

## flights\_example\_RDD

October 5, 2020

```
[1]: from operator import add
from pyspark import SparkContext

sc = SparkContext.getOrCreate()
lines = sc.textFile("flights.csv.bz2")
airports_lines = sc.textFile('airports.csv.bz2')
```

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[2]: # Removing the Header Line from CSV file
linesHeader = lines.first()
#header = sc.parallelize([linesHeader])
#linesWithoutHeader = lines.subtract(header)

flights_raw = lines\
    .zipWithIndex()\
    .filter(lambda x: x[1] > 2)\
    .keys()

#flights = flights_raw\
    # .map(lambda x: x.split(','))
#flights = flights_raw.map(lambda p: (p[0], p[1], p[2], p[3], p[4], p[5],
    ↪p[6], p[7], p[8], p[9], p[10], '0' if p[11] == '' else p[11], p[24]))

flights = flights_raw\
    .map(lambda x: x.split(','))\
    .map(lambda x: (x[0], x[1], x[2], x[3], x[4],
        x[5], x[6], x[7], x[8], x[9],
        x[10], 0 if x[11]=='' else float(x[11]), x[12], x[13],
    ↪x[14],
        x[15], x[16], x[17], x[18], x[19],
        x[20], x[21], x[22], x[23], x[24],
        x[25], x[26], x[27], x[28], x[29], x[30])
    ))

airports_raw = airports_lines\
    .zipWithIndex()
```

```

        .filter(lambda x:x[1]>2)\
        .keys()
airports = airports_raw\
    .map(lambda x: x.split(','))\
    .map(lambda x: (x[0], x[1], x[2], x[3]))\
    .filter(lambda x: x[0])

mainFlightsData = flights.map(lambda p:
                                (p[0], p[1], p[2], p[3], p[4], p[5], p[6],
                                 p[7], p[8], p[9], p[10], p[11], p[24]))

```

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[3]: # number 6 is ORIGIN_AIRPORT
flightsFromBoston = mainFlightsData\
    .filter(lambda p: True if p[7] == "BOS" else False )

# Get the total number of Flights from BOS
# 107847 flights from Logan Airport in Boston
print(flightsFromBoston.count())

# Find the subset of flights departing on the weekend.
weekEndFlights = flightsFromBoston\
    .filter(lambda p: True if (int(p[3])==6 or int(p[3]) ==7) else False)
print(weekEndFlights.count()) # 26092

```

107847  
26092

```

[4]: #Q1 Find a list of Origin Airports
result = flights\
    .map(lambda x:x[7])\
    .distinct()\
    .collect()

for idx, i in enumerate(sorted(result), start=1):
    print("{}: {}".format(idx, i))

```

1: 10135  
2: 10136  
3: 10140  
4: 10141  
5: 10146  
6: 10154  
7: 10155  
8: 10157  
9: 10158

10: 10165  
11: 10170  
12: 10185  
13: 10208  
14: 10257  
15: 10268  
16: 10279  
17: 10299  
18: 10333  
19: 10372  
20: 10397  
21: 10408  
22: 10423  
23: 10431  
24: 10434  
25: 10469  
26: 10529  
27: 10551  
28: 10561  
29: 10577  
30: 10581  
31: 10599  
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33: 10627  
34: 10631  
35: 10685  
36: 10693  
37: 10713  
38: 10721  
39: 10728  
40: 10731  
41: 10732  
42: 10739  
43: 10747  
44: 10754  
45: 10779  
46: 10781  
47: 10785  
48: 10792  
49: 10800  
50: 10821  
51: 10849  
52: 10868  
53: 10874  
54: 10918  
55: 10926  
56: 10980  
57: 10990

58: 10994  
59: 11003  
60: 11013  
61: 11042  
62: 11049  
63: 11057  
64: 11066  
65: 11067  
66: 11076  
67: 11097  
68: 11109  
69: 11111  
70: 11122  
71: 11140  
72: 11146  
73: 11150  
74: 11193  
75: 11203  
76: 11252  
77: 11259  
78: 11267  
79: 11274  
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81: 11292  
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94: 11537  
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109: 11697  
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111: 11775  
112: 11778  
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117: 11898  
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122: 11977  
123: 11980  
124: 11982  
125: 11986  
126: 11995  
127: 11996  
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129: 12007  
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137: 12197  
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188: 13256  
189: 13264  
190: 13277  
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273: 14843  
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279: 14960  
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288: 15249  
289: 15295  
290: 15304  
291: 15323  
292: 15356  
293: 15370  
294: 15376  
295: 15380  
296: 15389  
297: 15401



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299: 15412  
300: 15497  
301: 15607  
302: 15624  
303: 15841  
304: 15919  
305: 15991  
306: 16218  
307: ABE  
308: ABI  
309: ABQ  
310: ABR  
311: ABY  
312: ACK  
313: ACT  
314: ACV  
315: ACY  
316: ADK  
317: ADQ  
318: AEX  
319: AGS  
320: AKN  
321: ALB  
322: ALO  
323: AMA  
324: ANC  
325: APN  
326: ASE  
327: ATL  
328: ATW  
329: AUS  
330: AVL  
331: AVP  
332: AZO  
333: BDL  
334: BET  
335: BFL  
336: BGM  
337: BGR  
338: BHM  
339: BIL  
340: BIS  
341: BJI  
342: BLI  
343: BMI  
344: BNA  
345: BOI

346: BOS  
347: BPT  
348: BQK  
349: BQN  
350: BRD  
351: BRO  
352: BRW  
353: BTM  
354: BTR  
355: BTV  
356: BUF  
357: BUR  
358: BWI  
359: BZN  
360: CAE  
361: CAK  
362: CDC  
363: CDV  
364: CEC  
365: CHA  
366: CHO  
367: CHS  
368: CID  
369: CIU  
370: CLD  
371: CLE  
372: CLL  
373: CLT  
374: CMH  
375: CMI  
376: CMX  
377: CNY  
378: COD  
379: COS  
380: COU  
381: CPR  
382: CRP  
383: CRW  
384: CSG  
385: CVG  
386: CWA  
387: DAB  
388: DAL  
389: DAY  
390: DBQ  
391: DCA  
392: DEN  
393: DFW

