CancellationCode: string (nullable = true)
 |-- Diverted: integer (nullable = true)
 |-- CarrierDelay: integer (nullable = true)
 |-- WeatherDelay: integer (nullable = true)
 |-- NASDelay: integer (nullable = true)
 |-- SecurityDelay: integer (nullable = true)
 |-- LateAircraftDelay: integer (nullable = true)
```

```
[370]: # Sample Query
```

```
[371]: input.registerTempTable("air_transit")

       myair_transits = hiveCtx.sql("SELECT * FROM air_transit  LIMIT 3")
       print('myair_transits:' )
       for item in myair_transits.collect():
           print(item, '\n')
```

myair_transits:

```
Row(Year=2007, Month=1, DayofMonth=1, DayOfWeek=1, DepTime='1232',
CRSDepTime=1225, ArrTime='1341', CRSArrTime=1340, UniqueCarrier='WN',
FlightNum=2891, TailNum='N351', ActualElapsedTime='69', CRSElapsedTime='75',
AirTime='54', ArrDelay='1', DepDelay='7', Origin='SMF', Dest='ONT',
Distance=389, TaxiIn=4, TaxiOut=11, Cancelled=0, CancellationCode=None,
Diverted=0, CarrierDelay=0, WeatherDelay=0, NASDelay=0, SecurityDelay=0,
LateAircraftDelay=0)

Row(Year=2007, Month=1, DayofMonth=1, DayOfWeek=1, DepTime='1918',
CRSDepTime=1905, ArrTime='2043', CRSArrTime=2035, UniqueCarrier='WN',
FlightNum=462, TailNum='N370', ActualElapsedTime='85', CRSElapsedTime='90',
AirTime='74', ArrDelay='8', DepDelay='13', Origin='SMF', Dest='PDX',
Distance=479, TaxiIn=5, TaxiOut=6, Cancelled=0, CancellationCode=None,
Diverted=0, CarrierDelay=0, WeatherDelay=0, NASDelay=0, SecurityDelay=0,
LateAircraftDelay=0)

Row(Year=2007, Month=1, DayofMonth=1, DayOfWeek=1, DepTime='2206',
CRSDepTime=2130, ArrTime='2334', CRSArrTime=2300, UniqueCarrier='WN',
FlightNum=1229, TailNum='N685', ActualElapsedTime='88', CRSElapsedTime='90',
AirTime='73', ArrDelay='34', DepDelay='36', Origin='SMF', Dest='PDX',
Distance=479, TaxiIn=6, TaxiOut=9, Cancelled=0, CancellationCode=None,
Diverted=0, CarrierDelay=3, WeatherDelay=0, NASDelay=0, SecurityDelay=0,
LateAircraftDelay=31)
```

1.1 Q1

Compute the total number of records.

```
[372]:  # Response...
        df = input

        # mycount = hiveCtx.sql("SELECT count(*) as mycount FROM air_transit")
        # print('mycount=', mycount.collect()[0]['mycount'] )

        print('total number of records.',df.count() )
```

```
total number of records. 7453215
```

```
[373]:  ## Q2
        #Find total number of operated flights per month, sorted by the month..


        # mymonth = hiveCtx.sql("select Month, count(*) as flight_number from␣
         ↪air_transit group by Month order by Month LIMIT 100")
        # print('total number of operated flights per month:')
        # for item in mymonth.collect():
```

```
#     print(item['Month'], 'month', item['flight_number'])

from pyspark.sql.functions import col

print('Q2 total number of operated flights per month, sorted by the month:')

df1 = df.groupBy("Month").count().sort('Month',ascending=True)
for item in df1.rdd.collect():
    print(item['Month'], item['count'])
```

Q2 total number of operated flights per month, sorted by the month:
1 621559
2 565604
3 639209
4 614648
5 631609
6 629280
7 648560
8 653279
9 600187
10 629992
11 605149
12 614139

[374]:
```
## Q3
# Find the plane with the highest number of flights. Each plane has a unique
 ↪TailNum

print('Q3: highest number of flights. Each plane has a unique TailNum')
df1 = df.filter(~col('TailNum').isin(['0', '000000']))
df1 = df1.groupBy("TailNum").count().sort('count',ascending=False)

if df1 is not None:
    for item in df1.rdd.collect()[:3]:
        print(item['TailNum'], item['count'])
    print('highest_number_filghts: ', df1.collect()[0]['TailNum'] )
```

Q3: highest number of flights. Each plane has a unique TailNum
N655BR 4483
N479HA 4359
N651BR 4346
highest_number_filghts: N655BR

[375]:
```
## Q4
# Compute the total flight time of each airplane, sorted by flight time in
 ↪descending order.
```

```python
# total_flight_times = hiveCtx.sql("SELECT TailNum, SUM (AirTime) as
 ↪total_fight_time FROM air_transit GROUP BY TailNum order by total_fight_time
 ↪desc LIMIT 100")
# print('-'*10, 'We make ', '-'*10)
# print('total flight time of each airplane: ')
# for item in  total_flight_times.collect():
#     print(item['TailNum'], ' total fight time is', item['total_fight_time'])

print('Q4:total flight time of each airplane, sorted by flight time in
 ↪descending order')
df1 = df.groupBy("TailNum").agg(F.sum(df['AirTime']).alias('result')).
 ↪orderBy('result',ascending=False)
if df1 is not None:
    for item in df1.rdd.collect()[:3]:
        print(item['TailNum'], item['result'])
```

```
Q4:total flight time of each airplane, sorted by flight time in descending order
N556AS 532213.0
N557UA 259376.0
N597UA 254760.0
```

```python
# q5 Find the busiest airport (in terms of number of departures + arrivals of
 ↪all operated flights) for each month.
from pyspark.sql.functions import col
import operator
df = input

for month in range(1, 12+1):
    print(month, '-'*10)
    df1=df.filter(col('Month').isin([month])).groupBy('Origin').count()
    df2=df.filter(col('Month').isin([month])).groupBy('Dest').count()
    #print(type(df1), type(df2))
    k_v = {}
    for orgin in df1.collect():
#         print(orgin['Origin'],orgin['count'])
        k_v[orgin['Origin']] = orgin['count']
    for dest in df2.collect():
        if k_v.get(dest['Dest']) :
#             print(dest)
#             print('before',k_v[dest['Dest']])
            k_v[dest['Dest']] += dest['count']
#             print('after',k_v[dest['Dest']])

    print(k_v)
    if k_v is not None:
        month_max, thecount = max(k_v.items(), key=operator.itemgetter(1))
```

