

Hub Airports

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Постановка задачи

Необходимо построить хаб (найти аэропорт), который будет находиться между западным и восточным побережьями США (не считая Аляску и Гавайи).

Хаб должен удовлетворять условию:

- затраты топлива на полёт должны быть минимальны в совокупности

Выполнение работы

Для решения задачи был собран датасет аэропортов США, их пассажиропоток и мировые координаты.

Для поиска оптимального расположения хаба необходимо построить целевую функцию затрат топлива и найти ее минимум. Целевая функция отображает суммарные затраты топлива на полёт из любой точки США в каждый из аэропортов.

Целевая функция выглядит как

$$F(x) = \sum_{i=1}^N p_i * e^{c * h(x, a_i)},$$

где N - количество аэропортов, p_i - доля пассажиропотока (в сумме они равны единице), c - константа, $h(x, a_i)$ - расстояние из точки x в аэропорт a_i .

Для поиска минимума целевой функции был использован метод покоординатного спуска.

Итог

В ходе проделанной работы были найдены координаты оптимального расположения хаба: $-93.109375, 35.8359375$.

Код

Ссылка на github:

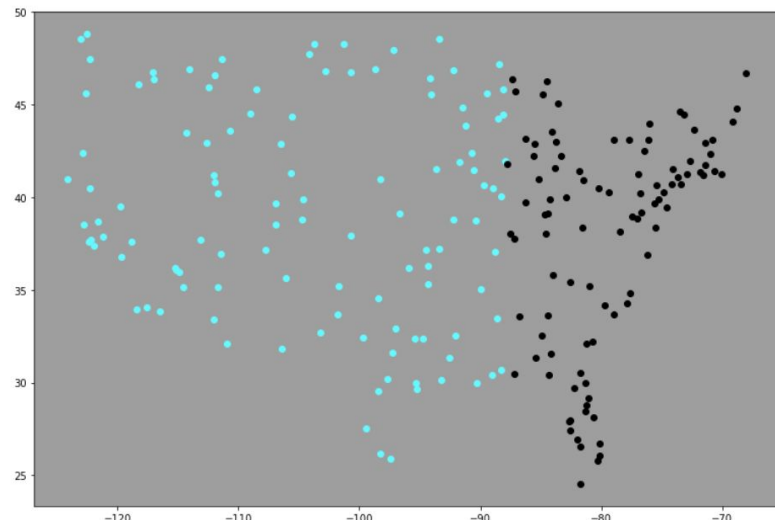
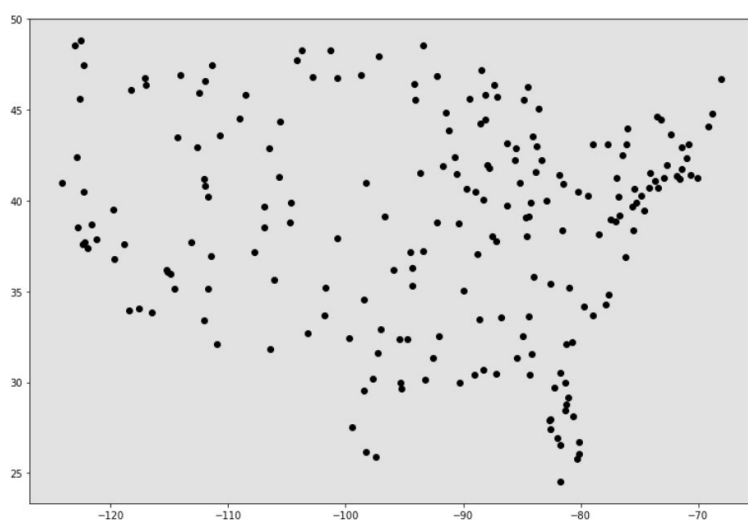
https://github.com/andreysimbalov/Math_model