394: DHN  
395: DIK  
396: DLG  
397: DLH  
398: DRO  
399: DSM  
400: DTW  
401: DVL  
402: EAU  
403: ECP  
404: EGE  
405: EKO  
406: ELM  
407: ELP  
408: ERI  
409: ESC  
410: EUG  
411: EVV  
412: EWN  
413: EWR  
414: EYW  
415: FAI  
416: FAR  
417: FAT  
418: FAY  
419: FCA  
420: FLG  
421: FLL  
422: FNT  
423: FSD  
424: FSM  
425: FWA  
426: GCC  
427: GCK  
428: GEG  
429: GFK  
430: GGG  
431: GJT  
432: GNV  
433: GPT  
434: GRB  
435: GRI  
436: GRK  
437: GRR  
438: GSO  
439: GSP  
440: GST  
441: GTF

442: GTR  
443: GUC  
444: GUM  
445: HDN  
446: HIB  
447: HLN  
448: HNL  
449: HOB  
450: HOU  
451: HPN  
452: HRL  
453: HSV  
454: HYA  
455: HYS  
456: IAD  
457: IAG  
458: IAH  
459: ICT  
460: IDA  
461: ILG  
462: ILM  
463: IMT  
464: IND  
465: INL  
466: ISN  
467: ISP  
468: ITH  
469: ITO  
470: JAC  
471: JAN  
472: JAX  
473: JFK  
474: JLN  
475: JMS  
476: JNU  
477: KOA  
478: KTN  
479: LAN  
480: LAR  
481: LAS  
482: LAW  
483: LAX  
484: LBB  
485: LBE  
486: LCH  
487: LEX  
488: LFT  
489: LGA

490: LGB  
491: LIH  
492: LIT  
493: LNK  
494: LRD  
495: LSE  
496: LWS  
497: MAF  
498: MBS  
499: MCI  
500: MCO  
501: MDT  
502: MDW  
503: MEI  
504: MEM  
505: MFE  
506: MFR  
507: MGM  
508: MHK  
509: MHT  
510: MIA  
511: MKE  
512: MKG  
513: MLB  
514: MLI  
515: MLU  
516: MMH  
517: MOB  
518: MOT  
519: MQT  
520: MRY  
521: MSN  
522: MSO  
523: MSP  
524: MSY  
525: MTJ  
526: MVY  
527: MYR  
528: OAJ  
529: OAK  
530: OGG  
531: OKC  
532: OMA  
533: OME  
534: ONT  
535: ORD  
536: ORF  
537: ORH

538: OTH  
539: OTZ  
540: PAH  
541: PBG  
542: PBI  
543: PDX  
544: PHF  
545: PHL  
546: PHX  
547: PIA  
548: PIB  
549: PIH  
550: PIT  
551: PLN  
552: PNS  
553: PPG  
554: PSC  
555: PSE  
556: PSG  
557: PSP  
558: PUB  
559: PVD  
560: PWM  
561: RAP  
562: RDD  
563: RDM  
564: RDU  
565: RHI  
566: RIC  
567: RKS  
568: RNO  
569: ROA  
570: ROC  
571: ROW  
572: RST  
573: RSW  
574: SAF  
575: SAN  
576: SAT  
577: SAV  
578: SBA  
579: SBN  
580: SBP  
581: SCC  
582: SCE  
583: SDF  
584: SEA  
585: SFO

586: SGF  
587: SGU  
588: SHV  
589: SIT  
590: SJC  
591: SJT  
592: SJU  
593: SLC  
594: SMF  
595: SMX  
596: SNA  
597: SPI  
598: SPS  
599: SRQ  
600: STC  
601: STL  
602: STT  
603: STX  
604: SUN  
605: SUX  
606: SWF  
607: SYR  
608: TLH  
609: TOL  
610: TPA  
611: TRI  
612: TTN  
613: TUL  
614: TUS  
615: TVC  
616: TWF  
617: TXK  
618: TYR  
619: TYS  
620: UST  
621: VEL  
622: VLD  
623: VPS  
624: WRG  
625: WYS  
626: XNA  
627: YAK  
628: YUM

```
[5]: #Q2 Find a list of (Origin, Destination) pairs
result = flights\
    .map(lambda x: (x[7],x[8]))\
```

```

        .distinct()\
        .collect()

for idx, i in enumerate(result, start=1):
    print("{}: {}".format(idx, i))

```

```

1: ('SEA', 'ANC')
2: ('LAS', 'ATL')
3: ('ANC', 'SEA')
4: ('ANC', 'PDX')
5: ('PDX', 'MSP')
6: ('SJU', 'MCO')
7: ('HNL', 'KOA')
8: ('IAH', 'MIA')
9: ('HNL', 'LIH')
10: ('SEA', 'DEN')
11: ('ORD', 'FLL')
12: ('RDD', 'SFO')
13: ('BUF', 'JFK')
14: ('ORD', 'DTW')
15: ('SMF', 'DEN')
16: ('AUS', 'LAX')
17: ('BOS', 'BWI')
18: ('PHX', 'DTW')
19: ('MFR', 'DEN')
20: ('SEA', 'IAH')
21: ('BOS', 'PBI')
22: ('BOS', 'JFK')
23: ('JFK', 'BQN')
24: ('CHS', 'EWR')
25: ('CHS', 'DFW')
26: ('BOS', 'BUF')
27: ('PDX', 'EWR')
28: ('IND', 'PHX')
29: ('BOS', 'EWR')
30: ('MCI', 'PHX')
31: ('MCI', 'IAH')
32: ('BDL', 'IAD')
33: ('RDM', 'DEN')
34: ('CID', 'ATL')
35: ('MCI', 'ORD')
36: ('ORD', 'LGA')
37: ('OAK', 'PHX')
38: ('PIT', 'IAH')
39: ('PHX', 'SLC')
40: ('SFO', 'LAX')
41: ('LAX', 'ORD')