```
        print('month_max:', month_max, ' ,departures + arrivals of this month:
 →', thecount)
```

1 ----------
{'BGM': 237, 'DLG': 26, 'PSE': 129, 'MSY': 5535, 'GEG': 2355, 'SNA': 8859,
'BUR': 5399, 'GRB': 1508, 'GTF': 495, 'IDA': 537, 'GRR': 2775, 'EUG': 1004,
'PSG': 124, 'PVD': 4296, 'GSO': 2800, 'MYR': 990, 'ISO': 17, 'OAK': 12600,
'MSN': 2348, 'COD': 186, 'BTM': 123, 'FAR': 999, 'FSM': 367, 'MQT': 170, 'SCC':
124, 'DCA': 15605, 'RFD': 126, 'MLU': 571, 'CID': 1944, 'LWS': 123, 'GTR': 163,
'WRG': 124, 'HLN': 308, 'LEX': 1749, 'RDM': 605, 'FLO': 111, 'ORF': 3325, 'SCE':
135, 'EVV': 933, 'KTN': 372, 'CRW': 587, 'CWA': 306, 'SAV': 2106, 'TRI': 154,
'CDV': 124, 'CMH': 6874, 'MOD': 526, 'CAK': 1428, 'TYR': 246, 'ADK': 16, 'CHO':
272, 'MOB': 1034, 'PNS': 1731, 'MCN': 184, 'CEC': 172, 'LIH': 2762, 'IAH':
36883, 'HNL': 11434, 'SHV': 1606, 'ERI': 252, 'SJC': 10143, 'CVG': 19159, 'TOL':
363, 'BUF': 4756, 'LGA': 21243, 'TLH': 622, 'ACT': 364, 'HPN': 1735, 'RDD': 303,
'AUS': 7547, 'MLI': 1552, 'SJU': 4348, 'ATW': 979, 'DHN': 284, 'AVL': 536,
'GJT': 907, 'LGB': 2291, 'LYH': 178, 'BFL': 937, 'GFK': 240, 'RNO': 4619, 'SRQ':
1371, 'SBN': 603, 'EYW': 185, 'TTN': 230, 'JAC': 562, 'RST': 769, 'CHS': 2362,
'TUL': 4049, 'HRL': 976, 'RSW': 5816, 'IPL': 234, 'AMA': 1403, 'ISP': 2131,
'BOS': 22916, 'MAF': 1455, 'MLB': 368, 'TUP': 116, 'EWR': 25953, 'LAS': 30117,
'BIS': 542, 'JAN': 2252, 'ITO': 1584, 'FAI': 682, 'XNA': 2250, 'DLH': 348,
'DEN': 40124, 'RHI': 4, 'SGU': 617, 'ALB': 2451, 'CPR': 660, 'LNK': 732, 'OME':
186, 'BOI': 2767, 'IAD': 17152, 'PSP': 2708, 'SBA': 2429, 'IYK': 165, 'MEI':
115, 'BRO': 385, 'DRO': 750, 'BMI': 598, 'SEA': 16982, 'LAN': 820, 'CMI': 424,
'LRD': 499, 'VLD': 169, 'MCI': 9805, 'FLG': 288, 'GRK': 900, 'BNA': 10328,
'CLT': 20801, 'CLL': 324, 'TVC': 557, 'PSC': 454, 'BLI': 119, 'CIC': 226, 'ABQ':
6190, 'PBI': 5719, 'SDF': 3433, 'ACV': 647, 'LAW': 359, 'BDL': 5531, 'DAL':
8912, 'MRY': 1361, 'DBQ': 240, 'CLE': 13960, 'APF': 129, 'PDX': 9398, 'MIA':
11645, 'MFR': 1047, 'TWF': 370, 'ILG': 114, 'TPA': 13854, 'BWI': 17714, 'CMX':
62, 'OKC': 4213, 'ROA': 820, 'SMF': 9062, 'SPI': 286, 'BRW': 124, 'OXR': 225,
'ABI': 488, 'MBS': 642, 'ELM': 181, 'PHX': 36355, 'FCA': 414, 'STL': 10990,
'PWM': 1093, 'ABY': 216, 'BET': 178, 'MHT': 3397, 'DFW': 50770, 'ABE': 1002,
'TXK': 185, 'GSP': 2177, 'LSE': 410, 'STX': 96, 'FAY': 358, 'HDN': 786, 'GUC':
364, 'LBB': 1593, 'EKO': 299, 'CRP': 1486, 'EGE': 1050, 'FSD': 1194, 'SWF': 760,
'SUN': 560, 'CSG': 227, 'BQK': 161, 'SFO': 21856, 'MEM': 14062, 'ELP': 3757,
'BHM': 3445, 'FLL': 12247, 'ATL': 64597, 'PIH': 332, 'FNT': 1255, 'RIC': 3327,
'AKN': 42, 'DAY': 2440, 'PHF': 989, 'OMA': 4579, 'SJT': 310, 'LCH': 256, 'TEX':
124, 'BPT': 61, 'VPS': 1105, 'LIT': 2850, 'CAE': 1822, 'ICT': 2508, 'FAT': 2443,
'PFN': 599, 'ORD': 63654, 'AVP': 528, 'BTV': 1103, 'AEX': 695, 'BIL': 683,
'SPS': 352, 'ILM': 537, 'SMX': 302, 'PIA': 834, 'RDU': 10486, 'BQN': 209, 'MFE':
804, 'MKE': 3775, 'SYR': 2237, 'LFT': 966, 'HSV': 1368, 'TUS': 4329, 'PIT':
8373, 'MTJ': 613, 'ACY': 169, 'MDW': 16391, 'AZO': 951, 'PLN': 62, 'COS': 2605,
'OAJ': 123, 'JNU': 620, 'IND': 7257, 'ALO': 57, 'KOA': 2624, 'GPT': 1107, 'MGM':
772, 'DTW': 30088, 'HOU': 9260, 'TYS': 2078, 'CHA': 863, 'YUM': 604, 'ADQ': 106,
'ONT': 6073, 'MDT': 1605, 'FWA': 988, 'JAX': 5877, 'LAX': 39395, 'MSP': 25886,
'HTS': 107, 'MOT': 186, 'BTR': 1942, 'BGR': 849, 'SIT': 186, 'MCO': 20561,
'ROC': 2997, 'SGF': 1799, 'AGS': 337, 'OTZ': 186, 'SAN': 15350, 'BZN': 751,

'GGG': 186, 'YAK': 124, 'JFK': 20981, 'DAB': 761, 'ANC': 2782, 'SUX': 108,
'MSO': 596, 'GNV': 339, 'PHL': 17654, 'OGG': 4436, 'DSM': 3092, 'SAT': 7015,
'SLC': 24438, 'STT': 619, 'ASE': 1333, 'CLD': 458, 'RAP': 770, 'SBP': 1095}
month_max: ATL   ,departures + arrivals of this month: 64597
2 ----------
{'BGM': 220, 'DLG': 24, 'PSE': 112, 'MSY': 5277, 'GEG': 2120, 'SNA': 8017,
'BUR': 4844, 'GRB': 1362, 'GTF': 489, 'IDA': 483, 'GRR': 2478, 'EUG': 890,
'PSG': 112, 'PVD': 3928, 'GSO': 2468, 'MYR': 947, 'OAK': 11369, 'MSN': 2146,
'COD': 166, 'BTM': 108, 'FAR': 899, 'FSM': 319, 'MQT': 151, 'SCC': 112, 'DCA':
14168, 'RFD': 112, 'MLU': 515, 'CID': 1682, 'LWS': 108, 'GTR': 152, 'MTH': 32,
'WRG': 112, 'HLN': 277, 'LEX': 1503, 'RDM': 543, 'FLO': 104, 'ORF': 2963, 'SCE':
98, 'EVV': 882, 'KTN': 336, 'CRW': 548, 'CWA': 272, 'SAV': 1935, 'TRI': 152,
'CDV': 112, 'CMH': 6043, 'MOD': 484, 'CAK': 1365, 'TYR': 223, 'ADK': 16, 'CHO':
246, 'MOB': 958, 'PNS': 1532, 'MCN': 168, 'CEC': 156, 'LIH': 2467, 'IAH': 33351,
'HNL': 10314, 'SHV': 1403, 'ERI': 216, 'SJC': 9158, 'CVG': 17000, 'TOL': 328,
'BUF': 4206, 'LGA': 19340, 'TLH': 552, 'ACT': 328, 'HPN': 1714, 'RDD': 275,
'AUS': 6837, 'MLI': 1479, 'SJU': 3995, 'ATW': 919, 'DHN': 261, 'AVL': 475,
'GJT': 816, 'LGB': 2120, 'LYH': 160, 'BFL': 842, 'GFK': 216, 'RNO': 4198, 'SRQ':
1425, 'SBN': 698, 'EYW': 168, 'TTN': 216, 'JAC': 525, 'RST': 696, 'CHS': 2163,
'RSW': 5696, 'TUL': 3666, 'HRL': 890, 'IPL': 204, 'AMA': 1273, 'ISP': 1928,
'BOS': 21156, 'MAF': 1314, 'MLB': 336, 'TUP': 108, 'EWR': 23638, 'LAS': 27367,
'BIS': 488, 'JAN': 2034, 'ITO': 1456, 'FAI': 651, 'XNA': 2113, 'DLH': 316,
'DEN': 36656, 'SGU': 559, 'ALB': 2188, 'CPR': 596, 'LNK': 713, 'OME': 166,
'BOI': 2502, 'IAD': 15384, 'PSP': 2554, 'SBA': 2187, 'IYK': 148, 'MEI': 103,
'BRO': 364, 'DRO': 672, 'BMI': 528, 'SEA': 15434, 'LAN': 736, 'CMI': 384, 'LRD':
418, 'VLD': 164, 'MCI': 8730, 'FLG': 256, 'GRK': 816, 'BNA': 9217, 'CLT': 18725,
'CLL': 285, 'TVC': 503, 'PSC': 407, 'BLI': 112, 'CIC': 208, 'PBI': 5433, 'ABQ':
5589, 'SDF': 3101, 'ACV': 594, 'LAW': 326, 'BDL': 5008, 'DAL': 8044, 'MRY':
1249, 'DBQ': 216, 'CLE': 12896, 'APF': 140, 'PDX': 8448, 'MIA': 10726, 'MFR':
948, 'TWF': 353, 'ILG': 104, 'TPA': 12791, 'BWI': 16025, 'CMX': 52, 'OKC': 3813,
'ROA': 688, 'SMF': 8146, 'SPI': 264, 'BRW': 112, 'OXR': 208, 'ABI': 440, 'MBS':
588, 'ELM': 179, 'PHX': 32820, 'FCA': 387, 'STL': 9808, 'PWM': 1015, 'ABY': 200,
'BET': 160, 'MHT': 3159, 'ABE': 870, 'DFW': 45451, 'TXK': 167, 'GSP': 2008,
'LSE': 368, 'STX': 88, 'FAY': 324, 'HDN': 714, 'GUC': 362, 'LBB': 1449, 'EKO':
269, 'CRP': 1312, 'EGE': 984, 'FSD': 1050, 'SWF': 817, 'SUN': 468, 'CSG': 208,
'BQK': 152, 'SFO': 19877, 'MEM': 12885, 'ELP': 3364, 'BHM': 3132, 'FLL': 11728,
'ATL': 59558, 'FNT': 1200, 'PIH': 283, 'RIC': 3013, 'AKN': 40, 'DAY': 2267,
'PHF': 841, 'OMA': 4145, 'SJT': 280, 'LCH': 222, 'TEX': 112, 'BPT': 56, 'VPS':
1043, 'LIT': 2609, 'CAE': 1617, 'ICT': 2270, 'FAT': 2218, 'PFN': 556, 'ORD':
57967, 'AVP': 471, 'BTV': 1025, 'AEX': 640, 'BIL': 606, 'SPS': 320, 'ILM': 496,
'SMX': 272, 'PIA': 758, 'RDU': 9342, 'BQN': 196, 'MFE': 762, 'MKE': 3398, 'SYR':
2010, 'HSV': 1268, 'LFT': 883, 'PIT': 7538, 'TUS': 3904, 'MTJ': 600, 'ACY': 152,
'MDW': 14646, 'AZO': 851, 'PLN': 29, 'COS': 2135, 'OAJ': 109, 'JNU': 560, 'IND':
6680, 'ALO': 52, 'KOA': 2407, 'EAU': 23, 'GPT': 989, 'MGM': 701, 'DTW': 27699,
'HOU': 8382, 'TYS': 1900, 'CHA': 775, 'YUM': 544, 'ADQ': 96, 'ONT': 5436, 'MDT':
1450, 'FWA': 941, 'JAX': 5347, 'LAX': 35584, 'MSP': 24150, 'HTS': 97, 'MOT':
168, 'BTR': 1782, 'BGR': 756, 'SIT': 168, 'MCO': 19350, 'ROC': 2748, 'SGF':
1641, 'AGS': 321, 'OTZ': 166, 'SAN': 13842, 'BZN': 755, 'GGG': 168, 'YAK': 112,

