# CS_475 Project #3

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1. I ran this program on my personal machine
2. I am currently using Arch Linux (more to get familiar with Operating Systems than anything else)
3. I used the GNU C++ Compiler
4.   (MCCpS stands for "Mega City Capitals per Second")

NUMT	NUMCITIES	NUM CAPITALS	MCCpS
1	331	2	58.543
1	331	3	68.266
1	331	4	65.312
1	331	5	77.329
1	331	10	94.921
1	331	15	99.401
1	331	20	111.668
1	331	30	121.483
1	331	40	122.712
1	331	50	133.746
2	331	2	42.088
2	331	3	44.133
2	331	4	40.636
2	331	5	55.756
2	331	10	111.287
2	331	15	141.232
2	331	20	111.302
2	331	30	188.318
2	331	40	197.165
2	331	50	188.409
4	331	2	20.227
4	331	3	27.955
4	331	4	34.776
4	331	5	42.398
4	331	10	45.884
4	331	15	143.369
4	331	20	185.486
4	331	30	255.789
4	331	40	295.628
4	331	50	315.948

6	331	2	15.05
6	331	3	21.171
6	331	4	26.08
6	331	5	34.444
6	331	10	77.849
6	331	15	114.965
6	331	20	147.504
6	331	30	231.442
6	331	40	312.699
6	331	50	363.505
8	331	2	13.178
8	331	3	19.062
8	331	4	26.954
8	331	5	34.908
8	331	10	66.89
8	331	15	99.705
8	331	20	139.193
8	331	30	202.628
8	331	40	283.081
8	331	50	337.893

Threads vs. Performance

Mega City Capitals per Second

Number of Threads

Legend: 2, 3, 4, 5, 10, 15, 20, 30, 40, 50
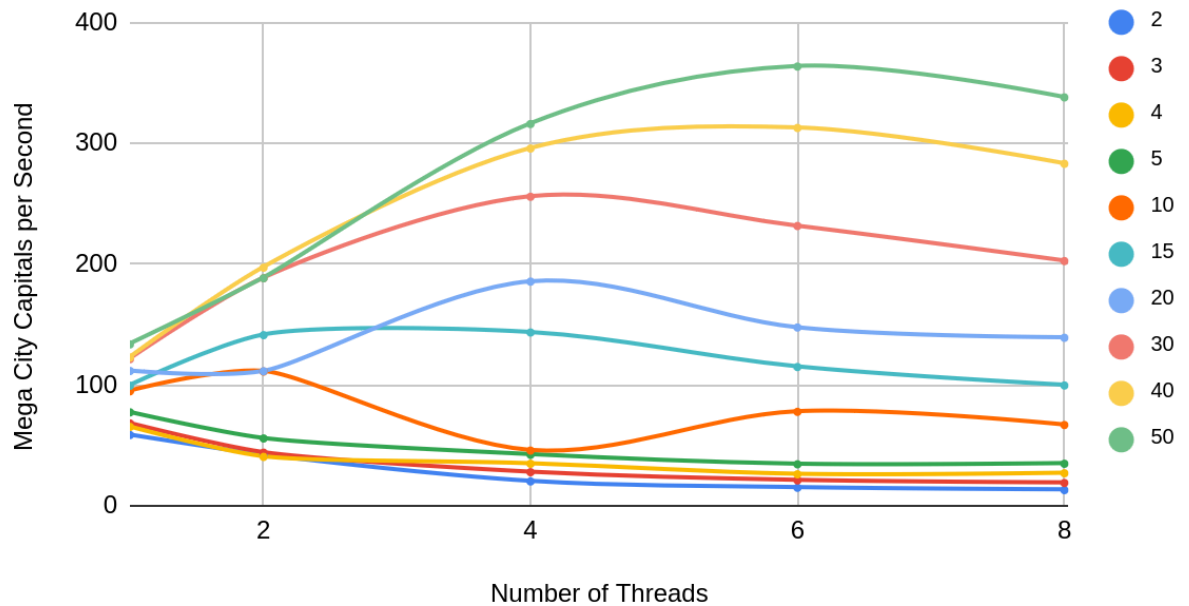
5.