```



42: ('IAH', 'PHX')  
43: ('BWI', 'MIA')  
44: ('TPA', 'DFW')  
45: ('FAI', 'ANC')  
46: ('PDX', 'SJC')  
47: ('PBI', 'JFK')  
48: ('AUS', 'JFK')  
49: ('DCA', 'BOS')  
50: ('LGA', 'DTW')  
51: ('RNO', 'SLC')  
52: ('ORD', 'ATL')  
53: ('MEM', 'EWR')  
54: ('TYS', 'IAD')  
55: ('ABE', 'DTW')  
56: ('ERI', 'ORD')  
57: ('ORD', 'MIA')  
58: ('ATL', 'TTN')  
59: ('CLL', 'DFW')  
60: ('RDU', 'JFK')  
61: ('DFW', 'OAK')  
62: ('DFW', 'FLL')  
63: ('RAP', 'DEN')  
64: ('FSD', 'ORD')  
65: ('DAL', 'IAH')  
66: ('CID', 'ORD')  
67: ('MRY', 'SFO')  
68: ('SLC', 'LAX')  
69: ('SFO', 'EWR')  
70: ('EWR', 'SFO')  
71: ('JFK', 'SFO')  
72: ('MFE', 'DFW')  
73: ('SJU', 'MIA')  
74: ('SEA', 'SFO')  
75: ('MCI', 'DEN')  
76: ('FSM', 'DFW')  
77: ('SPS', 'DFW')  
78: ('MTJ', 'DEN')  
79: ('RSW', 'DTW')  
80: ('GCC', 'RKS')  
81: ('RDM', 'SFO')  
82: ('OGG', 'HNL')  
83: ('EWR', 'CLT')  
84: ('LAS', 'SFO')  
85: ('BNA', 'DFW')  
86: ('BNA', 'LAX')  
87: ('RIC', 'MIA')  
88: ('ORF', 'MIA')  
89: ('RNO', 'PHX')

90: ('HOU', 'PHX')  
91: ('MOB', 'ATL')  
92: ('SMF', 'SLC')  
93: ('PIB', 'MEI')  
94: ('OMA', 'DEN')  
95: ('MSN', 'DFW')  
96: ('CMH', 'LGA')  
97: ('COS', 'IAH')  
98: ('LAR', 'DEN')  
99: ('DFW', 'ORD')  
100: ('BIS', 'DEN')  
101: ('CMH', 'FLL')  
102: ('MCO', 'ATL')  
103: ('PSP', 'SLC')  
104: ('LAX', 'PHL')  
105: ('IAD', 'DFW')  
106: ('LAX', 'AUS')  
107: ('SBA', 'PHX')  
108: ('SBP', 'PHX')  
109: ('COS', 'DEN')  
110: ('EWR', 'PHX')  
111: ('AUS', 'IAH')  
112: ('CLT', 'PHL')  
113: ('SAN', 'SEA')  
114: ('SEA', 'ATL')  
115: ('RIC', 'IAD')  
116: ('GPT', 'DFW')  
117: ('SAT', 'ATL')  
118: ('JFK', 'LAS')  
119: ('ABE', 'ATL')  
120: ('SPI', 'DFW')  
121: ('PDX', 'ONT')  
122: ('SJC', 'MSP')  
123: ('FLL', 'LAS')  
124: ('MKE', 'LAS')  
125: ('SJC', 'LAS')  
126: ('BDL', 'MIA')  
127: ('GSO', 'MIA')  
128: ('COS', 'LAX')  
129: ('GCC', 'DEN')  
130: ('LIT', 'DAL')  
131: ('FLL', 'ATL')  
132: ('SNA', 'MSP')  
133: ('ATL', 'LGA')  
134: ('LAS', 'DEN')  
135: ('CMI', 'DFW')  
136: ('GTF', 'DEN')  
137: ('SNA', 'SFO')

138: ('ATL', 'IAH')  
139: ('BWI', 'MCO')  
140: ('PHL', 'PHX')  
141: ('CLE', 'DFW')  
142: ('AVL', 'ATL')  
143: ('SUX', 'ORD')  
144: ('DFW', 'IAH')  
145: ('MSP', 'LAS')  
146: ('RDU', 'SFO')  
147: ('JAX', 'CLT')  
148: ('CLT', 'MIA')  
149: ('DCA', 'DAL')  
150: ('ISP', 'FLL')  
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152: ('ATL', 'MIA')  
153: ('BUR', 'SEA')  
154: ('PDX', 'LGB')  
155: ('ORF', 'ATL')  
156: ('CLE', 'ATL')  
157: ('LFT', 'IAH')  
158: ('GRK', 'DFW')  
159: ('GJT', 'DFW')  
160: ('HPN', 'ORD')  
161: ('ATL', 'FLL')  
162: ('ASE', 'DEN')  
163: ('BUR', 'SFO')  
164: ('CPR', 'SLC')  
165: ('FLL', 'BWI')  
166: ('BDL', 'FLL')  
167: ('MCO', 'LAS')  
168: ('TUS', 'DEN')  
169: ('MKE', 'PHX')  
170: ('SHV', 'IAH')  
171: ('MCO', 'BOS')  
172: ('AUS', 'BWI')  
173: ('LAS', 'SNA')  
174: ('ONT', 'MDW')  
175: ('PIT', 'PHX')  
176: ('IND', 'ATL')  
177: ('TVC', 'ORD')  
178: ('ALO', 'ORD')  
179: ('TPA', 'DTW')  
180: ('ASE', 'ORD')  
181: ('AUS', 'LGB')  
182: ('ISP', 'PBI')  
183: ('RNO', 'DFW')  
184: ('IAD', 'CVG')  
185: ('MRY', 'LAX')