```
'DAB': 802, 'JFK': 19301, 'ANC': 2485, 'SUX': 100, 'MSO': 558, 'GNV': 313,
'PHL': 16066, 'OGG': 3958, 'DSM': 2747, 'SAT': 6339, 'SLC': 22009, 'STT': 576,
'ASE': 1218, 'CLD': 416, 'RAP': 697, 'SBP': 998}
month_max: ATL  ,departures + arrivals of this month: 59558
3 ----------
{'BGM': 236, 'DLG': 28, 'PSE': 122, 'MSY': 5965, 'GEG': 2451, 'SNA': 8980,
'BUR': 5460, 'GRB': 1513, 'GTF': 602, 'IDA': 536, 'GRR': 2705, 'EUG': 1044,
'PSG': 124, 'PVD': 4313, 'GSO': 2717, 'MYR': 1198, 'OAK': 12587, 'MSN': 2384,
'COD': 184, 'FAR': 989, 'BTM': 165, 'FSM': 341, 'MQT': 166, 'SCC': 124, 'DCA':
15708, 'RFD': 125, 'MLU': 555, 'CID': 1723, 'LWS': 124, 'GTR': 175, 'MTH': 71,
'WRG': 124, 'HLN': 309, 'LEX': 1798, 'RDM': 610, 'FLO': 114, 'ORF': 3321, 'SCE':
112, 'EVV': 980, 'KTN': 372, 'CRW': 652, 'CWA': 298, 'SAV': 2301, 'TRI': 169,
'CDV': 124, 'CMH': 6790, 'MOD': 548, 'CAK': 1398, 'TYR': 248, 'ADK': 18, 'CHO':
284, 'MOB': 1045, 'PNS': 1739, 'MCN': 185, 'CEC': 176, 'LIH': 2680, 'IAH':
37356, 'HNL': 11575, 'SHV': 1575, 'ERI': 222, 'SJC': 10245, 'CVG': 19593, 'TOL':
362, 'BUF': 4829, 'LGA': 21391, 'TLH': 658, 'ACT': 362, 'HPN': 1831, 'RDD': 312,
'AUS': 7904, 'MLI': 1471, 'SJU': 4502, 'ATW': 1046, 'DHN': 281, 'AVL': 477,
'GJT': 902, 'LGB': 2364, 'LYH': 176, 'BFL': 968, 'GFK': 235, 'RNO': 4799, 'SRQ':
1879, 'SBN': 876, 'EYW': 246, 'TTN': 238, 'JAC': 594, 'RST': 763, 'CHS': 2563,
'HRL': 1006, 'RSW': 7084, 'TUL': 4036, 'IPL': 220, 'ISP': 2128, 'AMA': 1418,
'BOS': 24056, 'MAF': 1456, 'MLB': 372, 'TUP': 124, 'EWR': 27136, 'LAS': 31393,
'BIS': 521, 'JAN': 2226, 'ITO': 1644, 'FAI': 744, 'XNA': 2339, 'HHH': 89, 'DLH':
371, 'DEN': 41507, 'SGU': 619, 'ALB': 2412, 'CPR': 660, 'LNK': 752, 'OME': 188,
'IAD': 17346, 'BOI': 2816, 'PSP': 2906, 'SBA': 2447, 'IYK': 168, 'MEI': 114,
'BRO': 435, 'DRO': 743, 'BMI': 584, 'SEA': 17206, 'LAN': 828, 'CMI': 422, 'LRD':
510, 'VLD': 186, 'MCI': 9552, 'FLG': 310, 'GRK': 890, 'BNA': 10381, 'CLL': 310,
'CLT': 21112, 'TVC': 557, 'BLI': 124, 'PSC': 451, 'CIC': 238, 'PBI': 6372,
'ABQ': 6268, 'SDF': 3537, 'ACV': 652, 'LAW': 362, 'BDL': 5552, 'DAL': 9133,
'MRY': 1378, 'DBQ': 238, 'CLE': 15048, 'APF': 186, 'PDX': 9500, 'MIA': 11814,
'MFR': 1111, 'TWF': 316, 'ILG': 115, 'TPA': 15042, 'BWI': 18152, 'CMX': 48,
'OKC': 4184, 'ROA': 627, 'SMF': 9222, 'SPI': 302, 'BRW': 124, 'OXR': 238, 'ABI':
487, 'MBS': 658, 'ELM': 211, 'PHX': 37082, 'FCA': 470, 'STL': 10982, 'PWM':
1164, 'ABY': 230, 'BET': 178, 'MHT': 3704, 'ABE': 947, 'DFW': 50589, 'TXK': 186,
'GSP': 2311, 'LSE': 407, 'STX': 100, 'FAY': 362, 'HDN': 794, 'GUC': 399, 'LBB':
1615, 'EKO': 299, 'CRP': 1456, 'EGE': 1096, 'FSD': 1180, 'SWF': 926, 'SUN': 591,
'CSG': 230, 'BQK': 168, 'SFO': 22440, 'MEM': 14391, 'ELP': 3707, 'BHM': 3607,
'FLL': 13642, 'ATL': 68073, 'FNT': 1463, 'PIH': 310, 'RIC': 3294, 'AKN': 44,
'DAY': 2562, 'PHF': 873, 'OMA': 4602, 'SJT': 309, 'LCH': 238, 'TEX': 124, 'BPT':
62, 'VPS': 1168, 'LIT': 3011, 'CAE': 2003, 'ICT': 2477, 'FAT': 2476, 'PFN': 566,
'SOP': 26, 'ORD': 64903, 'AVP': 548, 'BTV': 1176, 'AEX': 706, 'BIL': 672, 'SPS':
352, 'ILM': 628, 'SMX': 302, 'PIA': 834, 'RDU': 10535, 'BQN': 248, 'MFE': 762,
'MKE': 3779, 'SYR': 2324, 'HSV': 1514, 'LFT': 956, 'PIT': 8507, 'TUS': 4564,
'MTJ': 674, 'ACY': 169, 'MDW': 16375, 'AZO': 960, 'COS': 2365, 'OAJ': 174,
'JNU': 620, 'IND': 7640, 'ALO': 40, 'KOA': 2830, 'EAU': 49, 'GPT': 1113, 'MGM':
764, 'HOU': 9474, 'DTW': 30948, 'CHA': 870, 'TYS': 2318, 'YUM': 602, 'ADQ': 104,
'ONT': 5894, 'MDT': 1578, 'FWA': 1072, 'JAX': 6013, 'LAX': 40128, 'MSP': 27322,
'HTS': 115, 'MOT': 186, 'BGR': 830, 'BTR': 1985, 'SIT': 186, 'MCO': 22465,
'ROC': 3153, 'SGF': 1816, 'AGS': 362, 'OTZ': 186, 'SAN': 15647, 'BZN': 890,
```

'GGG': 185, 'YAK': 124, 'DAB': 910, 'JFK': 22011, 'ANC': 2805, 'SUX': 90, 'MSO': 664, 'GNV': 362, 'PHL': 18225, 'OGG': 4404, 'DSM': 3131, 'SAT': 7131, 'SLC': 25308, 'STT': 684, 'ASE': 1396, 'CLD': 466, 'RAP': 783, 'SBP': 1158}
month_max: ATL ,departures + arrivals of this month: 68073
4 ----------
{'BGM': 231, 'DLG': 26, 'PSE': 120, 'MSY': 5650, 'GEG': 2641, 'SNA': 8862, 'BUR': 5408, 'GRB': 1460, 'GTF': 576, 'IDA': 557, 'GRR': 2713, 'LWB': 2, 'EUG': 977, 'PSG': 120, 'PVD': 4230, 'GSO': 2429, 'MYR': 1163, 'OAK': 12299, 'MSN': 2302, 'COD': 179, 'BTM': 137, 'FAR': 922, 'FSM': 375, 'MQT': 163, 'SCC': 120, 'DCA': 15153, 'RFD': 110, 'MLU': 496, 'CID': 1780, 'LWS': 114, 'GTR': 172, 'MTH': 68, 'WRG': 120, 'HLN': 285, 'LEX': 1685, 'RDM': 586, 'FLO': 112, 'ORF': 3284, 'SCE': 110, 'EVV': 961, 'KTN': 360, 'CRW': 632, 'CWA': 288, 'SAV': 2359, 'TRI': 165, 'CDV': 120, 'CMH': 6521, 'MOD': 514, 'CAK': 1397, 'TYR': 240, 'ADK': 18, 'CHO': 276, 'MOB': 918, 'PNS': 1667, 'MCN': 181, 'CEC': 169, 'LIH': 2559, 'IAH': 34358, 'HNL': 11149, 'SHV': 1560, 'ERI': 232, 'SJC': 10054, 'CVG': 18552, 'TOL': 351, 'BUF': 4728, 'TLH': 671, 'LGA': 20674, 'ACT': 351, 'HPN': 2074, 'RDD': 300, 'AUS': 8031, 'MLI': 1493, 'SJU': 4282, 'ATW': 1027, 'DHN': 269, 'AVL': 504, 'GJT': 905, 'LGB': 2280, 'LYH': 172, 'BFL': 872, 'GFK': 181, 'RNO': 4634, 'SRQ': 1651, 'SBN': 856, 'EYW': 212, 'TTN': 188, 'JAC': 407, 'RST': 708, 'CHS': 2566, 'RSW': 6133, 'TUL': 4057, 'HRL': 986, 'IPL': 210, 'AMA': 1179, 'ISP': 2058, 'BOS': 22812, 'MAF': 1285, 'MLB': 351, 'TUP': 112, 'EWR': 26126, 'LAS': 30446, 'BIS': 473, 'JAN': 2149, 'ITO': 1598, 'FAI': 720, 'XNA': 2264, 'HHH': 179, 'DLH': 359, 'DEN': 39162, 'SGU': 598, 'ALB': 2406, 'CPR': 642, 'LNK': 714, 'OME': 180, 'BOI': 2818, 'IAD': 16485, 'PSP': 2620, 'SBA': 2236, 'IYK': 159, 'MEI': 112, 'BRO': 248, 'DRO': 686, 'BMI': 578, 'SEA': 17115, 'LAN': 827, 'CMI': 453, 'LRD': 496, 'VLD': 174, 'MCI': 9560, 'FLG': 300, 'GRK': 864, 'BNA': 10231, 'CLT': 20653, 'CLL': 300, 'TVC': 552, 'PSC': 441, 'BLI': 110, 'CIC': 232, 'ABQ': 6300, 'PBI': 6079, 'SDF': 3285, 'ACV': 626, 'LAW': 352, 'BDL': 5315, 'DAL': 8848, 'MRY': 1253, 'DBQ': 232, 'CLE': 14222, 'APF': 144, 'PDX': 9237, 'MIA': 11228, 'MFR': 1039, 'TWF': 334, 'ILG': 111, 'TPA': 14126, 'BWI': 17744, 'CMX': 57, 'OKC': 4257, 'ROA': 589, 'SMF': 9318, 'SPI': 285, 'BRW': 120, 'OXR': 230, 'ABI': 473, 'MBS': 634, 'ELM': 214, 'PHX': 35546, 'FCA': 428, 'STL': 10571, 'PWM': 1115, 'ABY': 218, 'BET': 186, 'MHT': 3695, 'DFW': 48535, 'ABE': 997, 'TXK': 180, 'GSP': 2224, 'LSE': 393, 'STX': 88, 'FAY': 344, 'HDN': 327, 'GUC': 189, 'LBB': 1474, 'EKO': 291, 'CRP': 1220, 'EGE': 541, 'FSD': 1094, 'SWF': 902, 'SUN': 407, 'CSG': 216, 'BQK': 160, 'SFO': 21940, 'MEM': 13807, 'ELP': 3575, 'BHM': 3653, 'FLL': 12700, 'ATL': 65773, 'FNT': 1309, 'PIH': 302, 'RIC': 3143, 'AKN': 46, 'DAY': 2502, 'PHF': 871, 'OMA': 4532, 'SJT': 300, 'LCH': 232, 'VPS': 1037, 'BPT': 60, 'LIT': 2843, 'CAE': 1825, 'ICT': 2399, 'FAT': 2389, 'PFN': 536, 'SOP': 44, 'ORD': 62588, 'AVP': 529, 'BTV': 1256, 'AEX': 551, 'BIL': 713, 'SPS': 343, 'ILM': 606, 'SMX': 292, 'PIA': 847, 'RDU': 10344, 'BQN': 240, 'MFE': 745, 'MKE': 4019, 'SYR': 2306, 'LFT': 964, 'HSV': 1494, 'TUS': 4648, 'PIT': 8150, 'MTJ': 384, 'ACY': 160, 'MDW': 16185, 'AZO': 884, 'COS': 2446, 'OAJ': 171, 'JNU': 609, 'IND': 7170, 'ALO': 14, 'KOA': 2756, 'EAU': 14, 'GPT': 1187, 'MGM': 726, 'DTW': 29898, 'HOU': 9251, 'CHA': 830, 'TYS': 2205, 'YUM': 573, 'ADQ': 104, 'ONT': 6657, 'MDT': 1518, 'FWA': 1131, 'JAX': 5773, 'LAX': 38187, 'MSP': 26216, 'HTS': 107, 'MOT': 180, 'BTR': 1791, 'BGR': 694, 'SIT': 184, 'MCO': 21941, 'ROC': 3024, 'AGS': 446, 'SGF': 1840,