Датасет

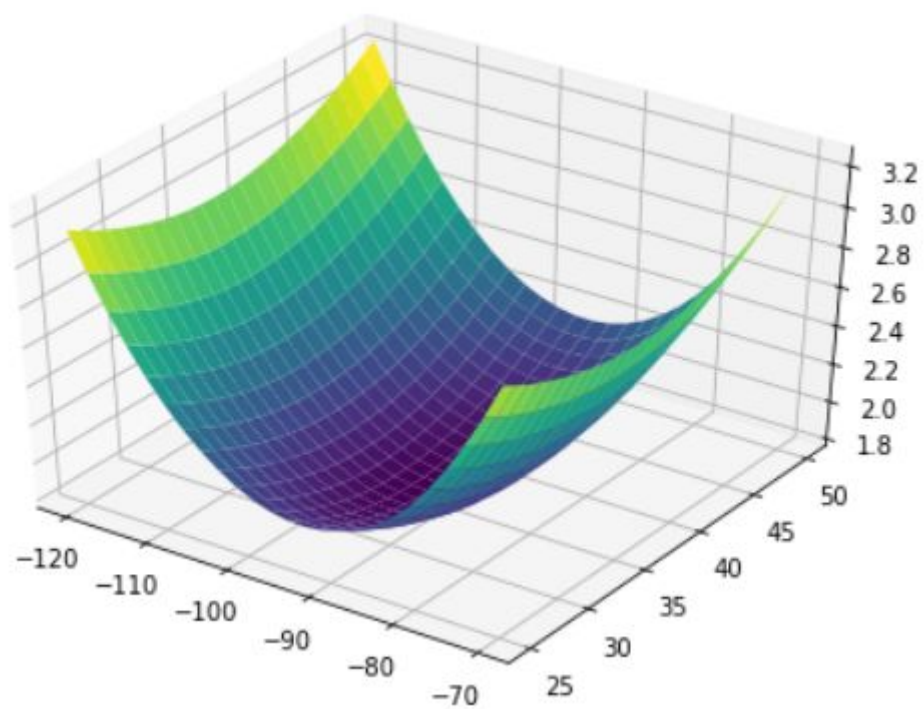
	Airport	Enplanements	latitude	longitude	empl_share	klaster
0	Hartsfield–Jackson Atlanta International Airport	50501858.0	33.63667	-84.42806	0.075565	0
1	Los Angeles International Airport	39636042.0	33.94250	-118.40806	0.059307	1
2	Chicago O'Hare International Airport	37589899.0	41.97861	-87.90472	0.056245	1
3	Dallas/Fort Worth International Airport	31283579.0	32.89694	-97.03806	0.046809	1
4	Denver International Airport	28267394.0	39.86167	-104.67306	0.042296	1
...
206	Republic Airport	10910.0	40.72889	-73.41333	0.000016	0
207	Lebanon Municipal Airport	10245.0	43.62611	-72.30417	0.000015	0
208	Alpena County Regional Airport	10031.0	45.07806	-83.56028	0.000015	0
209	Sidney–Richland Municipal Airport	8065.0	47.70694	-104.19250	0.000012	1
210	Jamestown Regional Airport	7941.0	46.92972	-98.67833	0.000012	1

Расположение аэропортов

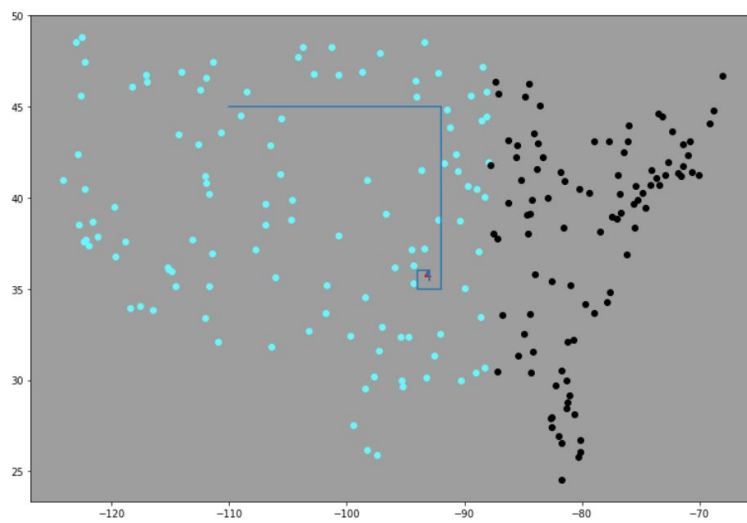
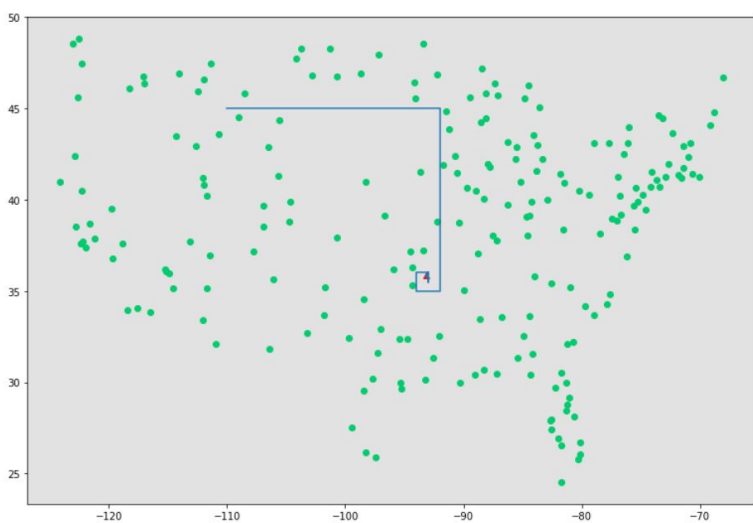
Разбиение аэропортов на Западное и Восточное побережье по численности пассажиропотока: 340921252 - на западе, 327403456 - на востоке