186: ('ASE', 'LAX')  
187: ('EWR', 'PBI')  
188: ('ORD', 'MKE')  
189: ('IAH', 'BWI')  
190: ('PDX', 'LAS')  
191: ('DFW', 'CVG')  
192: ('ELP', 'DEN')  
193: ('HNL', 'SFO')  
194: ('IAH', 'IAD')  
195: ('ORD', 'CLT')  
196: ('BDL', 'DEN')  
197: ('CMH', 'PHX')  
198: ('LGA', 'IAH')  
199: ('LGA', 'TPA')  
200: ('GSO', 'ATL')  
201: ('DEN', 'LGA')  
202: ('HPN', 'RSW')  
203: ('DFW', 'TYS')  
204: ('ACY', 'MCO')  
205: ('SFO', 'SMF')  
206: ('FLL', 'DEN')  
207: ('PHL', 'MIA')  
208: ('EWR', 'MDW')  
209: ('PBI', 'DFW')  
210: ('SEA', 'KTN')  
211: ('TPA', 'DCA')  
212: ('BOS', 'MCO')  
213: ('MSP', 'PDX')  
214: ('DEN', 'PDX')  
215: ('IND', 'BWI')  
216: ('LAS', 'DAL')  
217: ('LAS', 'SAT')  
218: ('MCO', 'DAL')  
219: ('JFK', 'RDU')  
220: ('BWI', 'ATL')  
221: ('JFK', 'SRQ')  
222: ('OKC', 'ORD')  
223: ('IAD', 'ORD')  
224: ('BNA', 'CLT')  
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231: ('DEN', 'DCA')  
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233: ('SJU', 'STT')

234: ('PIH', 'SLC')  
235: ('SEA', 'BUR')  
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237: ('SJC', 'OGG')  
238: ('IDA', 'SLC')  
239: ('BWI', 'TPA')  
240: ('FLL', 'HOU')  
241: ('LAS', 'MKE')  
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278: ('CHA', 'ATL')  
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311: ('MOT', 'MSP')  
312: ('ATL', 'BWI')  
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314: ('DSM', 'MDW')  
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318: ('EWR', 'CMH')  
319: ('MCO', 'FLL')  
320: ('SFO', 'RNO')  
321: ('DFW', 'SAN')  
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333: ('ORD', 'PNS')  
334: ('CMH', 'JFK')  
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336: ('MBS', 'ORD')  
337: ('ATL', 'CLE')  
338: ('BHM', 'BWI')  
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341: ('ORD', 'PIT')  
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353: ('MSP', 'BWI')  
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366: ('JAN', 'IAH')  
367: ('IAH', 'COS')  
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370: ('HOU', 'OAK')  
371: ('MSP', 'ROC')  
372: ('LIT', 'DEN')  
373: ('DFW', 'AEX')  
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375: ('JFK', 'BTV')  
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377: ('RSW', 'MKE')

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380: ('MSP', 'ABQ')  
381: ('ATL', 'ICT')  
382: ('ILM', 'ATL')  
383: ('IAH', 'ONT')  
384: ('JAX', 'BNA')  
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386: ('MIA', 'PHX')  
387: ('SEA', 'BOS')  
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389: ('PSP', 'LAX')  
390: ('CLT', 'MCO')  
391: ('RNO', 'LAS')  
392: ('MSP', 'BOS')  
393: ('IAH', 'SLC')  
394: ('OGG', 'ITO')  
395: ('BHM', 'TPA')  
396: ('IND', 'RSW')  
397: ('EWR', 'BNA')  
398: ('ORD', 'TYS')  
399: ('RHI', 'MSP')  
400: ('KTN', 'WRG')  
401: ('LAS', 'IND')  
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404: ('DCA', 'JAX')  
405: ('DFW', 'CHS')  
406: ('STL', 'EWR')  
407: ('ATL', 'SAV')  
408: ('ORD', 'BOI')  
409: ('CLT', 'TPA')  
410: ('IND', 'HOU')  
411: ('HOU', 'LAS')  
412: ('SFO', 'MCO')  
413: ('SLC', 'JFK')  
414: ('FLL', 'CLE')  
415: ('SLC', 'CNY')  
416: ('LAS', 'SJC')  
417: ('ORD', 'JAC')  
418: ('GEG', 'MSP')  
419: ('LBB', 'DFW')  
420: ('DFW', 'TYR')  
421: ('ORD', 'MKG')  
422: ('SLC', 'CVG')  
423: ('IND', 'IAD')  
424: ('ORD', 'BZN')  
425: ('FLL', 'BUF')



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428: ('SJU', 'DFW')  
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430: ('SJC', 'HNL')  
431: ('PHX', 'GJT')  
432: ('PHX', 'TPA')  
433: ('ORD', 'DBQ')  
434: ('ORD', 'FAR')  
435: ('DEN', 'FLL')  
436: ('ROC', 'CLT')  
437: ('LGA', 'RSW')  
438: ('DFW', 'PSP')  
439: ('DFW', 'ICT')  
440: ('DEN', 'MSO')  
441: ('MCI', 'STL')  
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443: ('PHX', 'IND')  
444: ('DEN', 'GRR')  
445: ('LGB', 'JFK')  
446: ('SLC', 'SEA')  
447: ('BWI', 'ISP')  
448: ('LAS', 'OAK')  
449: ('MDW', 'EWR')  
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451: ('ORD', 'PBI')  
452: ('LAX', 'SBA')  
453: ('ATL', 'ASE')  
454: ('DEN', 'BHM')  
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458: ('MDW', 'CMH')  
459: ('MDW', 'PVD')  
460: ('DAY', 'EWR')  
461: ('DFW', 'ROW')  
462: ('ORD', 'BDL')  
463: ('IAH', 'JAN')  
464: ('ORD', 'MTJ')  
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468: ('BNA', 'BOS')  
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471: ('LAN', 'DTW')  
472: ('DAL', 'SAN')  
473: ('LAS', 'SMF')

474: ('ATL', 'MYR')  
475: ('CVG', 'TTN')  
476: ('IAH', 'PHL')  
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478: ('SLC', 'PHL')  
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511: ('DCA', 'RSW')  
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639: ('SMF', 'ORD')  
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676: ('HOU', 'BNA')  
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756: ('ORF', 'IAD')  
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801: ('MCO', 'BMI')  
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806: ('LGA', 'LIT')  
807: ('YAK', 'JNU')  
808: ('MDT', 'DEN')  
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853: ('RIC', 'CAE')  
854: ('OMA', 'PDX')  
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856: ('RAP', 'JMS')  
857: ('MSY', 'IAD')