Capitals v. Performance

Mega City Capitals per Second

Number of Capitals

Legend: 1, 2, 4, 6, 8
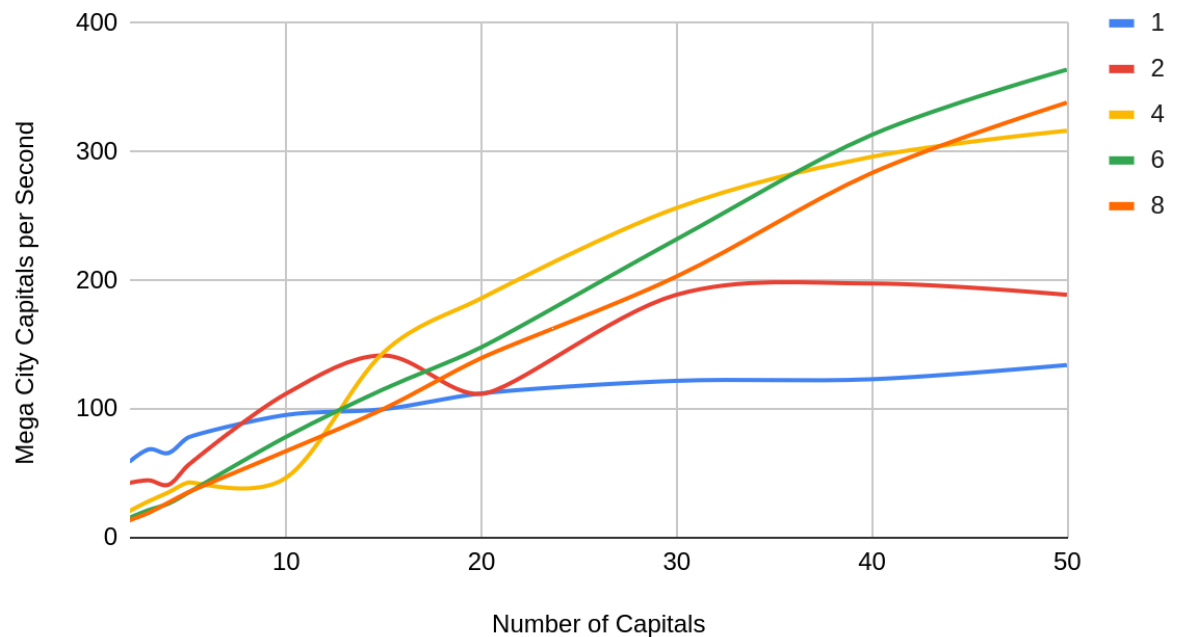
6.

7. The biggest pattern I see in these graphs is that the data is considerably less predictable in smaller data sets. Though, that might – in part – be due to more data points being included at those lower values. I can also see that performance increases when at 6 threads (which corroborates the data found in the last assignment). Another thing that is important to see and note is how much performance increases when the dataset grows

in size. For just about every thread their best performance is found at 50 capitals (not sure why 2 threads is lower, but having things be nondeterministic is expected)