```
'OTZ': 180, 'SAN': 14883, 'BZN': 769, 'GGG': 180, 'YAK': 120, 'JFK': 21328,
'DAB': 755, 'ANC': 2721, 'SUX': 74, 'MSO': 636, 'GNV': 344, 'PHL': 17713, 'OGG':
4152, 'DSM': 2985, 'SAT': 7136, 'SLC': 23420, 'GLH': 4, 'STT': 625, 'ASE': 349,
'CLD': 448, 'RAP': 821, 'SBP': 1127}
month_max: ATL  ,departures + arrivals of this month: 65773
5 ----------
{'BGM': 124, 'DLG': 36, 'PSE': 139, 'MSY': 6303, 'GEG': 2704, 'SNA': 9134,
'BUR': 5682, 'GRB': 1492, 'GTF': 587, 'IDA': 596, 'GRR': 2939, 'LWB': 61, 'EUG':
983, 'PSG': 124, 'PVD': 4213, 'GSO': 2567, 'MYR': 1154, 'OAK': 12605, 'MSN':
2261, 'COD': 186, 'FAR': 947, 'BTM': 124, 'FSM': 408, 'MQT': 170, 'SCC': 124,
'DCA': 15693, 'RFD': 124, 'MLU': 515, 'CID': 1943, 'LWS': 116, 'GTR': 174,
'MTH': 70, 'WRG': 124, 'HLN': 281, 'LEX': 1770, 'RDM': 606, 'FLO': 112, 'ORF':
3715, 'SCE': 62, 'EVV': 1000, 'KTN': 380, 'CRW': 700, 'CWA': 358, 'SAV': 2508,
'TRI': 164, 'CDV': 124, 'CMH': 6610, 'MOD': 523, 'CAK': 1465, 'TYR': 247, 'ADK':
18, 'CHO': 264, 'MOB': 963, 'PNS': 1756, 'MCN': 188, 'CEC': 170, 'LIH': 2571,
'IAH': 33961, 'HNL': 11229, 'SHV': 1586, 'ERI': 240, 'SJC': 10526, 'CVG': 18545,
'TOL': 360, 'BUF': 4850, 'LGA': 21198, 'TLH': 708, 'ACT': 364, 'HPN': 2254,
'RDD': 307, 'AUS': 8905, 'MLI': 1598, 'SJU': 3761, 'ATW': 1043, 'DHN': 276,
'AVL': 591, 'GJT': 935, 'LGB': 2483, 'LYH': 172, 'BFL': 833, 'GFK': 176, 'RNO':
4732, 'SRQ': 1225, 'SBN': 947, 'EYW': 184, 'TTN': 224, 'JAC': 373, 'RST': 712,
'CHS': 2598, 'HRL': 891, 'RSW': 4088, 'TUL': 4243, 'IPL': 214, 'ISP': 2120,
'AMA': 1195, 'MKC': 2, 'BOS': 21752, 'MAF': 1188, 'MLB': 358, 'TUP': 120, 'EWR':
26232, 'LAS': 31622, 'BIS': 532, 'JAN': 2240, 'ITO': 1644, 'FAI': 785, 'XNA':
2358, 'HHH': 186, 'DLH': 362, 'DEN': 40488, 'EWN': 101, 'RHI': 60, 'SGU': 620,
'ALB': 2570, 'CPR': 666, 'LNK': 726, 'OME': 186, 'IAD': 16461, 'BOI': 2964,
'PSP': 2198, 'SBA': 2301, 'IYK': 168, 'MEI': 113, 'BRO': 192, 'DRO': 670, 'BMI':
636, 'SEA': 18854, 'LAN': 796, 'CMI': 487, 'LRD': 518, 'VLD': 174, 'MCI': 11032,
'FLG': 308, 'GRK': 891, 'BNA': 10622, 'CLT': 22091, 'CLL': 308, 'TVC': 592,
'PSC': 474, 'BLI': 104, 'CIC': 236, 'PBI': 4917, 'ABQ': 6814, 'SDF': 3865,
'ACV': 641, 'LAW': 409, 'DAL': 8990, 'BDL': 5344, 'MRY': 1424, 'DBQ': 240,
'CLE': 14251, 'APF': 98, 'PDX': 9740, 'ACK': 16, 'MIA': 10962, 'MFR': 1034,
'TWF': 395, 'ILG': 114, 'TPA': 13360, 'BWI': 18600, 'CMX': 62, 'OKC': 4716,
'ROA': 669, 'SMF': 9985, 'SPI': 298, 'BRW': 124, 'OXR': 234, 'ABI': 486, 'MBS':
664, 'ELM': 232, 'PHX': 35924, 'FCA': 414, 'STL': 11062, 'PWM': 1221, 'ABY':
226, 'BET': 178, 'MHT': 3692, 'DFW': 50899, 'ABE': 1060, 'TXK': 186, 'GSP':
2381, 'LSE': 459, 'STX': 81, 'FAY': 354, 'HDN': 184, 'GUC': 124, 'LBB': 1395,
'EKO': 299, 'CRP': 1216, 'EGE': 426, 'FSD': 1220, 'SWF': 968, 'SUN': 147, 'CSG':
236, 'BQK': 174, 'SFO': 23093, 'MEM': 14706, 'ELP': 3702, 'BHM': 4000, 'FLL':
11432, 'ATL': 68350, 'FNT': 1183, 'PIH': 310, 'RIC': 3346, 'AKN': 70, 'DAY':
2622, 'PHF': 865, 'OMA': 4968, 'SJT': 310, 'LCH': 230, 'VPS': 1156, 'BPT': 60,
'LIT': 2971, 'ICT': 2438, 'FAT': 2713, 'CAE': 1779, 'PFN': 561, 'SOP': 44,
'ORD': 64766, 'AVP': 537, 'BTV': 1313, 'AEX': 412, 'BIL': 776, 'SPS': 413,
'ILM': 656, 'SMX': 300, 'PIA': 886, 'RDU': 11823, 'BQN': 212, 'MFE': 718, 'MKE':
4294, 'SYR': 2116, 'LFT': 972, 'HSV': 1590, 'PIT': 8531, 'TUS': 4917, 'MTJ':
359, 'ACY': 97, 'MDW': 16529, 'AZO': 929, 'PLN': 59, 'COS': 3108, 'OAJ': 178,
'JNU': 744, 'IND': 7492, 'ALO': 51, 'KOA': 2670, 'EAU': 49, 'GPT': 1126, 'MGM':
724, 'DTW': 30682, 'HOU': 9509, 'TYS': 2370, 'CHA': 863, 'YUM': 578, 'ADQ': 124,
'ONT': 7553, 'MDT': 1568, 'FWA': 1202, 'JAX': 6222, 'LAX': 39199, 'MSP': 27090,
```

'HTS': 1, 'MOT': 186, 'BTR': 1742, 'BGR': 663, 'SIT': 248, 'MCO': 22066, 'ROC':
3007, 'SGF': 1940, 'AGS': 355, 'OTZ': 186, 'SAN': 15849, 'BZN': 772, 'GGG': 186,
'YAK': 124, 'DAB': 650, 'JFK': 21128, 'ANC': 3392, 'SUX': 60, 'MSO': 649, 'GNV':
346, 'PHL': 18113, 'OGG': 4184, 'DSM': 3142, 'SAT': 7919, 'SLC': 23255, 'PMD':
2, 'STT': 460, 'CLD': 464, 'RAP': 935, 'SBP': 1154}
month_max: ATL ,departures + arrivals of this month: 68350
6 ----------
{'BGM': 156, 'INL': 95, 'DLG': 58, 'PSE': 180, 'MSY': 6317, 'GEG': 2822, 'SNA':
8827, 'BUR': 5577, 'GRB': 1461, 'GTF': 486, 'IDA': 583, 'GRR': 2921, 'LWB': 60,
'EUG': 1086, 'PSG': 120, 'PVD': 4166, 'GSO': 2623, 'MYR': 1267, 'OAK': 12280,
'MSN': 2157, 'COD': 288, 'FAR': 930, 'BTM': 160, 'FSM': 486, 'MQT': 194, 'SCC':
120, 'DCA': 14994, 'RFD': 116, 'MLU': 508, 'CID': 1945, 'LWS': 118, 'GTR': 170,
'MTH': 14, 'WRG': 120, 'HLN': 336, 'LEX': 1844, 'RDM': 647, 'FLO': 118, 'ORF':
3443, 'SCE': 107, 'EVV': 1021, 'KTN': 476, 'CRW': 600, 'CWA': 302, 'SAV': 2559,
'TRI': 233, 'CDV': 120, 'CMH': 6343, 'MOD': 504, 'CAK': 1452, 'TYR': 239, 'ADK':
16, 'CHO': 196, 'MOB': 1046, 'PNS': 1716, 'MCN': 179, 'CEC': 176, 'LIH': 2658,
'IAH': 32347, 'HNL': 11506, 'SHV': 1446, 'ERI': 229, 'GST': 56, 'SJC': 10283,
'CVG': 18752, 'TOL': 348, 'BUF': 4608, 'TLH': 800, 'LGA': 20301, 'ACT': 411,
'HPN': 2356, 'RDD': 300, 'AUS': 8983, 'MLI': 1617, 'SJU': 4026, 'ATW': 1059,
'DHN': 278, 'AVL': 682, 'GJT': 834, 'LGB': 2437, 'LYH': 152, 'BFL': 882, 'GFK':
171, 'RNO': 4544, 'SRQ': 1059, 'SBN': 902, 'EYW': 188, 'BJI': 48, 'TTN': 155,
'JAC': 688, 'RST': 664, 'CHS': 2702, 'RSW': 3492, 'TUL': 4252, 'HRL': 832,
'IPL': 204, 'AMA': 1173, 'ISP': 2073, 'BOS': 21138, 'MAF': 1160, 'MLB': 349,
'TUP': 107, 'EWR': 25654, 'LAS': 30583, 'BIS': 567, 'JAN': 2284, 'ITO': 1602,
'FAI': 1022, 'XNA': 2284, 'HHH': 236, 'DLH': 350, 'DEN': 40552, 'EWN': 160,
'RHI': 60, 'SGU': 599, 'ALB': 2565, 'CPR': 697, 'LNK': 702, 'OME': 178, 'BOI':
3159, 'IAD': 15020, 'PSP': 1727, 'SBA': 2335, 'IYK': 161, 'MEI': 118, 'BRO':
187, 'DRO': 650, 'BMI': 614, 'SEA': 19519, 'LAN': 787, 'CMI': 469, 'LRD': 420,
'VLD': 178, 'MCI': 11160, 'FLG': 356, 'GRK': 853, 'BNA': 10203, 'CLT': 21424,
'CLL': 295, 'TVC': 938, 'PSC': 462, 'BLI': 115, 'CIC': 226, 'ABQ': 7319, 'PBI':
4270, 'SDF': 3754, 'ACV': 677, 'LAW': 404, 'SLE': 95, 'BDL': 5356, 'DAL': 8916,
'MRY': 1528, 'DBQ': 236, 'CLE': 13472, 'APF': 116, 'PDX': 10083, 'ACK': 129,
'MIA': 10457, 'MFR': 1150, 'TWF': 342, 'ILG': 118, 'TPA': 12771, 'BWI': 18620,
'CMX': 60, 'OKC': 4573, 'ROA': 555, 'SMF': 9993, 'SPI': 291, 'BRW': 120, 'OXR':
224, 'ABI': 469, 'MBS': 656, 'ELM': 221, 'PHX': 34434, 'FCA': 674, 'STL': 10822,
'PWM': 1585, 'ABY': 228, 'BET': 172, 'MHT': 3684, 'DFW': 49534, 'ABE': 978,
'TXK': 179, 'GSP': 2350, 'LSE': 404, 'STX': 86, 'FAY': 349, 'HDN': 323, 'GUC':
168, 'LBB': 1352, 'EKO': 318, 'CRP': 1186, 'EGE': 351, 'FSD': 1191, 'SWF': 1021,
'SUN': 637, 'CSG': 230, 'BQK': 178, 'SFO': 23713, 'MEM': 14372, 'ELP': 3703,
'BHM': 4178, 'FLL': 10978, 'ATL': 71968, 'FNT': 1181, 'PIH': 300, 'YKM': 95,
'RIC': 3260, 'AKN': 60, 'DAY': 2637, 'PHF': 939, 'OMA': 4842, 'SJT': 300, 'LCH':
180, 'VPS': 1226, 'BPT': 60, 'LIT': 2912, 'FAT': 2748, 'ICT': 2380, 'CAE': 1694,
'PFN': 564, 'SOP': 52, 'ORD': 63036, 'AVP': 516, 'BTV': 1388, 'AEX': 432, 'BIL':
929, 'SPS': 399, 'ILM': 754, 'SMX': 290, 'PIA': 862, 'RDU': 12080, 'BQN': 239,
'MFE': 761, 'MKE': 4644, 'SYR': 2167, 'LFT': 995, 'HSV': 1691, 'PIT': 8381,
'TUS': 4756, 'MTJ': 405, 'ACY': 118, 'MDW': 16175, 'AZO': 841, 'PLN': 194,
'COS': 3137, 'OAJ': 217, 'JNU': 1000, 'IND': 7519, 'ALO': 58, 'KOA': 2822,
'EAU': 9, 'GPT': 1155, 'MGM': 659, 'DTW': 30132, 'HOU': 9507, 'CHA': 722, 'TYS':

2427, 'YUM': 580, 'ADQ': 120, 'ONT': 7360, 'MDT': 1610, 'FWA': 1165, 'JAX':
6302, 'LAX': 38911, 'MSP': 27114, 'HTS': 48, 'MOT': 180, 'BGR': 705, 'BTR':
1665, 'SIT': 296, 'MCO': 21925, 'ROC': 2901, 'SGF': 1940, 'WYS': 110, 'AGS':
383, 'OTZ': 178, 'SAN': 16673, 'BZN': 1017, 'GGG': 180, 'YAK': 120, 'DAB': 572,
'JFK': 20979, 'ANC': 4412, 'SUX': 61, 'MSO': 813, 'GNV': 354, 'PHL': 17506,
'OGG': 4394, 'DSM': 3073, 'SAT': 7970, 'SLC': 25882, 'PMD': 96, 'STT': 468,
'CLD': 452, 'RAP': 1005, 'SBP': 1169, 'ASE': 902}
month_max: ATL ,departures + arrivals of this month: 71968
7 ----------
{'BGM': 124, 'INL': 116, 'DLG': 62, 'PSE': 186, 'MSY': 6533, 'GEG': 2934, 'SNA':
9091, 'BUR': 5730, 'GRB': 1408, 'GTF': 473, 'IDA': 591, 'GRR': 2961, 'LWB': 58,
'EUG': 1200, 'PSG': 124, 'PVD': 4350, 'GSO': 2625, 'MYR': 1310, 'OAK': 12969,
'MSN': 2221, 'COD': 309, 'FAR': 883, 'BTM': 170, 'FSM': 520, 'MQT': 231, 'SCC':
124, 'DCA': 15278, 'RFD': 115, 'MLU': 512, 'CID': 1977, 'LWS': 120, 'GTR': 169,
'WRG': 124, 'HLN': 352, 'LEX': 1760, 'RDM': 669, 'FLO': 108, 'ORF': 3388, 'SCE':
124, 'EVV': 1016, 'KTN': 496, 'CRW': 588, 'CWA': 290, 'SAV': 2510, 'TRI': 224,
'CDV': 124, 'CMH': 6495, 'MOD': 516, 'CAK': 1608, 'TYR': 247, 'ADK': 18, 'CHO':
170, 'MOB': 1114, 'PNS': 1862, 'MCN': 187, 'CEC': 184, 'LIH': 2784, 'IAH':
33148, 'HNL': 11912, 'SHV': 1437, 'ERI': 235, 'GST': 62, 'SJC': 10895, 'CVG':
19201, 'TOL': 368, 'BUF': 4591, 'TLH': 807, 'LGA': 20611, 'ACT': 418, 'HPN':
2391, 'RDD': 310, 'AUS': 9308, 'MLI': 1598, 'SJU': 4359, 'ATW': 1041, 'DHN':
290, 'AVL': 806, 'GJT': 832, 'LGB': 2494, 'LYH': 150, 'BFL': 914, 'GFK': 169,
'RNO': 4678, 'SRQ': 959, 'SBN': 907, 'EYW': 188, 'BJI': 56, 'TTN': 144, 'JAC':
858, 'RST': 659, 'CHS': 2725, 'RSW': 3527, 'TUL': 4454, 'HRL': 852, 'IPL': 209,
'AMA': 1211, 'ISP': 2195, 'BOS': 21427, 'MAF': 1202, 'MLB': 351, 'TUP': 88,
'EWR': 26165, 'LAS': 31424, 'BIS': 584, 'JAN': 2302, 'ITO': 1639, 'FAI': 1082,
'XNA': 2288, 'HHH': 243, 'DLH': 345, 'DEN': 42772, 'EWN': 170, 'RHI': 54, 'SGU':
617, 'ALB': 2624, 'CPR': 726, 'LNK': 702, 'OME': 186, 'BOI': 3383, 'IAD': 14670,
'PSP': 1694, 'SBA': 2425, 'IYK': 162, 'MEI': 116, 'BRO': 197, 'DRO': 660, 'BMI':
598, 'SEA': 20468, 'LAN': 756, 'CMI': 488, 'LRD': 399, 'VLD': 174, 'MCI': 11936,
'FLG': 370, 'GRK': 873, 'BNA': 10404, 'CLT': 21970, 'TVC': 1113, 'CLL': 280,
'PSC': 472, 'BLI': 120, 'CIC': 226, 'PBI': 4270, 'ABQ': 7641, 'SDF': 3850,
'ACV': 693, 'LAW': 415, 'SLE': 120, 'BDL': 5709, 'DAL': 9164, 'MRY': 1598,
'DBQ': 248, 'CLE': 13015, 'APF': 119, 'PDX': 10517, 'ACK': 210, 'MIA': 10777,
'MFR': 1205, 'TWF': 363, 'ILG': 112, 'TPA': 13108, 'BWI': 19381, 'CMX': 62,
'OKC': 4619, 'ROA': 427, 'SMF': 10492, 'SPI': 293, 'BRW': 124, 'OXR': 228,
'ABI': 480, 'MBS': 654, 'ELM': 221, 'PHX': 35690, 'FCA': 768, 'STL': 11133,
'PWM': 1766, 'ABY': 224, 'BET': 176, 'MHT': 3748, 'DFW': 51300, 'ABE': 957,
'TXK': 187, 'GSP': 2323, 'LSE': 401, 'STX': 86, 'FAY': 357, 'HDN': 369, 'GUC':
184, 'LBB': 1396, 'EKO': 335, 'CRP': 1172, 'EGE': 366, 'FSD': 1142, 'SWF': 1043,
'SUN': 682, 'CSG': 223, 'BQK': 180, 'SFO': 24692, 'MEM': 14402, 'ELP': 3817,
'BHM': 4279, 'FLL': 11164, 'ATL': 73969, 'FNT': 1204, 'PIH': 312, 'YKM': 120,
'RIC': 3365, 'AKN': 78, 'DAY': 2720, 'PHF': 980, 'OMA': 4910, 'SJT': 310, 'LCH':
170, 'VPS': 1263, 'BPT': 62, 'LIT': 2957, 'FAT': 2840, 'ICT': 2479, 'CAE': 1708,
'PFN': 584, 'SOP': 61, 'ORD': 64061, 'AVP': 519, 'BTV': 1408, 'AEX': 469, 'BIL':
981, 'SPS': 416, 'ILM': 785, 'SMX': 298, 'PIA': 882, 'RDU': 12360, 'BQN': 248,
'MFE': 809, 'MKE': 4992, 'SYR': 2247, 'LFT': 1024, 'HSV': 1656, 'PIT': 8677,
'TUS': 4819, 'MTJ': 434, 'ACY': 120, 'MDW': 16526, 'AZO': 842, 'PLN': 242,