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860: ('SWF', 'DTW')  
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862: ('CVG', 'XNA')  
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8544: ('11433', '14057')  
8545: ('11259', '13342')  
8546: ('12173', '10299')  
8547: ('14635', '10158')  
8548: ('13577', '10158')  
8549: ('14747', '10849')  
8550: ('11433', '12264')  
8551: ('12953', '10581')  
8552: ('14679', '13303')  
8553: ('11697', '12265')  
8554: ('14893', '12478')  
8555: ('14771', '10821')  
8556: ('12892', '10299')  
8557: ('12953', '11996')  
8558: ('12758', '14679')  
8559: ('11193', '10529')  
8560: ('14843', '11057')  
8561: ('11995', '11292')  
8562: ('15356', '15304')  
8563: ('12441', '13930')  
8564: ('11057', '15024')  
8565: ('11292', '12758')  
8566: ('13930', '12441')  
8567: ('15016', '14679')  
8568: ('13930', '14321')  
8569: ('11042', '12264')  
8570: ('12173', '12264')  
8571: ('11292', '11921')  
8572: ('12953', '14100')  
8573: ('11921', '11292')  
8574: ('13964', '11292')  
8575: ('11193', '14492')  
8576: ('14122', '12953')  
8577: ('14100', '10529')  
8578: ('11298', '11423')  
8579: ('10529', '14100')  
8580: ('15249', '13303')  
8581: ('11624', '13303')  
8582: ('14193', '13303')  
8583: ('11057', '12264')  
8584: ('12266', '14262')  
8585: ('14262', '12266')

```

8586: ('10874', '11433')
8587: ('12339', '12953')
8588: ('12945', '13487')
8589: ('12264', '14843')
8590: ('14747', '10666')
8591: ('SEA', 'PSC')
8592: ('CHS', 'PHL')
8593: ('PSC', 'SEA')
8594: ('RDU', 'SEA')
8595: ('CLT', 'SGF')
8596: ('HNL', 'MSP')
8597: ('SEA', 'CHS')
8598: ('MIA', 'PBI')
8599: ('LBB', 'HOU')
8600: ('IAH', 'BDL')
8601: ('CRW', 'DTW')
8602: ('GCC', 'RAP')
8603: ('TPA', 'SFO')
8604: ('MSO', 'SEA')
8605: ('SEA', 'MSO')
8606: ('CRP', 'ATL')
8607: ('SWF', 'RSW')
8608: ('MSN', 'SAN')
8609: ('MIA', 'OKC')

```

[6]: *#Q3 Find the Origin airport which had the largest departure delay in the month of January*

```

result = flights\
    .filter(lambda x: x[1]=="1")\
    .map(lambda x: (x[7], x[11]))\
    .top(1, lambda x:x[1])

print(result)

```

```
[('BHM', 1988.0)]
```

[7]: *#Q4 Find out which carrier has the largest delay on Weekends.*

```

result = flights\
    .filter(lambda x: x[3]=="6" or x[3]=="7")\
    .map(lambda x: (x[4],x[11]))\
    .top(1,lambda x: x[1])

print(result)

```

```
[('AA', 1878.0)]
```

[8]: *#Q5 Which airport has the most cancellation of flights?*

```
result = flights\  
    .filter(lambda x: x[24]=="1")\  
    .map(lambda x: (x[7],1))\  
    .reduceByKey(add)\  
    .top(1, lambda x: x[1])  
  
print(result)
```

[('ORD', 8548)]

[9]: *#Q6 Find the percent of flights cancelled for each carrier.*

```
result = flights\  
    .map(lambda x: (x[4], ((int(x[24])), 1)))\  
    .reduceByKey(lambda x,y: (x[0]+y[0],x[1]+y[1]))\  
    .map(lambda x: (x[0], x[1][0]/x[1][1] * 100))\  
    .collect()  
  
for idx, i in enumerate(result, start=1):  
    print("{}: {}".format(idx, i))
```

```
1: ('AA', 1.5040297086846388)  
2: ('NK', 1.7072900604026275)  
3: ('UA', 1.274521400053905)  
4: ('B6', 1.6012102693148795)  
5: ('MQ', 5.0995818512585185)  
6: ('F9', 0.6473204456382932)  
7: ('WN', 1.2713822111098343)  
8: ('OO', 1.6928612584621818)  
9: ('EV', 2.6628693111785964)  
10: ('US', 2.0466497244797823)  
11: ('DL', 0.4365889886868193)  
12: ('HA', 0.22419760855884205)  
13: ('AS', 0.38778112682587523)  
14: ('VX', 0.8626399366751207)
```

[10]: *#Q7 Find the largest departure delay for each carrier*

```
result = flights\  
    .map(lambda x: (x[4], x[11]))\  
    .reduceByKey(max)\  
    .collect()  
  
for idx, i in enumerate(result, start=1):  
    print("{}: {}".format(idx, i))
```

```
1: ('AA', 1988.0)  
2: ('NK', 836.0)  
3: ('UA', 1314.0)
```

```

4: ('B6', 1006.0)
5: ('MQ', 1544.0)
6: ('F9', 1112.0)
7: ('WN', 665.0)
8: ('OO', 1378.0)
9: ('EV', 1274.0)
10: ('US', 759.0)
11: ('DL', 1289.0)
12: ('HA', 1433.0)
13: ('AS', 963.0)
14: ('VX', 644.0)

```

[11]: *#Q8 Find the largest departure delay for each carrier for each month*

```

result = flights\
    .map(lambda x: ((x[4], int(x[1])), x[11])) \
    .reduceByKey(max) \
    .collect()

for idx, i in enumerate(result, start=1):
    print("{}: {}".format(idx, i))

```

```

1: (('UA', 1), 886.0)
2: (('F9', 1), 696.0)
3: (('OO', 2), 913.0)
4: (('MQ', 2), 1154.0)
5: (('NK', 3), 745.0)
6: (('UA', 3), 649.0)
7: (('HA', 3), 952.0)
8: (('NK', 4), 836.0)
9: (('MQ', 4), 973.0)
10: (('OO', 4), 878.0)
11: (('AA', 5), 1492.0)
12: (('AS', 5), 612.0)
13: (('NK', 6), 696.0)
14: (('AA', 7), 1625.0)
15: (('AS', 7), 830.0)
16: (('F9', 7), 793.0)
17: (('DL', 8), 1207.0)
18: (('B6', 8), 522.0)
19: (('F9', 8), 726.0)
20: (('WN', 8), 620.0)
21: (('VX', 9), 331.0)
22: (('EV', 9), 1000.0)
23: (('DL', 10), 1120.0)
24: (('AS', 10), 580.0)
25: (('F9', 10), 550.0)
26: (('EV', 11), 993.0)
27: (('VX', 11), 288.0)