8. EXTRA CREDIT:
   All of the blue squares on the map below (and the *red* pin I believe) are the "new capitals" from the 50 capitals run (some may have not been pinned, I can't really tell and I'm not willing to count them). In retrospect I should have done this in an incognito tab, and not on my personal account, but I guess I wasn't really thinking about that.
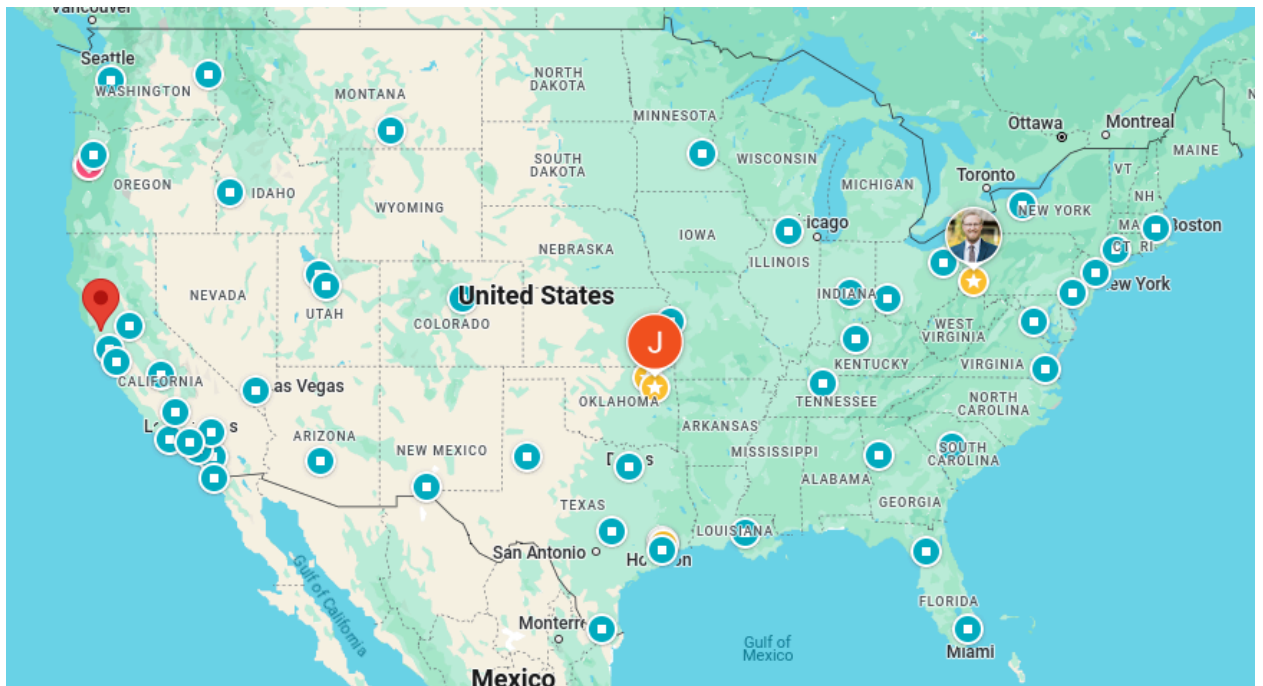
The longitudes and latitudes are still the averages, and were not changed to match those of the cities.

Longitude	Latitude	Closest City	State
0: 85.82	36.04	Murfreesboro	TN
1: 116.27	37.16	LasVegas	NV
0: 77.42	39.58	Washington	DC
1: 90.98	33.99	Memphis	TN
2: 116.71	37.28	LasVegas	NV
0: 74.24	40.72	Newark	NJ
1: 83.91	35.14	Knoxville	TN
2: 98.01	35	OklahomaCity	OK
3: 118.27	37.15	Visalia	CA
0: 74.24	40.72	Newark	NJ