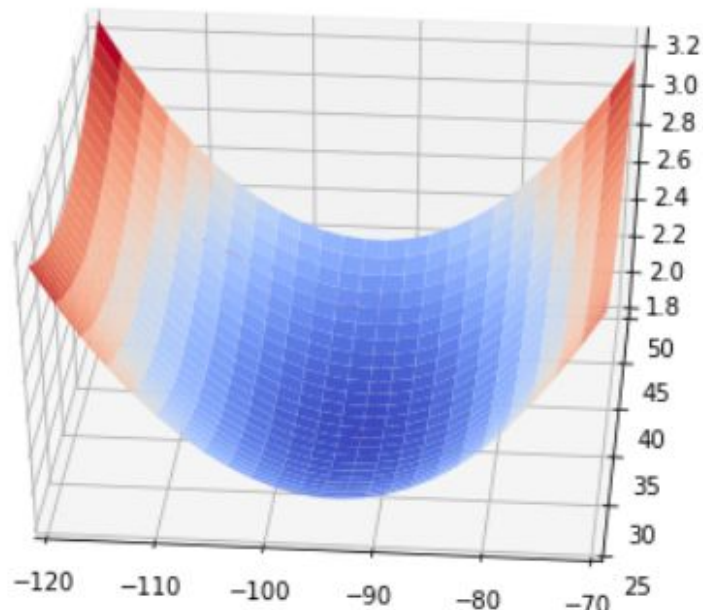
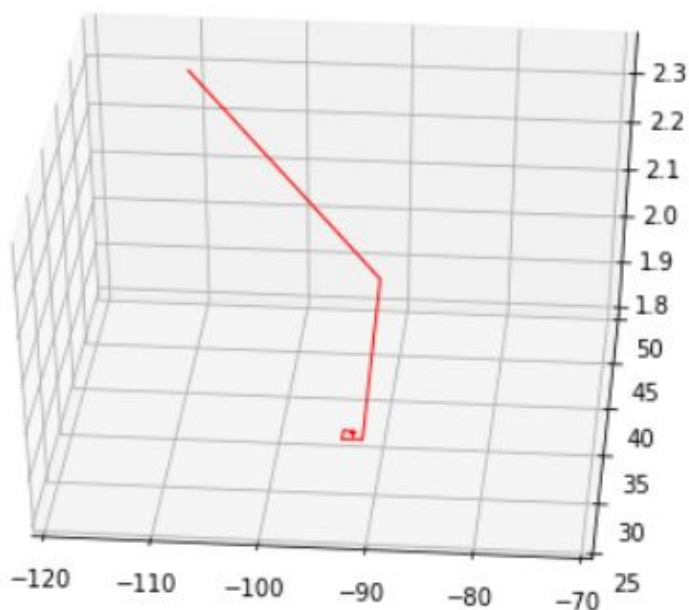