```

28: (('UA', 12), 1194.0)  
29: (('AS', 12), 803.0)  
30: (('HA', 12), 1095.0)  
31: (('EV', 12), 1274.0)  
32: (('US', 1), 638.0)  
33: (('B6', 1), 500.0)  
34: (('EV', 1), 726.0)  
35: (('AS', 2), 735.0)  
36: (('DL', 2), 1159.0)  
37: (('B6', 3), 674.0)  
38: (('EV', 3), 583.0)  
39: (('AS', 4), 812.0)  
40: (('US', 4), 522.0)  
41: (('B6', 4), 500.0)  
42: (('HA', 4), 865.0)  
43: (('EV', 4), 757.0)  
44: (('NK', 5), 650.0)  
45: (('WN', 5), 628.0)  
46: (('VX', 5), 335.0)  
47: (('AA', 6), 1522.0)  
48: (('US', 6), 759.0)  
49: (('UA', 6), 994.0)  
50: (('HA', 6), 961.0)  
51: (('DL', 7), 1125.0)  
52: (('WN', 7), 560.0)  
53: (('VX', 7), 410.0)  
54: (('NK', 8), 679.0)  
55: (('VX', 8), 441.0)  
56: (('AA', 9), 1670.0)  
57: (('DL', 9), 1103.0)  
58: (('UA', 9), 777.0)  
59: (('HA', 9), 1304.0)  
60: (('MQ', 9), 1083.0)  
61: (('F9', 9), 698.0)  
62: (('NK', 10), 545.0)  
63: (('OO', 10), 1122.0)  
64: (('EV', 10), 975.0)  
65: (('UA', 11), 1142.0)  
66: (('AA', 11), 1631.0)  
67: (('MQ', 11), 931.0)  
68: (('OO', 12), 1378.0)  
69: (('AA', 1), 1988.0)  
70: (('DL', 1), 1184.0)  
71: (('HA', 1), 1003.0)  
72: (('OO', 1), 931.0)  
73: (('MQ', 1), 780.0)  
74: (('NK', 2), 546.0)  
75: (('B6', 2), 942.0)

76: (('EV', 2), 600.0)  
 77: (('VX', 2), 577.0)  
 78: (('AA', 3), 1609.0)  
 79: (('OO', 3), 874.0)  
 80: (('F9', 3), 1112.0)  
 81: (('MQ', 3), 830.0)  
 82: (('F9', 4), 602.0)  
 83: (('VX', 4), 533.0)  
 84: (('F9', 6), 813.0)  
 85: (('MQ', 6), 1098.0)  
 86: (('OO', 6), 938.0)  
 87: (('WN', 6), 665.0)  
 88: (('HA', 7), 787.0)  
 89: (('UA', 8), 739.0)  
 90: (('MQ', 8), 1171.0)  
 91: (('NK', 9), 693.0)  
 92: (('B6', 9), 480.0)  
 93: (('AS', 9), 764.0)  
 94: (('WN', 9), 540.0)  
 95: (('AA', 10), 1573.0)  
 96: (('AS', 11), 634.0)  
 97: (('B6', 11), 510.0)  
 98: (('WN', 11), 505.0)  
 99: (('AA', 12), 1649.0)  
 100: (('DL', 12), 1228.0)  
 101: (('B6', 12), 1006.0)  
 102: (('AS', 1), 538.0)  
 103: (('NK', 1), 557.0)  
 104: (('WN', 1), 604.0)  
 105: (('AA', 2), 1587.0)  
 106: (('US', 2), 536.0)  
 107: (('UA', 2), 858.0)  
 108: (('AS', 3), 868.0)  
 109: (('WN', 3), 629.0)  
 110: (('AA', 4), 1542.0)  
 111: (('DL', 4), 1179.0)  
 112: (('UA', 5), 1102.0)  
 113: (('F9', 5), 767.0)  
 114: (('B6', 5), 544.0)  
 115: (('EV', 5), 730.0)  
 116: (('DL', 6), 1201.0)  
 117: (('AS', 6), 963.0)  
 118: (('NK', 7), 383.0)  
 119: (('UA', 7), 824.0)  
 120: (('B6', 7), 450.0)  
 121: (('EV', 7), 818.0)  
 122: (('AS', 8), 514.0)  
 123: (('HA', 8), 1037.0)

```

124: (('EV', 8), 762.0)
125: (('OO', 9), 893.0)
126: (('HA', 10), 1022.0)
127: (('B6', 10), 577.0)
128: (('WN', 10), 621.0)
129: (('VX', 10), 430.0)
130: (('DL', 11), 1071.0)
131: (('OO', 11), 1132.0)
132: (('F9', 11), 918.0)
133: (('F9', 12), 781.0)
134: (('WN', 12), 562.0)
135: (('VX', 12), 363.0)
136: (('VX', 1), 397.0)
137: (('HA', 2), 1433.0)
138: (('F9', 2), 852.0)
139: (('WN', 2), 506.0)
140: (('DL', 3), 1166.0)
141: (('US', 3), 726.0)
142: (('VX', 3), 365.0)
143: (('UA', 4), 1314.0)
144: (('WN', 4), 498.0)
145: (('US', 5), 711.0)
146: (('DL', 5), 1289.0)
147: (('HA', 5), 326.0)
148: (('MQ', 5), 956.0)
149: (('OO', 5), 852.0)
150: (('B6', 6), 507.0)
151: (('EV', 6), 1210.0)
152: (('VX', 6), 644.0)
153: (('MQ', 7), 911.0)
154: (('OO', 7), 956.0)
155: (('AA', 8), 1878.0)
156: (('OO', 8), 907.0)
157: (('UA', 10), 1037.0)
158: (('MQ', 10), 1544.0)
159: (('NK', 11), 476.0)
160: (('HA', 11), 691.0)
161: (('NK', 12), 723.0)
162: (('MQ', 12), 1278.0)