1: 108.10	36.56	RioRancho	NM
2: 82.85	34.2	Athens	GA
3: 94.64	35.37	BrokenArrow	OK
4: 119.45	37.39	Clovis	CA
0: 74.10	40.73	JerseyCity	NJ
1: 92.01	41.15	CedarRapids	IA
2: 111.39	33.45	Mesa	AZ
3: 81.58	28.82	Orlando	FL
4: 120.86	45.93	Gresham	OR
5: 117.77	34.11	Pomona	CA
6: 96.70	31.77	Waco	TX
7: 106.77	39.74	Boulder	CO
8: 83.57	37.95	Lexington	KY
9: 121.65	37.98	Antioch	CA
0: 73.03	41.52	Waterbury	CT
1: 112.53	35.42	Peoria	AZ
2: 119.66	36.04	Visalia	CA
3: 96.97	31.62	Waco	TX
4: 120.86	45.93	Gresham	OR
5: 80.99	27.33	PortSt.Lucie	FL
6: 86.47	33.49	Birmingham	AL
7: 78.58	36	Raleigh	NC
8: 82.22	41.8	Cleveland	OH
9: 87.51	40.93	Joliet	IL
10: 94.56	40.89	DesMoines	IA
11: 105.34	38.45	ColoradoSprings	CO
12: 118.41	34.17	Burbank	CA
13: 117.47	33.72	Corona	CA
14: 121.80	38.07	Antioch	CA
0: 71.89	42.1	Worcester	MA
1: 121.03	47.58	Bellevue	WA
2: 120.46	39.63	Reno	NV
3: 96.22	29.13	SugarLand	TX
4: 88.08	41.5	Joliet	IL
5: 78.79	35.47	Cary	NC

6: 119.66	36.04	Visalia	CA
7: 97.41	33.42	Denton	TX
8: 85.75	32.61	Montgomery	AL
9: 117.65	34.02	Ontario	CA
10: 80.98	27.1	PortSt.Lucie	FL
11: 106.77	39.74	Boulder	CO
12: 75.05	40.63	Allentown	PA
13: 82.76	41.65	Dearborn	MI
14: 121.75	38.23	Antioch	CA
15: 111.39	33.45	Mesa	AZ
16: 86.22	36.62	Nashville	TN
17: 120.73	44.6	Bend	OR
18: 94.40	41.06	DesMoines	IA
19: 122.18	37.54	Hayward	CA
0: 74.50	40.78	Woodbridge	NJ
1: 121.67	37.41	SanJose	CA
2: 78.82	42.17	Buffalo	NY
3: 120.93	39.1	Roseville	CA
4: 94.48	44.87	Minneapolis	MN
5: 119.60	36.65	Clovis	CA
6: 105.18	39.06	ColoradoSprings	CO
7: 89.23	42.98	Madison	WI
8: 113.17	42.36	SaltLakeCity	UT
9: 80.98	27.1	PortSt.Lucie	FL
10: 73.10	41.67	Waterbury	CT
11: 86.03	32.56	Montgomery	AL
12: 76.62	37.67	NewportNews	VA
13: 122.87	38.09	SantaRosa	CA
14: 111.39	33.45	Mesa	AZ
15: 94.79	38.59	Olathe	KS
16: 88.97	41.07	Peoria	IL
17: 118.02	34	ElMonte	CA
18: 116.93	34.01	MorenoValley	CA
19: 97.95	32.87	FortWorth	TX
20: 119.26	34.53	Ventura	CA

21: 79.93	34.72	Concord	NC
22: 86.39	36.37	Nashville	TN
23: 71.21	42.29	Cambridge	MA
24: 121.03	47.58	Bellevue	WA
25: 94.57	30.38	Beaumont	TX
26: 122.58	45.04	Salem	OR
27: 98.17	27.57	CorpusChristi	TX
28: 84.14	41.3	Toledo	OH
29: 122.17	37.92	Berkeley	CA
0: 78.15	42.39	Buffalo	NY
1: 95.65	36.07	BrokenArrow	OK
2: 122.46	37.89	Richmond	CA
3: 122.26	47.55	Renton	WA
4: 119.60	36.65	Clovis	CA
5: 117.67	33.81	Anaheim	CA
6: 96.88	32.97	Carrollton	TX
7: 97.76	26.57	Edinburg	TX
8: 79.48	35.57	Greensboro	NC
9: 84.23	40.98	FortWayne	IN
10: 99.49	27.56	Laredo	TX
11: 82.36	27.69	St.Petersburg	FL
12: 113.32	38.49	St.George	UT
13: 76.62	37.67	NewportNews	VA
14: 94.47	41.29	DesMoines	IA
15: 87.60	34.06	Tuscaloosa	AL
16: 110.66	33.44	Mesa	AZ
17: 122.21	44.06	Bend	OR
18: 80.29	25.92	Hialeah	FL
19: 97.61	30.46	RoundRock	TX
20: 80.32	33.26	NorthCharleston	SC
21: 88.76	41.47	Aurora	IL
22: 82.75	30.16	Gainesville	FL
23: 84.31	33.96	SandySprings	GA
24: 74.35	40.58	Woodbridge	NJ
25: 80.26	27.01	WestPalmBeach	FL