Целевая функция



Покоординатный спуск





Итерации покоординатного спуска (начальная точка -110, 45):

```

0: vector_ [1, 0], step_ 2, point_ [-108.0, 45.0], function_ 2.2740336134037
1: vector_ [1, 0], step_ 2, point_ [-106.0, 45.0], function_ 2.1907068735319286
2: vector_ [1, 0], step_ 2, point_ [-104.0, 45.0], function_ 2.120270538580563
3: vector_ [1, 0], step_ 2, point_ [-102.0, 45.0], function_ 2.0624178994861957
4: vector_ [1, 0], step_ 2, point_ [-100.0, 45.0], function_ 2.0166831175147744
5: vector_ [1, 0], step_ 2, point_ [-98.0, 45.0], function_ 1.982681269506015
6: vector_ [1, 0], step_ 2, point_ [-96.0, 45.0], function_ 1.9602424927468627
7: vector_ [1, 0], step_ 2, point_ [-94.0, 45.0], function_ 1.9494363385790312
8: vector_ [1, 0], step_ 2, point_ [-92.0, 45.0], function_ 1.950587855295167
9: vector_ [0, -1], step_ 2, point_ [-92.0, 43.0], function_ 1.890051869552413
10: vector_ [0, -1], step_ 2, point_ [-92.0, 41.0], function_ 1.844053407381405
11: vector_ [0, -1], step_ 2, point_ [-92.0, 39.0], function_ 1.813313969313755
12: vector_ [0, -1], step_ 2, point_ [-92.0, 37.0], function_ 1.7978068429091254
13: vector_ [0, -1], step_ 2, point_ [-92.0, 35.0], function_ 1.7972257233931197
14: vector_ [-1, 0], step_ 1.0, point_ [-93.0, 35.0], function_ 1.7951522848665538
15: vector_ [-1, 0], step_ 1.0, point_ [-94.0, 35.0], function_ 1.7960727368546203
16: vector_ [0, 1], step_ 1.0, point_ [-94.0, 36.0], function_ 1.7950829694591608
17: vector_ [1, 0], step_ 0.5, point_ [-93.5, 36.0], function_ 1.79409478373173
18: vector_ [1, 0], step_ 0.5, point_ [-93.0, 36.0], function_ 1.79386007679377
19: vector_ [0, -1], step_ 0.5, point_ [-93.0, 35.5], function_ 1.7940385439137836
20: vector_ [0, 1], step_ 0.25, point_ [-93.0, 35.75], function_ 1.7938327823884976
21: vector_ [0, 1], step_ 0.25, point_ [-93.0, 36.0], function_ 1.79386007679377
22: vector_ [0, -1], step_ 0.25, point_ [-93.0, 35.75], function_ 1.7938327823884976
23: vector_ [-1, 0], step_ 0.125, point_ [-93.125, 35.75], function_ 1.7938118874047313
24: vector_ [0, 1], step_ 0.125, point_ [-93.125, 35.875], function_ 1.7938009936035462
25: vector_ [0, -1], step_ 0.0625, point_ [-93.125, 35.8125], function_ 1.7937991670861189
26: vector_ [0, 1], step_ 0.0625, point_ [-93.125, 35.875], function_ 1.7938009936035462
27: vector_ [0, -1], step_ 0.03125, point_ [-93.125, 35.84375], function_ 1.7937982625728797
28: vector_ [0, -1], step_ 0.03125, point_ [-93.125, 35.8125], function_ 1.7937991670861189
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30: vector_ [1, 0], step_ 0.015625, point_ [-93.109375, 35.84375], function_ 1.7937978789185776
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38: vector_ [1, 0], step_ 0.001953125, point_ [-93.109375, 35.8359375], function_ 1.7937977997454133

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Датасет (целиком)

	Airport	Enplanements	latitude	longitude	empl_share	klaster
0	Hartsfield–Jackson Atlanta International Airport	50501858.0	33.636670	-84.428060	0.075565	0
1	Los Angeles International Airport	39636042.0	33.942500	-118.408060	0.059307	1
2	Chicago O'Hare International Airport	37589899.0	41.978610	-87.904720	0.056245	1
3	Dallas/Fort Worth International Airport	31283579.0	32.896940	-97.038060	0.046809	1
4	Denver International Airport	28267394.0	39.861670	-104.673060	0.042296	1
5	San Francisco International Airport	25707101.0	37.618890	-122.375000	0.038465	1
6	Orlando International Airport	24562271.0	28.429440	-81.308890	0.036752	0
7	McCarran International Airport	22833267.0	36.080000	-115.152220	0.034165	1
8	Seattle–Tacoma International Airport	21887110.0	47.448890	-122.309440	0.032749	1
9	Charlotte/Douglas International Airport	21511880.0	35.213890	-80.943060	0.032188	0
10	Miami International Airport	21421031.0	25.793330	-80.290560	0.032052	0