```

```

[12]: #Q9 For each carrier find the average Departure delay
result = flights \
    .map(lambda x: (x[4], (x[11], 1))) \
    .reduceByKey(lambda x,y: (x[0]+y[0], x[1]+y[1])) \
    .map(lambda x: (x[0], x[1][0]/x[1][1])) \
    .collect()

```



```
for idx, i in enumerate(result, start=1):
    print("{}: {}".format(idx, i))
```

```
1: ('AA', 8.773542906652084)
2: ('NK', 15.68327383944317)
3: ('UA', 14.26220664969373)
4: ('B6', 11.333044995656211)
5: ('MQ', 9.63204268375465)
6: ('F9', 13.27060856928971)
7: ('WN', 10.450107183471951)
8: ('OO', 7.67823058605973)
9: ('EV', 8.49219111957299)
10: ('US', 6.0209194071912036)
11: ('DL', 7.338090448359994)
12: ('HA', 0.48473882945248586)
13: ('AS', 1.7795501970785996)
14: ('VX', 8.947094648078446)
```

[13]: *#Q10 For each carrier find the average Departure delay for each month*

```
result = flights.map(lambda x: ((x[4], int(x[1])),(x[11],1)))\
    .reduceByKey(lambda x,y: (x[0]+y[0], x[1]+y[1]))\
    .map(lambda x: (x[0], x[1][0]/x[1][1]))\
    .collect()
```

```
for idx, i in enumerate(result, start=1):
    print("{}: {}".format(idx, i))
```

```
1: (('UA', 1), 13.666987889048054)
2: (('F9', 1), 17.763215697759556)
3: (('OO', 2), 10.620837027438677)
4: (('MQ', 2), 15.991388270230141)
5: (('NK', 3), 12.432021276595744)
6: (('UA', 3), 13.767470128202188)
7: (('HA', 3), 0.8225883098368446)
8: (('NK', 4), 9.86573294018534)
9: (('MQ', 4), 8.615839657520919)
10: (('OO', 4), 5.276855399460763)
11: (('AA', 5), 10.904853500335495)
12: (('AS', 5), -0.19656722517368205)
13: (('NK', 6), 34.43944636678201)
14: (('AA', 7), 9.661222585160989)
15: (('AS', 7), 2.5547689779407117)
16: (('F9', 7), 13.785784919653894)
17: (('DL', 8), 7.74069452851866)
18: (('B6', 8), 14.453034500125913)
19: (('F9', 8), 8.823262097764678)
20: (('WN', 8), 11.626461697741705)
21: (('VX', 9), 3.2865735351183547)
```

22: (('EV', 9), 3.564671439354086)  
 23: (('DL', 10), 3.2151895383312157)  
 24: (('AS', 10), -0.08820073270201148)  
 25: (('F9', 10), 4.025058634736452)  
 26: (('EV', 11), 7.015785023019825)  
 27: (('VX', 11), 5.7207240487624675)  
 28: (('UA', 12), 17.51819625716456)  
 29: (('AS', 12), 2.5786707241164675)  
 30: (('HA', 12), -0.4426517571884984)  
 31: (('EV', 12), 9.648164929768917)  
 32: (('US', 1), 5.051897638030398)  
 33: (('B6', 1), 9.528742542662906)  
 34: (('EV', 1), 9.42864296444667)  
 35: (('AS', 2), 2.68008856814827)  
 36: (('DL', 2), 11.892286971946653)  
 37: (('B6', 3), 14.87277556440903)  
 38: (('EV', 3), 8.553718398228455)  
 39: (('AS', 4), 0.004222126806927151)  
 40: (('US', 4), 4.483382570162481)  
 41: (('B6', 4), 8.2763851044505)  
 42: (('HA', 4), -2.212374856392582)  
 43: (('EV', 4), 6.673949204803635)  
 44: (('NK', 5), 23.10715351706298)  
 45: (('WN', 5), 11.826651315667304)  
 46: (('VX', 5), 10.648968678380443)  
 47: (('AA', 6), 14.019770063119928)  
 48: (('US', 6), 8.244110787172012)  
 49: (('UA', 6), 23.847821369672772)  
 50: (('HA', 6), -1.215216414557436)  
 51: (('DL', 7), 8.260103293246306)  
 52: (('WN', 7), 15.50250769907611)  
 53: (('VX', 7), 9.72038440214378)  
 54: (('NK', 8), 21.882764570552148)  
 55: (('VX', 8), 8.867791842475388)  
 56: (('AA', 9), 4.9449297482931085)  
 57: (('DL', 9), 3.514050206069689)  
 58: (('UA', 9), 7.435396620230743)  
 59: (('HA', 9), 2.089372765680858)  
 60: (('MQ', 9), 4.531930949910386)  
 61: (('F9', 9), 5.081544519242982)  
 62: (('NK', 10), 8.24030172413793)  
 63: (('OO', 10), 3.6338714964759875)  
 64: (('EV', 10), 4.5845433869839045)  
 65: (('UA', 11), 11.165943677163693)  
 66: (('AA', 11), 6.402241745745963)  
 67: (('MQ', 11), 6.905491258310761)  
 68: (('OO', 12), 12.437528892624501)  
 69: (('AA', 1), 10.380929683598893)