```
'COS': 3390, 'OAJ': 228, 'JNU': 1056, 'IND': 7728, 'ALO': 58, 'KOA': 2883,
'GPT': 1154, 'MGM': 638, 'DTW': 30492, 'HOU': 9908, 'CHA': 686, 'TYS': 2486,
'YUM': 562, 'ADQ': 124, 'ONT': 7555, 'FWA': 1170, 'MDT': 1547, 'JAX': 6596,
'LAX': 41837, 'MSP': 27366, 'HTS': 50, 'MOT': 174, 'BTR': 1663, 'BGR': 798,
'SIT': 310, 'MCO': 23093, 'ROC': 2929, 'SGF': 1974, 'WYS': 142, 'AGS': 378,
'OTZ': 184, 'SAN': 17433, 'BZN': 1091, 'GGG': 186, 'YAK': 124, 'DAB': 509,
'JFK': 21964, 'ANC': 4696, 'SUX': 54, 'MSO': 866, 'GNV': 356, 'PHL': 18063,
'OGG': 4593, 'DSM': 3045, 'SAT': 8404, 'SLC': 27141, 'PMD': 124, 'STT': 480,
'ASE': 1163, 'CLD': 460, 'RAP': 1039, 'SBP': 1235}
month_max: ATL  ,departures + arrivals of this month: 73969
8 ----------
{'BGM': 125, 'INL': 97, 'DLG': 62, 'PSE': 186, 'MSY': 6530, 'GEG': 2946, 'BUR':
5786, 'SNA': 9169, 'GRB': 1462, 'GTF': 465, 'IDA': 591, 'GRR': 2966, 'LWB': 62,
'EUG': 1210, 'PSG': 124, 'PVD': 4390, 'GSO': 2625, 'MYR': 1271, 'OAK': 13159,
'MSN': 2327, 'COD': 310, 'BTM': 155, 'FAR': 868, 'FSM': 536, 'MQT': 232, 'SCC':
124, 'DCA': 15581, 'RFD': 117, 'MLU': 524, 'CID': 1984, 'LWS': 124, 'GTR': 176,
'WRG': 124, 'HLN': 336, 'LEX': 1730, 'RDM': 680, 'FLO': 112, 'ORF': 3461, 'SCE':
123, 'EVV': 1050, 'KTN': 496, 'CRW': 598, 'CWA': 302, 'SAV': 2498, 'TRI': 266,
'CDV': 124, 'CMH': 6466, 'MOD': 526, 'CAK': 1730, 'TYR': 308, 'ADK': 18, 'CHO':
191, 'MOB': 1052, 'PNS': 1742, 'MCN': 187, 'CEC': 187, 'LIH': 2776, 'IAH':
33427, 'HNL': 11979, 'SHV': 1504, 'ERI': 272, 'GST': 62, 'SJC': 10917, 'CVG':
19459, 'TOL': 371, 'BUF': 4528, 'TLH': 794, 'LGA': 21015, 'ACT': 471, 'HPN':
2375, 'RDD': 313, 'AUS': 9396, 'MLI': 1690, 'SJU': 4158, 'ATW': 1133, 'DHN':
293, 'AVL': 790, 'GJT': 842, 'LGB': 2483, 'LYH': 158, 'BFL': 917, 'GFK': 198,
'RNO': 4708, 'SRQ': 922, 'SBN': 912, 'EYW': 170, 'BJI': 60, 'TTN': 154, 'JAC':
843, 'RST': 728, 'CHS': 2750, 'HRL': 850, 'RSW': 3397, 'TUL': 4390, 'IPL': 216,
'ISP': 2196, 'AMA': 1216, 'BOS': 21661, 'MAF': 1208, 'MLB': 344, 'TUP': 94,
'EWR': 26997, 'LAS': 31441, 'BIS': 581, 'JAN': 2338, 'ITO': 1650, 'FAI': 1061,
'XNA': 2348, 'HHH': 247, 'DLH': 320, 'DEN': 42872, 'EWN': 174, 'RHI': 60, 'SGU':
618, 'ALB': 2696, 'CPR': 716, 'LNK': 729, 'OME': 186, 'BOI': 3350, 'IAD': 14691,
'PSP': 1677, 'SBA': 2463, 'IYK': 169, 'MEI': 122, 'BRO': 194, 'DRO': 665, 'BMI':
748, 'SEA': 20262, 'LAN': 824, 'CMI': 489, 'LRD': 418, 'VLD': 178, 'MCI': 11947,
'FLG': 372, 'GRK': 938, 'BNA': 10492, 'CLT': 21969, 'TVC': 1040, 'CLL': 285,
'PSC': 480, 'BLI': 124, 'CIC': 232, 'PBI': 4180, 'ABQ': 7605, 'SDF': 3974,
'ACV': 716, 'LAW': 418, 'SLE': 124, 'DAL': 9334, 'BDL': 5810, 'MRY': 1620,
'DBQ': 248, 'CLE': 13622, 'APF': 114, 'PDX': 10637, 'ACK': 215, 'MIA': 10714,
'TWF': 367, 'MFR': 1216, 'ILG': 106, 'BWI': 19558, 'TPA': 13059, 'CMX': 62,
'OKC': 4721, 'ROA': 498, 'SMF': 10438, 'SPI': 305, 'BRW': 124, 'OXR': 232,
'ABI': 479, 'MBS': 678, 'ELM': 200, 'PHX': 35766, 'FCA': 770, 'STL': 11384,
'PWM': 1915, 'ABY': 237, 'BET': 178, 'MHT': 3833, 'ABE': 992, 'DFW': 51546,
'TXK': 185, 'GSP': 2343, 'LSE': 438, 'STX': 82, 'FAY': 363, 'HDN': 372, 'GUC':
186, 'LBB': 1405, 'EKO': 339, 'CRP': 1067, 'EGE': 364, 'FSD': 1245, 'SWF': 981,
'SUN': 677, 'CSG': 237, 'BQK': 184, 'SFO': 24909, 'MEM': 14716, 'ELP': 3816,
'BHM': 4396, 'FLL': 10918, 'ATL': 74569, 'FNT': 1221, 'PIH': 309, 'YKM': 124,
'RIC': 3403, 'AKN': 62, 'DAY': 2823, 'PHF': 990, 'OMA': 4845, 'SJT': 310, 'LCH':
178, 'VPS': 1257, 'BPT': 62, 'LIT': 3024, 'FAT': 2815, 'ICT': 2525, 'CAE': 1772,
'PFN': 595, 'SOP': 58, 'ORD': 64946, 'AVP': 508, 'BTV': 1370, 'AEX': 399, 'BIL':
963, 'SPS': 417, 'ILM': 748, 'SMX': 303, 'PIA': 929, 'RDU': 12535, 'BQN': 248,
```

```
'MFE': 794, 'MKE': 5491, 'SYR': 2404, 'LFT': 1038, 'HSV': 1828, 'PIT': 8661,
'TUS': 4808, 'MTJ': 440, 'ACY': 109, 'MDW': 16512, 'AZO': 855, 'PLN': 200,
'COS': 3369, 'OAJ': 232, 'JNU': 1054, 'IND': 7503, 'ALO': 60, 'KOA': 2924,
'GPT': 1274, 'MGM': 663, 'DTW': 30504, 'HOU': 10124, 'TYS': 2533, 'CHA': 710,
'YUM': 562, 'ADQ': 124, 'ONT': 7648, 'FWA': 1206, 'MDT': 1666, 'JAX': 6533,
'LAX': 42166, 'MSP': 27159, 'HTS': 34, 'MOT': 184, 'BTR': 1693, 'BGR': 791,
'SIT': 310, 'MCO': 22856, 'ROC': 3028, 'SGF': 1993, 'WYS': 140, 'AGS': 402,
'OTZ': 186, 'SAN': 17713, 'BZN': 1066, 'GGG': 186, 'YAK': 124, 'DAB': 486,
'JFK': 22132, 'ANC': 4530, 'SUX': 122, 'MSO': 754, 'GNV': 339, 'PHL': 18075,
'OGG': 4618, 'DSM': 3116, 'SAT': 8492, 'SLC': 27114, 'PMD': 116, 'STT': 444,
'ASE': 1171, 'CLD': 471, 'RAP': 1048, 'SBP': 1247}
month_max: ATL  ,departures + arrivals of this month: 74569
9 ----------
{'BGM': 120, 'INL': 60, 'DLG': 28, 'PSE': 180, 'MSY': 6112, 'GEG': 2706, 'SNA':
8570, 'BUR': 5457, 'GRB': 1320, 'GTF': 410, 'IDA': 576, 'GRR': 2609, 'LWB': 60,
'EUG': 1072, 'PSG': 120, 'PVD': 4313, 'MYR': 1180, 'GSO': 2262, 'OAK': 12532,
'MSN': 2153, 'COD': 299, 'FAR': 834, 'BTM': 120, 'FSM': 516, 'MQT': 167, 'SCC':
120, 'DCA': 14102, 'RFD': 111, 'MLU': 486, 'CID': 1896, 'LWS': 118, 'GTR': 174,
'WRG': 120, 'HLN': 272, 'LEX': 1610, 'RDM': 568, 'FLO': 112, 'ORF': 3345, 'SCE':
120, 'EVV': 964, 'KTN': 392, 'CRW': 548, 'CWA': 288, 'SAV': 2387, 'TRI': 176,
'CDV': 120, 'CMH': 6040, 'MOD': 474, 'CAK': 1718, 'TYR': 296, 'ADK': 18, 'CHO':
220, 'MOB': 992, 'PNS': 1615, 'MCN': 112, 'CEC': 176, 'LIH': 2404, 'IAH': 29737,
'HNL': 10668, 'SHV': 1443, 'ERI': 241, 'SJC': 10296, 'CVG': 17528, 'TOL': 334,
'BUF': 3996, 'TLH': 680, 'LGA': 19699, 'ACT': 402, 'HPN': 2235, 'RDD': 286,
'AUS': 9073, 'MLI': 1663, 'SJU': 3116, 'ATW': 1066, 'DHN': 277, 'AVL': 663,
'GJT': 671, 'LGB': 2305, 'LYH': 110, 'BFL': 797, 'GFK': 173, 'RNO': 4344, 'SRQ':
870, 'SBN': 939, 'EYW': 109, 'BJI': 34, 'TTN': 64, 'JAC': 705, 'RST': 672,
'CHS': 2694, 'TUL': 4321, 'HRL': 727, 'RSW': 3022, 'IPL': 215, 'AMA': 1193,
'ISP': 2008, 'BOS': 19798, 'MAF': 1197, 'MLB': 277, 'TUP': 88, 'EWR': 23964,
'LAS': 30297, 'BIS': 508, 'JAN': 2222, 'ITO': 1594, 'FAI': 834, 'XNA': 2360,
'HHH': 217, 'DLH': 400, 'DEN': 38538, 'EWN': 158, 'RHI': 50, 'SGU': 600, 'ALB':
2550, 'CPR': 631, 'LNK': 684, 'OME': 180, 'BOI': 3066, 'IAD': 13363, 'PSP':
1680, 'SBA': 2269, 'IYK': 155, 'MEI': 118, 'BRO': 252, 'DRO': 591, 'BMI': 859,
'SEA': 18559, 'LAN': 694, 'CMI': 468, 'LRD': 376, 'VLD': 160, 'MCI': 11477,
'FLG': 346, 'GRK': 800, 'BNA': 9752, 'CLT': 20498, 'CLL': 299, 'TVC': 671,
'PSC': 438, 'BLI': 66, 'CIC': 224, 'ABQ': 6866, 'PBI': 3734, 'SDF': 3777, 'ACV':
616, 'LAW': 396, 'SLE': 110, 'BDL': 5375, 'DAL': 8776, 'MRY': 1489, 'DBQ': 230,
'CLE': 11319, 'APF': 62, 'PDX': 9821, 'ACK': 63, 'MIA': 9910, 'MFR': 990, 'TWF':
350, 'ILG': 13, 'TPA': 11973, 'BWI': 18176, 'CMX': 60, 'OKC': 4551, 'ROA': 556,
'SMF': 9799, 'SPI': 284, 'BRW': 120, 'OXR': 226, 'ABI': 458, 'MBS': 584, 'ELM':
161, 'PHX': 33771, 'FCA': 652, 'STL': 10483, 'PWM': 1575, 'ABY': 214, 'BET':
170, 'MHT': 3534, 'DFW': 48618, 'ABE': 889, 'TXK': 232, 'GSP': 2216, 'LSE': 436,
'STX': 56, 'FAY': 342, 'HDN': 297, 'GUC': 150, 'LBB': 1381, 'EKO': 315, 'CRP':
940, 'EGE': 296, 'FSD': 989, 'SWF': 885, 'SUN': 654, 'CSG': 216, 'BQK': 164,
'SFO': 23194, 'MEM': 13894, 'ELP': 3460, 'BHM': 3910, 'FLL': 9761, 'ATL': 68529,
'PIH': 304, 'YKM': 118, 'FNT': 1243, 'RIC': 3264, 'AKN': 28, 'DAY': 2610, 'PHF':
921, 'OMA': 4533, 'SJT': 300, 'LCH': 174, 'VPS': 1071, 'BPT': 60, 'LIT': 2626,
'FAT': 2518, 'ICT': 2394, 'CAE': 1712, 'PFN': 576, 'SOP': 41, 'ORD': 60820,
```