11	Phoenix Sky Harbor International Airport	20896265.0	33.434170	-112.011670	0.031267	1
12	George Bush Intercontinental Airport	20062072.0	29.984440	-95.341390	0.030018	1
13	Newark Liberty International Airport	19923009.0	40.692500	-74.168610	0.029810	0
14	Fort Lauderdale–Hollywood International Airport	17950989.0	26.072500	-80.152780	0.026860	0
15	Gen. Edward Lawrence Logan International Airport	17759044.0	42.363060	-71.006390	0.026572	0
16	Detroit Metropolitan Airport	16847135.0	42.212500	-83.353330	0.025208	0
17	Philadelphia International Airport	15285948.0	39.871940	-75.241110	0.022872	0
18	Baltimore/Washington International Thurgood Ma...	13371816.0	39.175280	-76.668330	0.020008	0
19	Ronald Reagan Washington National Airport	11470854.0	38.852220	-77.037780	0.017164	0
20	Salt Lake City International Airport	11143738.0	40.788330	-111.977780	0.016674	1
21	Chicago Midway International Airport	11044387.0	41.786110	-87.752500	0.016525	0
22	Tampa International Airport	10941173.0	27.975560	-82.533330	0.016371	0
23	Washington Dulles International Airport	10596942.0	38.944440	-77.455830	0.015856	0
24	Portland International Airport	9071154.0	45.588610	-122.597500	0.013573	1
25	St. Louis Lambert International Airport	6793076.0	38.747220	-90.361390	0.010164	1
26	William P. Hobby Airport	6285181.0	29.645560	-95.278890	0.009404	1
27	Austin-Bergstrom International Airport	6095545.0	30.194440	-97.670000	0.009121	1
28	Oakland International Airport	5934639.0	37.721390	-122.220830	0.008880	1
29	Louis Armstrong New Orleans International Airport	5569705.0	29.993330	-90.258060	0.008334	1
30	Norman Y. Mineta San José International Airport	5321603.0	37.362780	-121.929170	0.007963	1
31	Southwest Florida International Airport	5044024.0	26.536110	-81.755280	0.007547	0
32	Sacramento International Airport	4969366.0	38.695560	-121.590830	0.007436	1
33	Pittsburgh International Airport	4670954.0	40.496000	-80.246000	0.006989	0
34	Ontario International Airport	4217366.0	34.056110	-117.601110	0.006310	1
35	Indianapolis International Airport	4216766.0	39.717220	-86.294440	0.006309	0
36	San Antonio International Airport	4179994.0	29.526670	-98.471940	0.006254	1

37	Cleveland-Hopkins International Airport	4083476.0	41.411670	-81.849720	0.006110	0
38	John Glenn Columbus International Airport	3567864.0	39.998060	-82.891940	0.005339	0
39	Jacksonville International Airport	3479923.0	30.494170	-81.687780	0.005207	0
40	Cincinnati/Northern Kentucky International Air...	3269979.0	39.048890	-84.667780	0.004893	0
41	Palm Beach International Airport	3100624.0	26.683200	-80.095600	0.004639	0
42	Bradley International Airport	2982194.0	41.939170	-72.683330	0.004462	0
43	Memphis International Airport	2016089.0	35.042500	-89.976670	0.003017	1
44	Theodore Francis Green State Airport	1803000.0	41.723890	-71.428330	0.002698	0
45	Reno/Tahoe International Airport	1771864.0	39.499170	-119.768060	0.002651	1
46	Norfolk International Airport	1602631.0	36.894720	-76.201110	0.002398	0
47	Orlando Sanford International Airport	1601614.0	28.777780	-81.237500	0.002396	0
48	Tucson International Airport	1594594.0	32.116110	-110.941110	0.002386	1
49	El Paso International Airport	1414376.0	31.807220	-106.377500	0.002116	1
50	Tulsa International Airport	1342315.0	36.198330	-95.888060	0.002008	1
51	Gerald R. Ford International Airport	1334979.0	42.880830	-85.522780	0.001998	0
52	Birmingham-Shuttlesworth International Airport	1304467.0	33.563890	-86.752220	0.001952	0
53	Des Moines International Airport	1216357.0	41.533890	-93.663060	0.001820	1
54	Greater Rochester International Airport	1205774.0	43.118890	-77.672500	0.001804	0
55	St. Pete-Clearwater International Airport	1143483.0	27.910000	-82.687500	0.001711	0
56	Pensacola International Airport	1098889.0	30.473330	-87.186670	0.001644	0
57	Savannah/Hilton Head International Airport	1056265.0	32.127500	-81.202220	0.001580	0