70: (('DL', 1), 5.842923891277689)  
 71: (('HA', 1), 1.3055900621118013)  
 72: (('OO', 1), 11.860082304526749)  
 73: (('MQ', 1), 14.881839464882944)  
 74: (('NK', 2), 16.419458523921374)  
 75: (('B6', 2), 18.38879044099033)  
 76: (('EV', 2), 10.498648588772209)  
 77: (('VX', 2), 12.152971820980346)  
 78: (('AA', 3), 10.749923856763695)  
 79: (('OO', 3), 5.789528335796158)  
 80: (('F9', 3), 19.849928057553957)  
 81: (('MQ', 3), 11.44983301357209)  
 82: (('F9', 4), 11.665780637940683)  
 83: (('VX', 4), 5.637232960325534)  
 84: (('F9', 6), 19.004434308881287)  
 85: (('MQ', 6), 12.511945526823316)  
 86: (('OO', 6), 9.952690480450038)  
 87: (('WN', 6), 15.784661492493806)  
 88: (('HA', 7), 0.7089863407620417)  
 89: (('UA', 8), 14.20782595292097)  
 90: (('MQ', 8), 8.052929106821322)  
 91: (('NK', 9), 9.6110776035384)  
 92: (('B6', 9), 7.745753087588132)  
 93: (('AS', 9), 0.23249947445869246)  
 94: (('WN', 9), 5.360186795171146)  
 95: (('AA', 10), 5.265661793246216)  
 96: (('AS', 11), 1.7022939068100358)  
 97: (('B6', 11), 7.071484537032769)  
 98: (('WN', 11), 7.79386803786823)  
 99: (('AA', 12), 8.979036597790026)  
 100: (('DL', 12), 10.495618567646767)  
 101: (('B6', 12), 18.021162661183226)  
 102: (('AS', 1), 3.165132770066385)  
 103: (('NK', 1), 13.001944412672996)  
 104: (('WN', 1), 9.349463225445312)  
 105: (('AA', 2), 9.613731643027489)  
 106: (('US', 2), 8.661360395317216)  
 107: (('UA', 2), 14.501504070649924)  
 108: (('AS', 3), 3.05540767722051)  
 109: (('WN', 3), 9.935640075060643)  
 110: (('AA', 4), 10.477239222693768)  
 111: (('DL', 4), 6.221449355687959)  
 112: (('UA', 5), 14.603138861993651)  
 113: (('F9', 5), 11.199802907119981)  
 114: (('B6', 5), 6.981520053179703)  
 115: (('EV', 5), 9.886026050027432)  
 116: (('DL', 6), 10.844916186654585)  
 117: (('AS', 6), 1.933665008291874)

118: (('NK', 7), 16.220075355038162)  
 119: (('UA', 7), 19.23004432204484)  
 120: (('B6', 7), 11.192808689500188)  
 121: (('EV', 7), 8.896925428236836)  
 122: (('AS', 8), 3.661696178937558)  
 123: (('HA', 8), 4.790465149978264)  
 124: (('EV', 8), 7.676483914816493)  
 125: (('OO', 9), 3.8390551181102364)  
 126: (('HA', 10), 0.1680551105414931)  
 127: (('B6', 10), 7.990644822707981)  
 128: (('WN', 10), 6.034080906272724)  
 129: (('VX', 10), 7.053440702781844)  
 130: (('DL', 11), 4.536910893282384)  
 131: (('OO', 11), 6.72536581239956)  
 132: (('F9', 11), 11.607883550173902)  
 133: (('F9', 12), 15.89396551724138)  
 134: (('WN', 12), 12.74923703896684)  
 135: (('VX', 12), 18.216118539934946)  
 136: (('VX', 1), 6.793912492073558)  
 137: (('HA', 2), 2.57916594566534)  
 138: (('F9', 2), 25.258564296780857)  
 139: (('WN', 2), 9.487024797054518)  
 140: (('DL', 3), 8.386646172100424)  
 141: (('US', 3), 5.826573183451153)  
 142: (('VX', 3), 10.472604145290376)  
 143: (('UA', 4), 12.880508925547868)  
 144: (('WN', 4), 8.767129982050053)  
 145: (('US', 5), 4.043807944077486)  
 146: (('DL', 5), 7.475145358551092)  
 147: (('HA', 5), -1.3484612993472178)  
 148: (('MQ', 5), 9.21988911171405)  
 149: (('OO', 5), 5.949663083587358)  
 150: (('B6', 6), 11.31625144073056)  
 151: (('EV', 6), 14.712840245118997)  
 152: (('VX', 6), 8.668060836501901)  
 153: (('MQ', 7), 8.852282828282828)  
 154: (('OO', 7), 8.72339293518536)  
 155: (('AA', 8), 9.272520940964037)  
 156: (('OO', 8), 7.639654845439029)  
 157: (('UA', 10), 7.3631193620081055)  
 158: (('MQ', 10), 3.4174779364934946)  
 159: (('NK', 11), 8.559720582447856)  
 160: (('HA', 11), -1.7247675962815405)  
 161: (('NK', 12), 14.084153312716708)  
 162: (('MQ', 12), 6.825560901252799)

```
[14]: #Q11 Which date of year has the highest rate of flight cancellations?
# Rate of flight cancellation is calculated by deviding number of canceled
    ↳ flights by total number of flights.
result = flights\
    .map(lambda x: ((x[0],x[1],x[2]), ((int(x[24])), 1)) )\
    .reduceByKey(lambda x,y: (x[0]+y[0],x[1]+y[1]))\
    .map(lambda x: (x[0], x[1][0]/x[1][1]))\
    .top(1, lambda x:x[1])

print(result)
```

```
[(('2015', '1', '27'), 0.19030023094688223)]
```

```
[15]: #Q12 Calculate the number of flights to each destination state
# For each carrier, for which state do they have the largest average delay?
# You will need the airline and airport data sets for this question.

result = flights\
    .map(lambda x: ( (x[4],x[8]), (x[11],1) ) )\
    .reduceByKey(lambda x,y: (x[0]+y[0], x[1]+y[1]))\
    .map(lambda x: (x[0][1], (x[0][0], x[1][0]/x[1][1]) ) )\
    .leftOuterJoin(airports.map(lambda x: (x[0], x[3])))\
    .filter(lambda x: x[1][1] is not None)\
    .map(lambda x: (x[1][0][0], (x[1][1], x[1][0][1])))\
    .reduceByKey(lambda x,y: (x[0],x[1]) if x[1] > y[1] else (y[0],y[1]) )\
    .map(lambda x: (x[0], x[1][0]))\
    .collect()

for idx, i in enumerate(result, start=1):
    print("{}: {}".format(idx, i))
```

```
1: ('NK', 'IL')
2: ('HA', 'HI')
3: ('WN', 'IL')
4: ('F9', 'CO')
5: ('AS', 'WA')
6: ('AA', 'TX')
7: ('UA', 'IL')
8: ('US', 'NC')
9: ('DL', 'GA')
10: ('MQ', 'IL')
11: ('EV', 'GA')
12: ('VX', 'CA')
13: ('B6', 'NY')
14: ('OO', 'IL')
```

```
[ ]:
```