26: 101.58	33.02	Lubbock	TX
27: 93.92	30.15	Beaumont	TX
28: 80.96	28.18	Orlando	FL
29: 81.61	32.68	Savannah	GA
30: 73.10	41.67	Waterbury	CT
31: 105.21	40.18	Boulder	CO
32: 122.73	45.43	Portland	OR
33: 119.03	34.54	Ventura	CA
34: 120.46	39.63	Reno	NV
35: 80.20	26.15	FortLauderdale	FL
36: 71.13	41.85	Brockton	MA
37: 116.77	45.22	Meridian	ID
38: 71.24	42.48	Cambridge	MA
39: 121.72	37.85	Antioch	CA
0: 74.08	40.68	JerseyCity	NJ
1: 98.10	26.77	Edinburg	TX
2: 83.90	39.64	Dayton	OH
3: 85.24	33.6	SouthFulton	GA
4: 85.45	36.84	Louisville	KY
5: 119.60	36.65	Clovis	CA
6: 77.31	36.38	NewportNews	VA
7: 119.04	35.35	Bakersfield	CA
8: 83.74	42.42	AnnArbor	MI
9: 82.42	28.83	Gainesville	FL
10: 80.43	34.46	Columbia	SC
11: 114.74	36.4	NorthLasVegas	NV
12: 85.94	40.5	Fishers	IN
13: 112.00	33.37	Tempe	AZ
14: 122.26	47.55	Renton	WA
15: 117.33	34.47	Victorville	CA
16: 117.44	34.03	JurupaValley	CA
17: 108.55	45.79	Billings	MT
18: 101.58	33.02	Lubbock	TX
19: 88.97	41.99	Rockford	IL
20: 81.06	41	Akron	OH

21: 91.08	31.55	BatonRouge	LA
22: 88.77	37.08	Clarksville	TN
23: 104.93	39.71	Denver	CO
24: 122.17	37.92	Berkeley	CA
25: 71.21	42.29	Cambridge	MA
26: 117.13	32.95	SanDiego	CA
27: 95.18	29.78	Pasadena	TX
28: 77.54	43.03	Rochester	NY
29: 76.90	39.01	Washington	DC
30: 94.34	44.32	Minneapolis	MN
31: 75.31	40.3	Philadelphia	PA
32: 116.40	43.6	Meridian	ID
33: 121.67	37.41	SanJose	CA
34: 97.61	30.46	RoundRock	TX
35: 95.04	38.65	Olathe	KS
36: 120.93	39.1	Roseville	CA
37: 111.98	40.69	WestValleyCity	UT
38: 73.03	41.77	Waterbury	CT
39: 111.65	40.25	Provo	UT
40: 117.17	33.58	Murrieta	CA
41: 117.33	47.67	Spokane	WA
42: 119.63	34.47	Ventura	CA
43: 106.64	33.64	LasCruces	NM
44: 80.40	26.36	CoralSprings	FL
45: 117.93	33.85	Fullerton	CA
46: 118.38	34.23	Burbank	CA
47: 96.94	33.22	Frisco	TX
48: 122.58	45.04	Salem	OR
49: 122.87	38.09	SantaRosa	CA