58	James M. Cox Dayton International Airport	1019922.0	39.902220	-84.219440	0.001526	0
59	Syracuse Hancock International Airport	1013149.0	43.111110	-76.106390	0.001516	0
60	Palm Springs International Airport	995801.0	33.829720	-116.506670	0.001490	1
61	Manchester-Boston Regional Airport	995403.0	42.932500	-71.435560	0.001489	0
62	Sarasota-Bradenton International Airport	977530.0	27.395560	-82.554440	0.001463	0
63	Myrtle Beach International Airport	944849.0	33.679720	-78.928330	0.001414	0
64	McGhee Tyson Airport	887103.0	35.811110	-83.993890	0.001327	0
65	Punta Gorda Airport	821557.0	26.918890	-81.990830	0.001229	0
66	Fresno Yosemite International Airport	761298.0	36.776670	-119.718890	0.001139	1
67	Westchester County Airport	759334.0	41.066940	-73.707500	0.001136	0
68	Akron-Canton Regional Airport	685553.0	40.915000	-81.443670	0.001026	0
69	Northwest Arkansas Regional Airport	673810.0	36.281670	-94.307780	0.001008	1
70	City of Colorado Springs Municipal Airport	657694.0	38.805830	-104.700830	0.000984	1
71	Blue Grass Airport	638316.0	38.036390	-84.605830	0.000955	0
72	Harrisburg International Airport	636916.0	40.193060	-76.763330	0.000953	0
73	Burlington International Airport	593311.0	44.471940	-73.153330	0.000888	0
74	Atlantic City International Airport	589091.0	39.457500	-74.577220	0.000881	0
75	The Eastern Iowa Airport	547786.0	41.889078	-91.700331	0.000820	1

76	Key West International Airport	497656.0	24.556110	-81.759440	0.000745	0
77	Springfield-Branson National Airport	462126.0	37.245560	-93.388610	0.000691	1
78	Lubbock Preston Smith International Airport	448093.0	33.663610	-101.820560	0.000670	1
79	Billings Logan International Airport	423213.0	45.807780	-108.542780	0.000633	1
80	Asheville Regional Airport	416939.0	35.436110	-82.541670	0.000624	0
81	Bellingham International Airport	415285.0	48.792500	-122.537500	0.000621	1
82	Tallahassee International Airport	415272.0	30.396670	-84.350280	0.000621	0
83	Wilmington International Airport	413185.0	34.270560	-77.902500	0.000618	0
84	Rogue Valley International-Medford Airport	401469.0	42.374170	-122.873610	0.000601	1
85	Bishop International Airport	398508.0	42.965560	-83.743610	0.000596	0
86	Missoula International Airport	381582.0	46.916390	-114.090560	0.000571	1
87	Quad City International Airport	364393.0	41.448610	-90.507500	0.000545	1
88	Fort Wayne International Airport	360369.0	40.978330	-85.195280	0.000539	0
89	McAllen Miller International Airport	355224.0	26.175830	-98.238610	0.000532	1
90	Appleton International Airport	348026.0	44.258060	-88.519170	0.000521	1
91	Jackson Hole Airport	342044.0	43.607220	-110.737780	0.000512	1
92	Daytona Beach International Airport	340815.0	29.184720	-81.060560	0.000510	0
93	Rick Husband Amarillo International Airport	334815.0	35.219440	-101.705830	0.000501	1
94	Green Bay–Austin Straubel International Airport	314909.0	44.484720	-88.129720	0.000471	1
95	General Wayne A. Downing Peoria International ...	307189.0	40.664170	-89.693330	0.000460	1
96	Gulfport–Biloxi International Airport	305157.0	30.407220	-89.070000	0.000457	1
97	Charlottesville–Albemarle Airport	295930.0	38.138610	-78.452780	0.000443	0
98	Mobile Regional Airport	288209.0	30.691390	-88.242780	0.000431	1
99	Trenton Mercer Airport	278436.0	40.276670	-74.813330	0.000417	0
100	Bismarck Municipal Airport	273980.0	46.772780	-100.745830	0.000410	1
101	Gainesville Regional Airport	273253.0	29.690000	-82.271670	0.000409	0
102	Bangor International Airport	269013.0	44.807220	-68.828060	0.000403	0
103	Valley International Airport	263760.0	40.652333	-75.440472	0.000395	0
104	Orlando Melbourne International Airport	241289.0	28.102780	-80.645280	0.000361	0
105	Stewart International Airport	228640.0	41.504170	-74.104720	0.000342	0
106	Yeager Airport	213412.0	38.375830	-81.593060	0.000319	0
107	Boulder City Municipal Airport	211615.0	35.947220	-114.860280	0.000317	1