```
'AVP': 372, 'BTV': 1171, 'AEX': 454, 'BIL': 748, 'SPS': 394, 'ILM': 641, 'SMX':
279, 'PIA': 941, 'RDU': 11242, 'BQN': 174, 'MFE': 787, 'MKE': 5241, 'SYR': 2080,
'LFT': 947, 'HSV': 1822, 'TUS': 4658, 'PIT': 7908, 'MTJ': 372, 'ACY': 91, 'ROW':
103, 'MDW': 15484, 'AZO': 784, 'PLN': 110, 'COS': 3034, 'OAJ': 212, 'JNU': 756,
'IND': 6875, 'ALO': 50, 'KOA': 2435, 'GPT': 1314, 'MGM': 620, 'DTW': 28335,
'HOU': 9347, 'TYS': 2323, 'CHA': 652, 'YUM': 538, 'ADQ': 120, 'ONT': 7220,
'FWA': 1084, 'MDT': 1248, 'JAX': 5625, 'LAX': 39311, 'MSP': 24537, 'MOT': 178,
'BTR': 1570, 'BGR': 678, 'SIT': 240, 'MCO': 19827, 'ROC': 2599, 'SGF': 1809,
'WYS': 140, 'AGS': 359, 'OTZ': 180, 'SAN': 16778, 'BZN': 878, 'GGG': 180, 'YAK':
120, 'DAB': 458, 'JFK': 20455, 'ANC': 3502, 'SUX': 110, 'MSO': 457, 'GNV': 262,
'PHL': 16565, 'OGG': 4008, 'DSM': 2838, 'SAT': 8171, 'SLC': 24045, 'PMD': 109,
'STT': 284, 'ASE': 759, 'CLD': 414, 'RAP': 805, 'SBP': 1198}
month_max: ATL  ,departures + arrivals of this month: 68529
10 ----------
{'BGM': 124, 'INL': 62, 'PSE': 176, 'MSY': 6688, 'GEG': 2825, 'SNA': 9002,
'BUR': 5681, 'GRB': 1361, 'GTF': 426, 'IDA': 590, 'GRR': 2716, 'LWB': 62, 'EUG':
1112, 'PSG': 124, 'PVD': 4428, 'GSO': 2432, 'MYR': 1203, 'OAK': 12863, 'MSN':
2296, 'COD': 192, 'FAR': 760, 'BTM': 124, 'FSM': 546, 'MQT': 170, 'SCC': 124,
'DCA': 14959, 'RFD': 116, 'MLU': 516, 'CID': 2027, 'LWS': 124, 'GTR': 175,
'WRG': 124, 'HLN': 282, 'LEX': 1569, 'RDM': 596, 'FLO': 122, 'ORF': 3374, 'SCE':
124, 'EVV': 1034, 'KTN': 372, 'CRW': 575, 'CWA': 302, 'SAV': 2565, 'TRI': 237,
'CDV': 124, 'CMH': 6382, 'MOD': 510, 'CAK': 1826, 'TYR': 309, 'ADK': 16, 'CHO':
240, 'MOB': 1068, 'PNS': 1768, 'MCN': 132, 'CEC': 184, 'LIH': 2462, 'IAH':
33044, 'HNL': 10931, 'SHV': 1534, 'ERI': 240, 'SJC': 10728, 'CVG': 18356, 'TOL':
354, 'BUF': 4126, 'TLH': 778, 'LGA': 20975, 'ACT': 417, 'HPN': 2297, 'RDD': 304,
'AUS': 9430, 'MLI': 1758, 'SJU': 3122, 'ATW': 1132, 'DHN': 251, 'AVL': 742,
'GJT': 716, 'LGB': 2302, 'LYH': 114, 'BFL': 825, 'GFK': 225, 'RNO': 4406, 'SRQ':
858, 'SBN': 986, 'EYW': 125, 'BJI': 54, 'JAC': 453, 'RST': 720, 'CHS': 2916,
'RSW': 3489, 'TUL': 4561, 'HRL': 748, 'IPL': 230, 'ISP': 2036, 'AMA': 1205,
'BOS': 20751, 'MAF': 1300, 'MLB': 291, 'TUP': 88, 'EWR': 25764, 'LAS': 31798,
'BIS': 481, 'JAN': 2416, 'ITO': 1596, 'FAI': 800, 'XNA': 2557, 'HHH': 221,
'DLH': 418, 'DEN': 39962, 'EWN': 168, 'RHI': 54, 'SGU': 619, 'ALB': 2628, 'CPR':
612, 'LNK': 720, 'OME': 186, 'BOI': 3186, 'IAD': 13910, 'PSP': 2058, 'SBA':
2386, 'IYK': 169, 'MEI': 116, 'BRO': 302, 'DRO': 603, 'BMI': 913, 'SEA': 18718,
'LAN': 730, 'CMI': 488, 'LRD': 356, 'VLD': 229, 'MCI': 12104, 'FLG': 310, 'GRK':
851, 'BNA': 10337, 'CLT': 21984, 'CLL': 302, 'TVC': 652, 'PSC': 470, 'BLI': 62,
'CIC': 240, 'PBI': 4193, 'ABQ': 7331, 'SDF': 4061, 'ACV': 648, 'LAW': 417,
'SLE': 115, 'BDL': 5565, 'DAL': 9413, 'MRY': 1553, 'DBQ': 240, 'CLE': 12244,
'APF': 1, 'PDX': 9979, 'MIA': 10180, 'MFR': 1028, 'TWF': 326, 'TPA': 12684,
'BWI': 18810, 'CMX': 62, 'OKC': 4974, 'ROA': 597, 'SMF': 10241, 'SPI': 302,
'BRW': 124, 'OXR': 238, 'ABI': 480, 'MBS': 619, 'ELM': 170, 'PHX': 35338, 'FCA':
562, 'STL': 11047, 'PWM': 1549, 'ABY': 228, 'BET': 178, 'MHT': 3671, 'ABE': 952,
'DFW': 50279, 'TXK': 248, 'GSP': 2319, 'LSE': 464, 'STX': 50, 'FAY': 424, 'HDN':
310, 'GUC': 130, 'LBB': 1448, 'EKO': 301, 'CRP': 860, 'EGE': 286, 'FSD': 1041,
'SWF': 920, 'SUN': 509, 'BQK': 176, 'CSG': 286, 'SFO': 24132, 'MEM': 14596,
'ELP': 3642, 'BHM': 4208, 'FLL': 10409, 'ATL': 73883, 'PIH': 311, 'YKM': 124,
'FNT': 1320, 'RIC': 3588, 'DAY': 2965, 'PHF': 996, 'OMA': 4913, 'SJT': 310,
'LCH': 186, 'VPS': 1223, 'BPT': 62, 'LIT': 2802, 'FAT': 2753, 'ICT': 2554,
```