108	Evansville Regional Airport	204352.0	38.038330	-87.530830	0.000306	0
109	Central Illinois Regional Airport at Bloomingt...	188490.0	40.477220	-88.915830	0.000282	1
110	Durango-La Plata County Airport	187789.0	37.151390	-107.753890	0.000281	1
111	Great Falls International Airport	176730.0	47.482780	-111.370560	0.000264	1
112	Charles M. Schulz–Sonoma County Airport	167151.0	38.508890	-122.812780	0.000250	1
113	Eagle County Regional Airport	163840.0	39.642500	-106.917780	0.000245	1
114	Kalamazoo/Battle Creek International Airport	154242.0	42.235000	-85.551940	0.000231	0

115	Arnold Palmer Regional Airport	151704.0	40.274720	-79.406670	0.000227	0
116	Minot International Airport	150634.0	48.257780	-101.278060	0.000225	1
117	Albert J. Ellis Airport	149987.0	34.829170	-77.612220	0.000224	0
118	Niagara Falls International Airport	142605.0	43.107220	-78.946110	0.000213	0
119	Plattsburgh International Airport	139398.0	44.650830	-73.468060	0.000209	0
120	Grand Forks International Airport	132557.0	47.949170	-97.176110	0.000198	1
121	Alexandria International Airport	129776.0	31.327500	-92.548610	0.000194	1
122	Nantucket Memorial Airport	126197.0	41.252889	-70.059000	0.000189	0
123	Duluth International Airport	124284.0	46.842220	-92.193610	0.000186	1
124	MBS International Airport	122469.0	43.532780	-84.079720	0.000183	0
125	Brownsville/South Padre Island International A...	120151.0	25.906940	-97.425830	0.000180	1
126	Laughlin/Bullhead International Airport	109334.0	35.156110	-114.559440	0.000164	1
127	Helena Regional Airport	103239.0	46.606670	-111.982780	0.000154	1
128	Monroe Regional Airport	102342.0	32.510830	-92.037780	0.000153	1
129	Laredo International Airport	101115.0	27.543890	-99.461670	0.000151	1
130	La Crosse Regional Airport	99651.0	43.879170	-91.256670	0.000149	1
131	Ithaca Tompkins International Airport	97212.0	42.491390	-76.458610	0.000145	0
132	Stockton Metropolitan Airport	93076.0	37.894170	-121.238330	0.000139	1
133	Casper/Natrona County International Airport	92805.0	42.908060	-106.464440	0.000139	1
134	Toledo Express Airport	92522.0	41.586806	-83.807833	0.000138	0
135	University of Illinois - Willard Airport	89318.0	40.039170	-88.278060	0.000134	1
136	Abilene Regional Airport	84809.0	32.413250	-99.683111	0.000127	1
137	Fort Smith Regional Airport	83920.0	35.336670	-94.367500	0.000126	1
138	Provo Municipal Airport	78451.0	40.219194	-111.723361	0.000117	1
139	Friedman Memorial Airport	77729.0	43.503890	-114.295560	0.000116	1
140	Portsmouth International Airport at Pease	73247.0	43.078060	-70.823330	0.000110	0
141	Lewiston-Nez Perce County Airport	72724.0	46.374440	-117.015280	0.000109	1
142	Santa Fe Regional Airport	71252.0	35.617220	-106.089440	0.000107	1
143	Arcata Airport	69732.0	40.977780	-124.108330	0.000104	1
144	Central Nebraska Regional Airport	68879.0	40.967500	-98.309720	0.000103	1
145	Williston Basin International Airport	68829.0	48.259720	-103.750560	0.000103	1
146	Columbia Regional Airport	65014.0	38.818060	-92.219720	0.000097	1
147	Flagstaff Pulliam Airport	64578.0	35.140280	-111.669170	0.000097	1
148	Salisbury-Ocean City Wicomico Regional Airport	64393.0	38.340000	-75.509440	0.000096	0
149	Waco Regional Airport	64356.0	31.611390	-97.230560	0.000096	1
150	Manhattan Regional Airport	63761.0	39.141110	-96.671670	0.000095	1
151	Pullman/Moscow Regional Airport	61833.0	46.744000	-117.108000	0.000093	1
152	Martha's Vineyard Airport	54084.0	41.393060	-70.614440	0.000081	0
153	Lake Charles Regional Airport	53576.0	30.126110	-93.223330	0.000080	1

154	Tyler Pounds Regional Airport	52494.0	32.353890	-95.402780	0.000079	1
155	Lawton–Fort Sill Regional Airport	51088.0	34.567780	-98.416390	0.000076	1
156	Dothan Regional Airport	49411.0	31.321110	-85.449440	0.000074	0
157	Walla Walla Regional Airport	47439.0	46.090000	-118.290000	0.000071	1
158	Sawyer International Airport	45462.0	46.353610	-87.395280	0.000068	0
159	Florence Regional Airport	45300.0	34.185280	-79.723890	0.000068	0
160	Columbus Metropolitan Airport	44813.0	32.516390	-84.938890	0.000067	0
161	Redding Municipal Airport	43414.0	40.508890	-122.293330	0.000065	1
162	Golden Triangle Regional Airport	40823.0	33.448330	-88.591390	0.000061	1
163	Yellowstone Regional Airport	40340.0	44.520280	-109.023890	0.000060	1
164	Dubuque Regional Airport	37954.0	42.401940	-90.709440	0.000057	1
165	Pocatello Regional Airport	34462.0	42.909720	-112.595830	0.000052	1
166	Southwest Georgia Regional Airport	34226.0	31.535560	-84.194440	0.000051	0
167	Hilton Head Airport	30956.0	32.224440	-80.697500	0.000046	0
168	Gunnison-Crested Butte Regional Airport	30780.0	38.533890	-106.933060	0.000046	1
169	Wilmington Airport	30355.0	39.678610	-75.606670	0.000045	0
170	Northeast Florida Regional Airport	28462.0	29.959250	-81.339720	0.000043	0
171	Gillette–Campbell County Airport	28383.0	44.348890	-105.539440	0.000042	1
172	Joplin Regional Airport	27930.0	37.151670	-94.498330	0.000042	1
173	Tweed New Haven Regional Airport	27911.0	41.263890	-72.886670	0.000042	0
174	Garden City Regional Airport	26825.0	37.927500	-100.724440	0.000040	1
175	Bert Mooney Airport	25890.0	45.954720	-112.497500	0.000039	1
176	Cincinnati Municipal Lunken Airport	25706.0	39.103330	-84.418610	0.000038	0
177	Pellston Regional Airport	25497.0	45.570830	-84.796670	0.000038	0
178	Houghton County Memorial Airport	25439.0	47.168330	-88.489170	0.000038	1
179	Rhineland–Oneida County Airport	24477.0	45.630830	-89.466390	0.000037	1
180	Chippewa Valley Regional Airport	23950.0	44.865830	-91.484170	0.000036	1
181	Owensboro–Davies County Regional Airport	23537.0	37.738890	-87.166940	0.000035	0
182	Watertown International Airport	22785.0	43.991940	-76.020560	0.000034	0
183	Williamsport Regional Airport	22547.0	41.241670	-76.921670	0.000034	0
184	East Texas Regional Airport	22480.0	32.383890	-94.711390	0.000034	1
185	Mammoth Yosemite Airport	21826.0	37.624170	-118.838890	0.000033	1
186	Chippewa County International Airport	20974.0	46.250830	-84.472500	0.000031	0
187	Barkley Regional Airport	20266.0	37.060280	-88.773060	0.000030	1
188	Brainerd Lakes Regional Airport	18200.0	46.402220	-94.135560	0.000027	1
189	Muskegon County Airport	18165.0	43.167780	-86.235560	0.000027	0
190	Page Municipal Airport	17435.0	36.926110	-111.448330	0.000026	1
191	Block Island State Airport	17225.0	41.168060	-71.577780	0.000026	0
192	Westerly State Airport	17218.0	41.349720	-71.803330	0.000026	0

193	Delta County Airport	16822.0	45.722780	-87.093610	0.000025	0
194	Dickinson Theodore Roosevelt Regional Airport	16822.0	46.797220	-102.801940	0.000025	1
195	Knox County Regional Airport	16206.0	44.060000	-69.099170	0.000024	0
196	Laramie Regional Airport	15957.0	41.311940	-105.675000	0.000024	1
197	North Las Vegas Airport	15828.0	36.210560	-115.194440	0.000024	1
198	St. Cloud Regional Airport	15615.0	45.546670	-94.060000	0.000023	1
199	Ogden-Hinckley Airport	15609.0	41.195560	-112.013060	0.000023	1
200	Lea County Regional Airport	14707.0	32.687500	-103.216940	0.000022	1
201	Cedar City Regional Airport	14413.0	37.700830	-113.098890	0.000022	1
202	Falls International Airport	13831.0	48.565560	-93.402220	0.000021	1
203	Friday Harbor Airport	12831.0	48.521940	-123.024440	0.000019	1
204	Ford Airport	12604.0	45.818330	-88.114440	0.000019	1
205	Northern Maine Regional Airport at Presque Isle	12526.0	46.688890	-68.044720	0.000019	0
206	Republic Airport	10910.0	40.728890	-73.413330	0.000016	0
207	Lebanon Municipal Airport	10245.0	43.626110	-72.304170	0.000015	0
208	Alpena County Regional Airport	10031.0	45.078060	-83.560280	0.000015	0
209	Sidney-Richland Municipal Airport	8065.0	47.706940	-104.192500	0.000012	1
210	Jamestown Regional Airport	7941.0	46.929720	-98.678330	0.000012	1