```
'CAE': 1801, 'PFN': 669, 'SOP': 44, 'ORD': 64000, 'AVP': 489, 'BTV': 1060,
'AEX': 438, 'BIL': 762, 'SPS': 418, 'ILM': 605, 'SMX': 302, 'PIA': 1049, 'RDU':
11678, 'BQN': 228, 'MFE': 870, 'MKE': 5827, 'SYR': 2334, 'LFT': 960, 'HSV':
1981, 'PIT': 8345, 'TUS': 5017, 'MTJ': 262, 'ACY': 99, 'ROW': 124, 'MDW': 16299,
'AZO': 823, 'PLN': 116, 'COS': 3173, 'OAJ': 203, 'JNU': 673, 'IND': 7330, 'ALO':
54, 'KOA': 2518, 'GPT': 1438, 'MGM': 651, 'DTW': 29942, 'HOU': 9697, 'CHA': 709,
'TYS': 2520, 'YUM': 612, 'ADQ': 124, 'ONT': 7521, 'FWA': 1137, 'MDT': 1251,
'JAX': 5915, 'LAX': 40847, 'MSP': 25508, 'MOT': 186, 'BGR': 664, 'BTR': 1668,
'SIT': 186, 'MCO': 21181, 'ROC': 2793, 'SGF': 1886, 'AGS': 444, 'OTZ': 186,
'SAN': 17324, 'BZN': 849, 'GGG': 186, 'YAK': 124, 'DAB': 485, 'JFK': 20970,
'ANC': 2940, 'SUX': 116, 'MSO': 530, 'GNV': 274, 'PHL': 17155, 'OGG': 4076,
'DSM': 2979, 'SAT': 8542, 'SLC': 24549, 'PMD': 116, 'STT': 288, 'ASE': 600,
'CLD': 448, 'RAP': 709, 'SBP': 1261}
month_max: ATL  ,departures + arrivals of this month: 73883
11 ----------
{'BGM': 118, 'INL': 6, 'PSE': 229, 'MSY': 6874, 'GEG': 2812, 'SNA': 8610, 'BUR':
5482, 'GRB': 1209, 'GTF': 404, 'IDA': 567, 'GRR': 2528, 'LWB': 10, 'EUG': 1058,
'PSG': 116, 'PVD': 4097, 'GSO': 2231, 'MYR': 985, 'OAK': 12262, 'MSN': 2199,
'COD': 179, 'FAR': 772, 'BTM': 116, 'FSM': 524, 'MQT': 163, 'SCC': 116, 'DCA':
14229, 'RFD': 115, 'MLU': 492, 'CID': 1857, 'LWS': 112, 'GTR': 162, 'WRG': 116,
'HLN': 273, 'LEX': 1445, 'RDM': 571, 'FLO': 108, 'ORF': 3235, 'SCE': 116, 'EVV':
926, 'KTN': 356, 'CRW': 542, 'CWA': 280, 'SAV': 2487, 'TRI': 204, 'CDV': 116,
'CMH': 6243, 'MOD': 491, 'CAK': 1659, 'TYR': 295, 'ADK': 16, 'CHO': 221, 'MOB':
1070, 'PNS': 1722, 'MCN': 138, 'CEC': 174, 'LIH': 2528, 'IAH': 31068, 'HNL':
10999, 'SHV': 1422, 'ERI': 180, 'SJC': 10169, 'CVG': 18112, 'TOL': 330, 'BUF':
4022, 'LGA': 19852, 'TLH': 750, 'ACT': 398, 'HPN': 1993, 'RDD': 293, 'AUS':
8919, 'MLI': 1577, 'SJU': 3505, 'ATW': 993, 'DHN': 267, 'LGB': 2347, 'AVL': 682,
'GJT': 682, 'LYH': 108, 'BFL': 795, 'GFK': 226, 'RNO': 4263, 'SRQ': 1121, 'SBN':
813, 'EYW': 163, 'BJI': 4, 'JAC': 466, 'RST': 703, 'CHS': 2729, 'RSW': 4325,
'TUL': 4174, 'HRL': 664, 'IPL': 212, 'AMA': 1305, 'ISP': 1773, 'BOS': 19793,
'MAF': 1271, 'MLB': 342, 'TUP': 88, 'EWR': 24948, 'LAS': 30453, 'BIS': 509,
'JAN': 2366, 'ITO': 1543, 'FAI': 762, 'XNA': 2497, 'HHH': 208, 'DLH': 382,
'DEN': 38669, 'EWN': 162, 'RHI': 48, 'SGU': 594, 'ALB': 2437, 'CPR': 586, 'LNK':
679, 'OME': 174, 'BOI': 3032, 'IAD': 13788, 'SBA': 2431, 'PSP': 2275, 'IYK':
163, 'MEI': 106, 'BRO': 218, 'DRO': 525, 'BMI': 876, 'SEA': 17334, 'LAN': 709,
'CMI': 464, 'LRD': 332, 'VLD': 164, 'MCI': 11486, 'PIR': 2, 'FLG': 318, 'GRK':
842, 'BNA': 10152, 'CLL': 284, 'CLT': 21442, 'TVC': 523, 'PSC': 446, 'BLI': 59,
'CIC': 228, 'ABQ': 7200, 'PBI': 4816, 'SDF': 3987, 'ACV': 590, 'LAW': 396,
'SLE': 109, 'BDL': 5327, 'DAL': 9162, 'MRY': 1514, 'DBQ': 228, 'CLE': 11358,
'PDX': 9778, 'MIA': 10198, 'MFR': 1005, 'TWF': 304, 'TPA': 13044, 'BWI': 17899,
'CMX': 7, 'OKC': 4680, 'ROA': 734, 'SMF': 9667, 'SPI': 289, 'BRW': 116, 'OXR':
211, 'ABI': 460, 'MBS': 586, 'ELM': 203, 'PHX': 34140, 'FCA': 540, 'STL': 10762,
'PWM': 1306, 'ABY': 212, 'BET': 166, 'MHT': 3269, 'DFW': 48465, 'ABE': 889,
'TXK': 238, 'GSP': 2179, 'LSE': 436, 'STX': 66, 'FAY': 404, 'HDN': 296, 'GUC':
118, 'LBB': 1433, 'EKO': 286, 'CRP': 826, 'EGE': 238, 'FSD': 1091, 'SWF': 984,
'SUN': 526, 'CSG': 282, 'BQK': 161, 'SFO': 23190, 'MEM': 13932, 'ELP': 3457,
'BHM': 4145, 'FLL': 11449, 'ATL': 69358, 'PIH': 299, 'YKM': 115, 'FNT': 1492,
'RIC': 3342, 'DAY': 2770, 'PHF': 866, 'OMA': 4543, 'SJT': 298, 'LCH': 170,
```

'BPT': 62, 'VPS': 1150, 'LIT': 2636, 'FAT': 2719, 'ICT': 2517, 'CAE': 1760,
'PFN': 576, 'SOP': 18, 'ORD': 60227, 'AVP': 400, 'BTV': 1054, 'AEX': 391, 'BIL':
774, 'SPS': 398, 'ILM': 613, 'SMX': 290, 'PIA': 1010, 'RDU': 11206, 'BQN': 238,
'MFE': 818, 'MKE': 5635, 'SYR': 2195, 'LFT': 866, 'HSV': 1715, 'PIT': 7680,
'TUS': 4887, 'MTJ': 238, 'ACY': 90, 'ROW': 120, 'MDW': 15278, 'AZO': 778, 'PLN':
11, 'COS': 2915, 'OAJ': 212, 'JNU': 592, 'IND': 7002, 'ALO': 56, 'KOA': 2489,
'GPT': 1368, 'MGM': 620, 'DTW': 27888, 'HOU': 9270, 'CHA': 677, 'TYS': 2438,
'YUM': 606, 'ADQ': 116, 'ONT': 7188, 'FWA': 1070, 'MDT': 1304, 'JAX': 5798,
'LAX': 39276, 'MSP': 24418, 'MOT': 176, 'BTR': 1645, 'BGR': 375, 'SIT': 180,
'MCO': 21436, 'ROC': 2691, 'SGF': 1765, 'AGS': 404, 'OTZ': 174, 'SAN': 16406,
'BZN': 756, 'GGG': 178, 'YAK': 116, 'JFK': 20606, 'ANC': 2486, 'DAB': 468,
'SUX': 63, 'MSO': 507, 'GNV': 278, 'PHL': 16526, 'OGG': 3968, 'DSM': 2792,
'SAT': 7830, 'SLC': 23737, 'PMD': 110, 'STT': 404, 'RAP': 685, 'ASE': 521,
'CLD': 479, 'SBP': 1195}
month_max: ATL ,departures + arrivals of this month: 69358
12 ----------
{'BGM': 116, 'PSE': 248, 'MSY': 6867, 'GEG': 2944, 'SNA': 8774, 'BUR': 5560,
'GRB': 1306, 'GTF': 420, 'IDA': 570, 'GRR': 2526, 'EUG': 1098, 'PSG': 120,
'PVD': 4010, 'GSO': 2165, 'MYR': 867, 'OAK': 12369, 'MSN': 2121, 'COD': 186,
'FAR': 797, 'BTM': 124, 'FSM': 536, 'MQT': 167, 'SCC': 120, 'DCA': 13863, 'RFD':
113, 'MLU': 494, 'CID': 1606, 'LWS': 112, 'GTR': 150, 'WRG': 120, 'HLN': 310,
'LEX': 1486, 'RDM': 611, 'FLO': 78, 'ORF': 3160, 'SCE': 124, 'EVV': 896, 'KTN':
368, 'CRW': 419, 'CWA': 262, 'SAV': 2340, 'TRI': 263, 'CDV': 120, 'CMH': 6287,
'MOD': 502, 'CAK': 1622, 'TYR': 306, 'ADK': 18, 'CHO': 194, 'MOB': 1084, 'PNS':
1704, 'MCN': 143, 'CEC': 177, 'LIH': 2702, 'IAH': 32168, 'HNL': 11497, 'SHV':
1413, 'ERI': 154, 'SJC': 10224, 'CVG': 16804, 'TOL': 326, 'BUF': 4129, 'TLH':
637, 'LGA': 19477, 'ACT': 410, 'HPN': 1867, 'RDD': 300, 'AUS': 8806, 'MLI':
1523, 'SJU': 4245, 'ATW': 922, 'DHN': 247, 'LGB': 2519, 'AVL': 598, 'GJT': 801,
'LYH': 104, 'BFL': 814, 'GFK': 230, 'RNO': 4499, 'SRQ': 1323, 'SBN': 821, 'EYW':
168, 'JAC': 555, 'RST': 710, 'CHS': 2576, 'RSW': 5162, 'TUL': 4149, 'HRL': 687,
'IPL': 229, 'AMA': 1314, 'ISP': 1800, 'BOS': 19345, 'MAF': 1171, 'MLB': 352,
'TUP': 74, 'EWR': 25629, 'LAS': 30418, 'BIS': 524, 'JAN': 2351, 'ITO': 1590,
'FAI': 794, 'XNA': 2392, 'HHH': 168, 'DLH': 406, 'DEN': 40384, 'EWN': 109,
'RHI': 56, 'SGU': 606, 'ALB': 2405, 'CPR': 591, 'LNK': 587, 'OME': 180, 'BOI':
3176, 'IAD': 13803, 'SBA': 2604, 'PSP': 2356, 'IYK': 165, 'MEI': 104, 'BRO':
211, 'DRO': 657, 'BMI': 906, 'SEA': 17823, 'LAN': 697, 'CMI': 475, 'LRD': 343,
'VLD': 164, 'MCI': 11241, 'PIR': 6, 'FLG': 288, 'GRK': 770, 'BNA': 10014, 'CLT':
21555, 'CLL': 296, 'TVC': 574, 'PSC': 482, 'BLI': 59, 'CIC': 233, 'ABQ': 7201,
'PBI': 5532, 'SDF': 3826, 'ACV': 620, 'LAW': 408, 'SLE': 121, 'BDL': 5350,
'DAL': 9213, 'MRY': 1545, 'DBQ': 231, 'CLE': 11190, 'PDX': 10099, 'MIA': 10885,
'MFR': 1052, 'TWF': 436, 'TPA': 13767, 'BWI': 18060, 'CMX': 25, 'OKC': 4581,
'ROA': 664, 'SMF': 9795, 'SPI': 288, 'BRW': 120, 'OXR': 220, 'ABI': 474, 'MBS':
477, 'ELM': 218, 'PHX': 35304, 'FCA': 525, 'STL': 10674, 'PWM': 1433, 'ABY':
188, 'BET': 168, 'MHT': 3307, 'DFW': 48840, 'ABE': 862, 'TXK': 243, 'GSP': 2182,
'LSE': 408, 'STX': 78, 'FAY': 387, 'HDN': 588, 'GUC': 167, 'LBB': 1466, 'EKO':
278, 'CRP': 793, 'EGE': 711, 'FSD': 1128, 'SWF': 976, 'SUN': 478, 'CSG': 206,
'BQK': 128, 'SFO': 23877, 'MEM': 14296, 'ELP': 3609, 'BHM': 4122, 'FLL': 12430,
'ATL': 69029, 'FNT': 1478, 'PIH': 311, 'YKM': 123, 'RIC': 3360, 'DAY': 2691,

'PHF': 967, 'OMA': 4764, 'SJT': 305, 'LCH': 171, 'TEX': 72, 'VPS': 1149, 'BPT':
62, 'LIT': 2779, 'FAT': 2737, 'ICT': 2559, 'CAE': 1827, 'PFN': 553, 'ORD':
60532, 'AVP': 403, 'BTV': 1153, 'AEX': 397, 'BIL': 788, 'SPS': 401, 'ILM': 561,
'SMX': 294, 'PIA': 1002, 'RDU': 10768, 'BQN': 248, 'MFE': 839, 'MKE': 5674,
'SYR': 2104, 'LFT': 848, 'HSV': 1658, 'PIT': 7668, 'TUS': 5050, 'MTJ': 437,
'ACY': 77, 'ROW': 124, 'MDW': 15319, 'AZO': 731, 'COS': 2940, 'OAJ': 214, 'JNU':
610, 'IND': 6948, 'ALO': 52, 'KOA': 2643, 'GPT': 1439, 'MGM': 633, 'DTW': 28341,
'HOU': 9332, 'CHA': 703, 'TYS': 2323, 'YUM': 689, 'ADQ': 120, 'ONT': 7182,
'FWA': 1022, 'MDT': 1233, 'JAX': 5859, 'LAX': 40432, 'MSP': 24912, 'MOT': 176,
'BTR': 1553, 'BGR': 370, 'SIT': 185, 'MCO': 22878, 'ROC': 2673, 'SGF': 1781,
'AGS': 374, 'OTZ': 180, 'SAN': 16720, 'BZN': 875, 'GGG': 186, 'YAK': 120, 'DAB':
518, 'JFK': 20849, 'ANC': 2753, 'SUX': 111, 'MSO': 575, 'GNV': 288, 'PHL':
16458, 'OGG': 4205, 'DSM': 2793, 'SAT': 7781, 'SLC': 24699, 'PMD': 111, 'STT':
576, 'RAP': 745, 'ASE': 1143, 'CLD': 480, 'SBP': 1245}
month_max: ATL ,departures + arrivals of this month: 69029

[377]:
```
## Q6
# 6nd the airline with highest average delay of each type in March 2007.
#Note: do not write separate code for each error type.
# You should compute a single RDD where each row contains the delay type,
# the airline that is worst regarding that delay type, and its average delay of␣
 ↪that type in minutes.


import pyspark.sql.functions as F
from pyspark.sql.functions import count, avg
from pyspark.sql.functions import  max as max_

# d_columns =  ['CarrierDelay','WeatherDelay', 'NASDelay', 'SecurityDelay',␣
 ↪'LateAircraftDelay']
print('1 all of group:')
df1 = df.groupBy("FlightNum") \
    .avg('CarrierDelay','WeatherDelay', 'NASDelay', 'SecurityDelay',␣
 ↪'LateAircraftDelay')
df1.show()

r = df1.groupBy("FlightNum").agg(F.sum(df1[1]+df1[2] + df1[3] + df1[4]).
 ↪alias('result')).orderBy('result',ascending=False).head(1)
print('2 the filghtnum is:', r[0].FlightNum)

print('3 the max row:')
df1.filter(col('FlightNum').isin([r[0].FlightNum])).show()
```

1 all of group:
+---------+-----------------+------------------+-----------------+-----------
---------+--------------------+
|FlightNum| avg(CarrierDelay)| avg(WeatherDelay)| avg(NASDelay)|
avg(SecurityDelay)|avg(LateAircraftDelay)|

```
+--------+----------------+-----------------+----------------+----------
---------+--------------------+
|    1959|1.2679558011049723| 0.5041436464088398|
4.433701657458563|0.029005524861878452|    1.6505524861878453|
|    2142|3.2524964336661912| 0.9900142653352354|2.6390870185449358|
0.0|       6.8830242510699|
|     496|2.0320776927604474|0.30341377280753384|
2.695703354914656|0.023543260741612712|    4.066509711595056|
|    1342|1.9002100840336134| 1.0777310924369747|
2.653361344537815|0.017857142857142856|    8.884453781512605|
|    2659| 4.656678082191781| 0.5136986301369864|          2.1875|
0.06763698630136987|    5.648972602739726|
|    1238| 4.135495078170237| 0.5964099594672843|
3.854082223508975|0.008685581933989578|    6.342790966994789|
|    2122|1.1527924130663856|0.36459430979978924|2.8219178082191783|
0.09272918861959958|    1.334035827186512|
|    1829|1.7451162790697674|0.28093023255813954| 5.782325581395349|
0.12930232558139534|    11.238139534883722|
|     148| 3.586683107274969|0.46732429099876693|
4.400246609124538|0.059186189889025895|    4.884340320591862|
|    1645|2.4296435272045027| 0.5590994371482176| 3.161976235146967|
0.0|    6.607879924953096|
|    1088| 2.456610366919045| 0.1671520093185789| 6.555620267909144|
0.0|    3.8747815958066396|
|    2866| 3.172109443954104| 1.6540158870255957|1.8905560458958517|
0.00706090026478376|    5.623124448367167|
|     463| 2.181451612903226|
0.780241935483871|3.1838709677419357|0.010887096774193548|
7.198387096774193|
|     471|2.5846069868995634|
0.4683406113537118|3.4001091703056767|0.026473799126637554|
3.2491812227074237|
|    2366|2.9061624649859943|0.04061624649859944|
2.057422969187675|0.023809523809523808|    11.518207282913165|
|    3175|2.2657894736842104|               0.0|1.9631578947368422|
0.03684210526315789|    1.5789473684210527|
|    7340| 5.451990632318501| 0.4918032786885246| 2.812646370023419|
0.7002341920374707|    6.686182669789227|
|    7253|4.2555555555555555|0.43555555555555553|2.7155555555555555|
0.0|    6.302222222222222|
|    7240| 4.732394366197183| 0.504225352112676|2.9380281690140846|
0.08450704225352113|    2.7661971830985914|
|    5518| 5.430722891566265| 2.608433734939759|
5.621987951807229|0.061746987951807226|    2.9819277108433737|
+--------+----------------+-----------------+----------------+----------
---------+--------------------+
only showing top 20 rows
```

```
2 the filghtnum is: 7823
3 the max row:
+--------+----------------+----------------+----------------+-------------
----+--------------------+
|FlightNum|avg(CarrierDelay)|avg(WeatherDelay)|
avg(NASDelay)|avg(SecurityDelay)|avg(LateAircraftDelay)|
+--------+----------------+----------------+----------------+-------------
----+--------------------+
|    7823|76.35714285714286|          0.0|21.285714285714285|
0.0|           0.0|
+--------+----------------+----------------+----------------+-------------
----+--------------------+
```

[378]:
```python
## q7
# Compute median, mean, and mode of columns 12-16, 19-21 and 25-29
# for the flights in the third week of 2007. Exclude the non-numeric values.

from pyspark.sql import functions as F
from pyspark.sql.types import IntegerType

print('filter out week 3')
mydf = df.filter(col('DayOfWeek').isin([3]))

print('median of [12:16]:')
df1 = mydf.select(mydf.columns[12:16])
# df1.show()

# res  = df1.select(*[F.percentile_approx(c).alias(c) for c in df1.columns])
# res.show()
for name in ('CRSElapsedTime', 'AirTime', 'ArrDelay', 'DepDelay'):
    df1 = df1.withColumn(name, df1[name].cast(IntegerType()))
    quantiles = df1.approxQuantile("CRSElapsedTime", [0.25, 0.5, 0.75], 0)
    print(name, ' median: ',quantiles)

df2 = mydf.select(mydf.columns[19:21])
# df2.show()
res2  = df2.select(*[F.mean(c).alias(c) for c in df2.columns])
print('mean of [19:21] :')
res2.show()

df3 = mydf.select(mydf.columns[25:29])
# df3.show()
print('mode of [25:29] :')
# [df3.groupby(i).count().orderBy("count", ascending=False).first()[0] for i in
 →df3.columns]
for i in df3.columns:
```

```
        t = df3.groupby(i).count().orderBy("count", ascending=False).first()
        if t is not None:
            print(t)
```

filter out week 3
median of [12:16]:
CRSElapsedTime median: [77.0, 108.0, 155.0]
AirTime median: [77.0, 108.0, 155.0]
ArrDelay median: [77.0, 108.0, 155.0]
DepDelay median: [77.0, 108.0, 155.0]
mean of [19:21] :
```
+----------------+-----------------+
|           TaxiIn|          TaxiOut|
+----------------+-----------------+
|6.592582320192348|16.593127845871546|
+----------------+-----------------+
```

mode of [25:29] :
Row(WeatherDelay=0, count=1069792)
Row(NASDelay=0, count=936107)
Row(SecurityDelay=0, count=1087801)
Row(LateAircraftDelay=0, count=970520)

[384]:
```python
## Q8
#Assume that a passenger wants to travel from Philadelphia International␣
 ↪Airport (airport code: PHL)
# to Los Angeles International Airport (airport code: LAX), and then go back to␣
 ↪Philadelphia (PHL).
# He departs PHL not earlier than 5:59 am (scheduled time), stays at least 3:01␣
 ↪hours in Los Angeles and then arrive at PHL not later than 11pm. Based on␣
 ↪the "scheduled" times, find which carrier has the highest number of flights␣
 ↪with these constraints.
# Limit your analysis to February 2007 and use scheduled times.

from pyspark.sql.functions import col
import pyspark.sql.functions as F



df1 = df.filter(col('Month').isin([2]) & df.DepTime.isNotNull() & df.ArrTime.
 ↪isNotNull() )
# filter datetime is too early data
df1 = df1.filter( df.DepTime > '500' )
# df1 = df1.where(col("DepTime").isNotNull()).collect()
# df1 = df1.where(col("ArrTime").isNotNull()).collect()

df1 = df1.filter(col('Origin').isin(['PHL', 'LAX'])).filter(col('Dest').
 ↪isin(['PHL', 'LAX']))
```

```python
# df1.show()

# df2 = df1.filter(col('DepTime').isin([2]))
print('stay 3:0 hour, it means before we shoulf flight here at least before␣
 ↪back-fight start time - 3hours')
dates = ("1970-01-01 5:59:00", "1970-01-01 20:00:00", "1970-01-01 23:00:00")
# date_from, date_to = [to_date(lit(s)).cast(TimestampType()) for s in dates]


df2 = df1.withColumn('DepTime_Date', F.to_timestamp('DepTime', 'hhmm'))
df3 = df2.withColumn('ArrTime_Date', F.to_timestamp('ArrTime', 'hhmm'))
# df2.show()

df4 = df3.where( ((col('DepTime_Date') > dates[0]) & (col('ArrTime_Date') <␣
 ↪dates[1])) |
         (col('ArrTime_Date') < dates[2])
        )
# df4.show()
if df4 is not None:
    df5 = df4.groupBy('UniqueCarrier').count()
    k_v = {}
    for orgin in df5.rdd.collect():

        k_v[orgin['UniqueCarrier']] = orgin['count']
    print(k_v)
    if k_v is not None:
        carriar_max = max(k_v.items(), key=operator.itemgetter(1))[0]
        print('max UniqueCarrier :', carriar_max)
```

stay 3:0 hour, it means before we shoulf flight here at least before back-fight
start time - 3hours
{'UA': 17, 'US': 20, 'WN': 27}
max UniqueCarrier : WN

[388]:
```python
## Q9
#Generate the `departure flights` board of the Los Angeles Airport at 12 Jan␣
 ↪2007 at 13:00.
# The board should contain flights with actual departure times between 12:00␣
 ↪and 14:00,
# sorted by scheduled departure time. The resulting table should at least␣
 ↪contain scheduled departure time,
# actual departure time (if departed),
# airline code, and destination
df1 = df.filter(col('Month').isin([1])).filter(col('DayofMonth').isin([1]))
df1 = df1.filter( df.CRSDepTime > '500' )

dates = ("1970-01-01 12:00:00", "1970-01-01 14:00:00")
```

```python
dates = ("1970-01-01 00:01:00", "1970-01-01 23:59:00")
# date_from, date_to = [to_date(lit(s)).cast(TimestampType()) for s in dates]

df1 = df1.withColumn(
    "CRSDepTime",
    F.when(F.col("CRSDepTime").isNull(), '0')
    .otherwise(F.col("CRSDepTime").cast("string"))
)
df2 = df1.withColumn('DepTime_Date', F.to_timestamp('CRSDepTime', 'hhmm'))

# df2.show()
# print('@'*20)

df4 = df2.where(
    ((col('DepTime_Date') > dates[0]) & (col('DepTime_Date') < dates[1]))
        )

print('-'*10, 'departure flights(limit 100)', '-'*10)
for item in df4.rdd.collect()[:100]:
#     print(item)
    print(item['CRSArrTime'],item['DepTime'], item['FlightNum'], item['Dest'])
```

```
---------- departure flights(limit 100) ----------
1340 1232 2891 ONT
1410 1251 933 SAN
1205 1042 1554 SAN
1225 1045 1502 SEA
1300 1140 1596 SNA
1300 1233 851 LAS
1155 1035 1184 OAK
1315 1101 324 PHX
1450 1245 1684 PHX
1250 1136 2037 SJC
1220 1052 1977 SMF
1340 1215 2588 SMF
1225 959 1477 CLE
1225 1058 2108 DAL
1115 1014 1361 LIT
1330 1224 2584 MCI
1450 1132 338 MCO
1250 1151 2142 MDW
1155 1207 2968 MDW
1340 1159 2747 OKC
1445 1323 271 PHX
1405 1122 1167 ALB
1245 1007 2844 BDL
1115 1036 653 BNA
```

```
1405 1213 163 BWI
1325 1120 2503 CMH
1140 1046 430 FLL
1315 1213 2792 FLL
1220 1018 3026 IAD
1500 1303 1265 IND
1515 1242 2182 ISP
1145 1055 2374 JAX
1250 1121 250 MDW
1415 1125 845 MHT
1335 1253 710 PBI
1320 1055 2951 PHL
1250 1034 2999 PIT
1325 1039 880 PVD
1155 1058 188 DAL
1155 1015 2673 HOU
1325 1228 1075 MCI
1415 1231 1590 PHX
1120 1051 2970 LAX
1440 1024 379 MDW
1345 1142 2980 MSP
1230 1039 2462 STL
1357 1349 2622 EWR
1426 1241 2498 CLE
1125 1004 2815 EWR
1342 1036 2307 JAX
1344 1240 2461 IAH
1429 1108 2312 CMH
1439 1223 3112 IND
1305 1134 2630 OKC
1325 1132 2387 BNA
1245 1120 2087 RDU
1150 956 2419 CLE
1235 1109 2771 IAH
1430 1315 3288 EWR
1419 1102 3113 CVG
1347 1227 2796 SDF
1315 1146 2950 EWR
1419 1034 2005 ORF
1145 1025 3119 MOB
1544 1329 2078 EWR
1205 1035 2438 EWR
1347 1135 2459 OMA
1242 1121 3282 BWI
1320 1043 2659 IAH
1319 1214 2838 GRR
1412 1052 2165 CAE
1145 1019 2483 LIT
```

```
1135 1016 3218 BRO
1428 1103 2793 CLT
1159 1020 3259 VPS
1300 1157 2989 IAH
1358 1242 2256 EWR
1517 1207 2242 ATL
1130 1029 2708 CLE
1315 1218 2708 DAY
1347 1235 3012 BTV
1202 1009 2343 EWR
1345 1025 2544 IND
1300 1149 2103 CRP
1311 1134 2942 LBB
1221 1027 3245 EWR
1258 1136 2847 HRL
1450 1213 3254 JAX
1314 957 3256 EWR
1304 1142 2448 RIC
1203 1054 2539 IAH
1348 1235 2458 IAH
1226 1101 3229 IAH
1322 1233 2046 STL
1436 1245 2134 IAH
1653 1157 2054 IAH
1342 1132 2278 IAH
1439 1136 2310 CLE
1302 1046 2346 LIT
1337 1100 2552 CHS
```

[ ]:

[ ]:

[ ]:

[ ]:

[ ]:

[ ]: