Implications of an Economic Downturn on Private Businesses

New Mexico

Supercomputing Challenge

Final Report

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Team 2

Rio Rancho Cyber Academy

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Data Source:

Event Rental Systems LLC

Executive Summary:

Pandemics are often credited with inciting economic disaster, though there is a degree of variation in the severity of that damage. With the current pandemic, it has become possible to analyze the effectiveness of various strategies when it comes to combating economic downturn. One way to measure the success of differing methods, such as full lockdowns and mask mandates (or lack thereof), is by examining the health of private businesses within states. Even with smaller pools of data, it is possible to draw a correlation between pandemic-related factors. When scaling the analysis up, though, the horizons of the results expand greatly. More particular issues can be identified and combatted. So, the project focused on building a strong foundation through which larger data sets can be studied. It accomplishes this by taking an in-depth look at two businesses that can later be expanded into massive amounts of input.

Problem:

The ongoing pandemic has led to varying forms of catastrophe in many regions, though the extent of its destructive economic impact is mostly based on estimations and projections. It is thus important to measure the degree to which state economies and private businesses were affected by the worldwide pandemic and the subsequent lockdowns. A plethora of multidimensional analyses can be performed to draw conclusions regarding the consequences of the pandemic, showing that the issue is a large one. The modernity of the

problem also makes the topic especially significant and applicable to current times.

Method:

While there is a lot to unpack with the presented issue, it was rather beneficial to start small. The program was designed to analyze a select few companies to begin, with the expandability of the code being kept in mind throughout its development. This allows for the potential addition of massive amounts of data. All of the data used within the program were based on the economic health of the clients of Event Rental Systems. Localized, concrete information was integral in obtaining scalable and precise results.

Process:

Many iterations of the program were developed, and sometimes scrapped, though the final product was a culmination of the most positive aspects of each version. The code began in PyCharm, a development environment for the Python coding language, though certain libraries were more difficult to import. So, the project was moved to Jupyter Notebook, where it was very simple to employ libraries such as Panda. Furthermore, the original, completely raw form of the data needed to be reformatted to process in Jupyter Notebook with relative ease. The newly formatted data is shown below.

Company	Month	Year	Count	AverageTicke	Total	Merchandise	Coupon	eneralDiscoun	DamageWon	Non-reside	Tax	TravelFee
letsjumpfl	January	2019	42	625.31	26263.03	23905.50	-382.20	-249.00	167.94	50.00	1447.59	690.00
letsjumpfl	January	2020	45	300.71	13532.09	12636.35	-200.00	-65.20	253.92	25.00	812.02	70.00
letsjumpfl	February	2019	73	568.38	41491.70	40114.25	-1481.00	-660.70	208.41	125.00	1990.74	1100.00
letsjumpfl	February	2020	27	565.28	15262.56	14261.75	-432.20	-86.00	164.88	25.00	619.13	710.00
letsjumpfl	March	2019	80	557.66	44613.15	44556.50	-1419.30	-1491.40	203.31	183.50	1860.54	0.00
letsjumpfl	March	2020	4	804.56	3218.23	3160.50	-30.00	-20.00	16.20	5.00	86.53	0.00
letsjumpfl	April	2019	138	82.67	11408.93	10575.00	-130.17	-270.00	731.75	0.00	0.00	0.00
letsjumpfl	April	2020	3	1177.83	3533.50	3800.00	-50.00	-235.05	18.55	0.00	0.00	0.00
letsjumpfl	May	2019	99	256.57	25400.82	23533.14	-230.00	-107.50	257.63	1637.56	0.00	0.00
letsjumpfl	May	2020	2	263.70	527.40	2288.00	-10.00	-1813.00	27.90	34.50	0.00	0.00
letsjumpfl	June	2019	71	321.56	22830.83	21153.28	0.00	0.00	0.00	0.00	0.00	0.00
letsjumpfl	June	2020	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
letsjumpfl	July	2019	99	403.23	39919.61	36669.25	0.00	0.00	0.00	0.00	0.00	0.00
letsjumpfl	July	2020	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
letsjumpfl	August	2019	69	428.29	29552.07	26453.60	0.00	0.00	0.00	0.00	0.00	0.00
letsjumpfl	August	2020	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
letsjumpfl	September	2019	54	344.12	18582.59	17467.00	0.00	0.00	0.00	0.00	0.00	0.00
letsjumpfl	September	2020	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
letsjumpfl	October	2019	76	433.66	32958.14	31259.50	0.00	0.00	0.00	1713.12	0.00	0.00
letsjumpfl	October	2020	1	820.00	820.00	795.00	0.00	0.00	0.00	0.00	0.00	0.00
letsjumpfl	November	2019	76	412.26	31331.49	29763.50	0.00	0.00	0.00	0.00	0.00	0.00
letsjumpfl	November	2020	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
letsjumpfl	December	2019	50	547.87	27393.28	26179.00	0.00	0.00	0.00	0.00	0.00	0.00
letsjumpfl	December	2020	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Baj	January	2019	174	213.27	37108.15	35788.50	-1057.35	-448.00	195.00	730.00	120.00	1780.00
Baj	January	2020	136	229.09	31156.23	30116.50	-547.50	-265.25	75.00	397.48	200.00	1180.00
Baj	February	2019	175	345.89	60530.14	59082.00	-2260.20	-508.66	870.00	400.00	0.00	2872.00
Baj	February	2020	288	248.14	71465.44	73351.00	-1957.65	-5079.76	976.85	480.00	0.00	3755.00
Baj	March	2019	352	244.62	86107.24	87200.00	-2574.50	-4093.66	132.60	1400.00	520.00	3522.80
Baj	March	2020	129	230.08	29679.86	29637.00	-965.85	-917.92	50.00	366.63	200.00	1310.00
Baj	April	2019	470	303.52	142653.01	146150.00	-5994.10	-6523.85	2020.96	1200.00	5435.00	0.00

	A	B	C	D	E	F	G	H	I	J	K	L	M
32	Baj	April	2019	470	303.52	142653.01	146150.00	-5994.10	-6523.85	2020.96	1200.00	5435.00	0.00
33	Baj	April	2020	42	228.08	9579.57	11767.00	-826.50	-2179.25	68.32	80.00	670.00	0.00
34	Baj	May	2019	577	352.06	203136.79	207726.50	-11512.75	-4240.80	440.70	2738.14	1760.00	6225.00
35	Baj	May	2020	289	244.11	70547.27	90775.00	-19996.94	-4512.87	133.25	875.58	480.00	2793.25
36	Baj	June	2019	845	375.48	317276.59	324998.50	-16749.10	-6822.32	764.50	4901.93	1680.00	8503.08
37	Baj	June	2020	406	258.45	104930.22	121418.00	-19219.10	-4107.26	191.66	1315.99	640.00	4815.00
38	Baj	July	2019	659	364.79	240397.87	250347.00	-11973.15	-10840.65	744.00	3569.87	1360.00	7434.80
39	Baj	July	2020	451	311.43	140453.47	152582.00	-11591.97	-9734.08	1280.41	1713.36	600.00	6361.75
40	Baj	August	2019	705	351.70	247948.90	257260.50	-11452.30	-9692.84	225.00	3616.19	1720.00	6815.00
41	Baj	August	2020	535	286.16	153094.35	162718.00	-10259.60	-7825.86	164.98	1598.90	1240.00	7130.00
42	Baj	September	2019	644	340.98	219594.23	222005.50	-7217.90	-7807.48	1361.80	2728.91	1360.00	7850.00
43	Baj	September	2020	395	288.32	113885.00	121386.00	-7252.92	-7278.72	13.00	1129.99	640.00	6000.00
44	Baj	October	2019	639	387.09	247348.66	255860.00	-11916.50	-12859.14	5547.00	3025.90	1280.00	7115.00
45	Baj	October	2020	479	293.21	140448.82	155995.50	-11530.19	-12148.24	300.00	1561.76	600.00	8055.00
46	Baj	November	2019	352	328.39	115593.00	115151.00	-3411.90	-3447.62	2405.00	1300.20	440.00	4450.00
47	Baj	November	2020	310	237.49	73622.57	80675.50	-10260.75	-2264.45	29.00	617.87	440.00	5135.00
48	Baj	December	2019	156	255.26	39821.17	41244.50	-3055.40	-852.40	155.00	520.63	520.00	1345.00
49	Baj	December	2020	153	257.26	39361.11	43109.50	-6549.95	-220.50	15.00	379.21	320.00	2905.00
50													
51													

Validity:

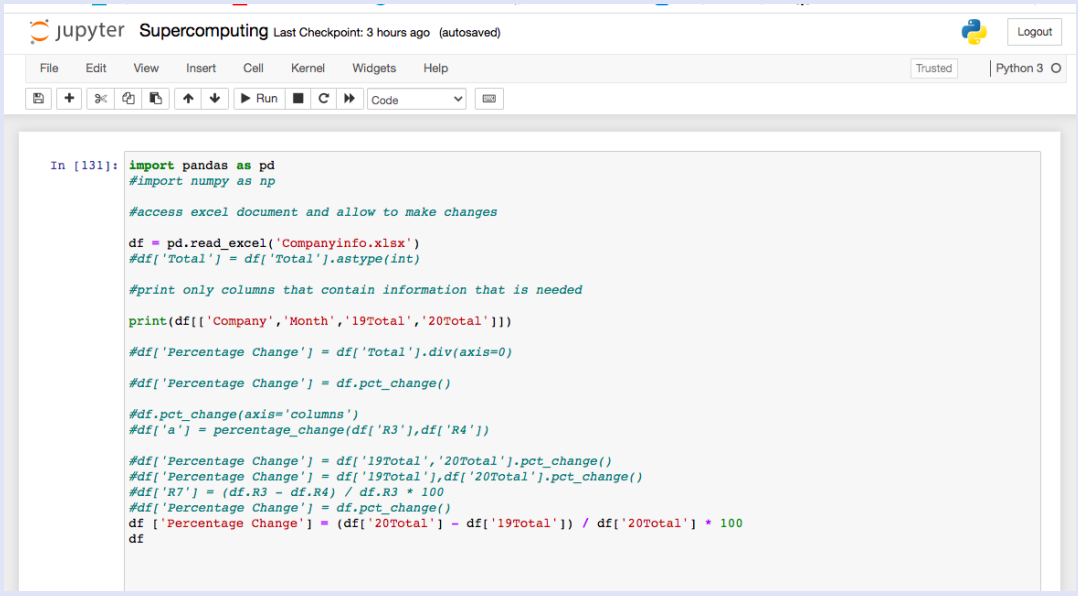
A wide variety of techniques were used in verifying the results of the program, though the most emphasized method involved using a small sample size. By limiting the initial number of businesses managed in the project, it was possible to manually check the numeric results to ensure an accurate outcome. Moreover, previous iterations of the final code were reviewed to compare consistent products and potential sources of error in the event of conflicting results. Lastly, the program was executed several times after each edit in order to confirm a dependable and repeatable outcome.

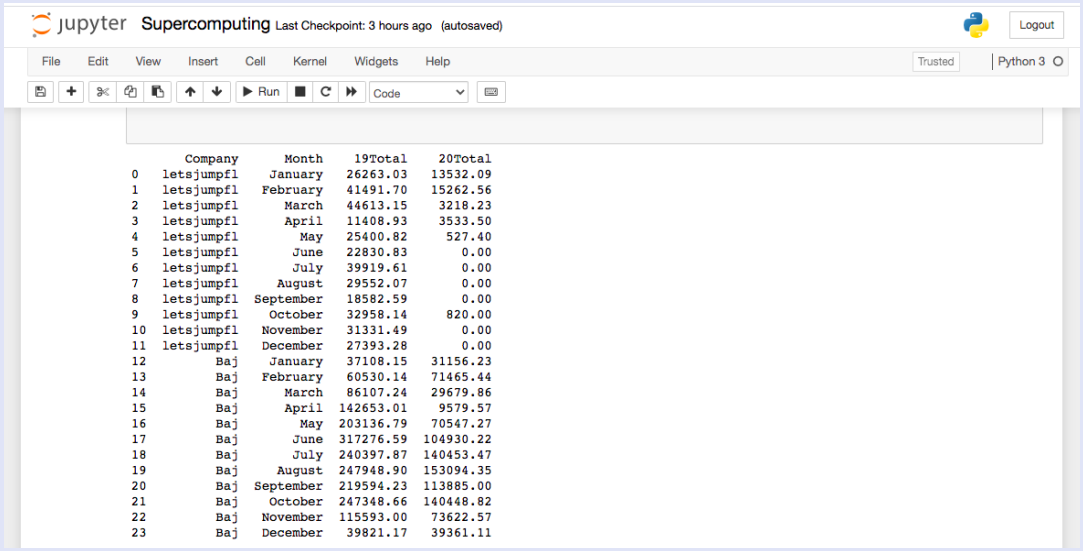
Conclusion:

While no statement can be made regarding the effects of state politics given the current sample size, it is clear that the introduction of pandemic-esque conditions to an economy yields negative results. Out of the two analyzed businesses, there was only one month in which sales increased from 2019 to 2020 (when the pandemic was in full-swing). Again, no definitive conclusion or specific cause can be drawn from the results, though a clear correlation is present in the inverse relationship between the pandemic and economic growth, as displayed in the graphs.

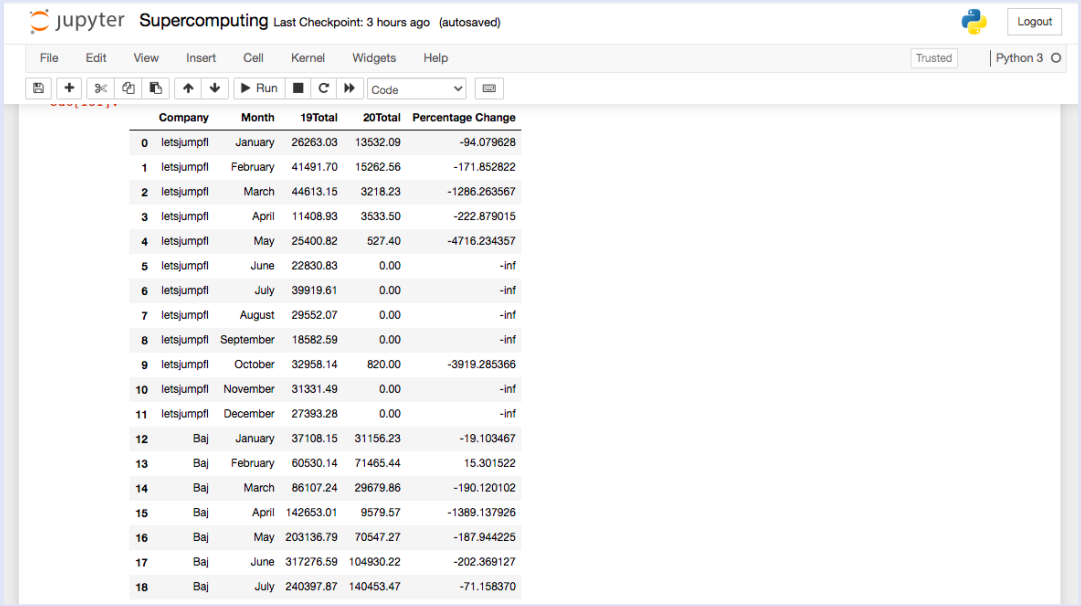
Code:

The code, the output, and graphical representations of the results are shown below.

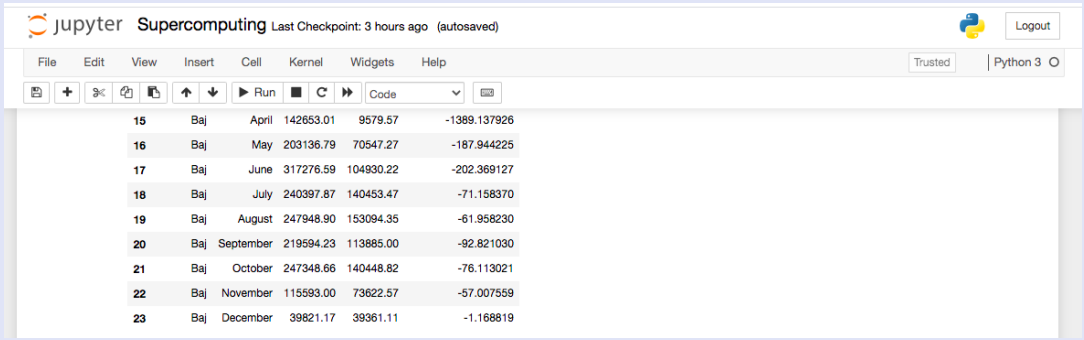




	Company	Month	19Total	20Total
0	letsjumpfl	January	26263.03	13532.09
1	letsjumpfl	February	41491.70	15262.56
2	letsjumpfl	March	44613.15	3218.23
3	letsjumpfl	April	11408.93	3533.50
4	letsjumpfl	May	25400.82	527.40
5	letsjumpfl	June	22830.83	0.00
6	letsjumpfl	July	39919.61	0.00
7	letsjumpfl	August	29552.07	0.00
8	letsjumpfl	September	18582.59	0.00
9	letsjumpfl	October	32958.14	820.00
10	letsjumpfl	November	31331.49	0.00
11	letsjumpfl	December	27393.28	0.00
12	Baj	January	37108.15	31156.23
13	Baj	February	60530.14	71465.44
14	Baj	March	86107.24	29679.86
15	Baj	April	142653.01	9579.57
16	Baj	May	203136.79	70547.27
17	Baj	June	317276.59	104930.22
18	Baj	July	240397.87	140453.47
19	Baj	August	247948.90	153094.35
20	Baj	September	219594.23	113885.00
21	Baj	October	247348.66	140448.82
22	Baj	November	115593.00	73622.57
23	Baj	December	39821.17	39361.11

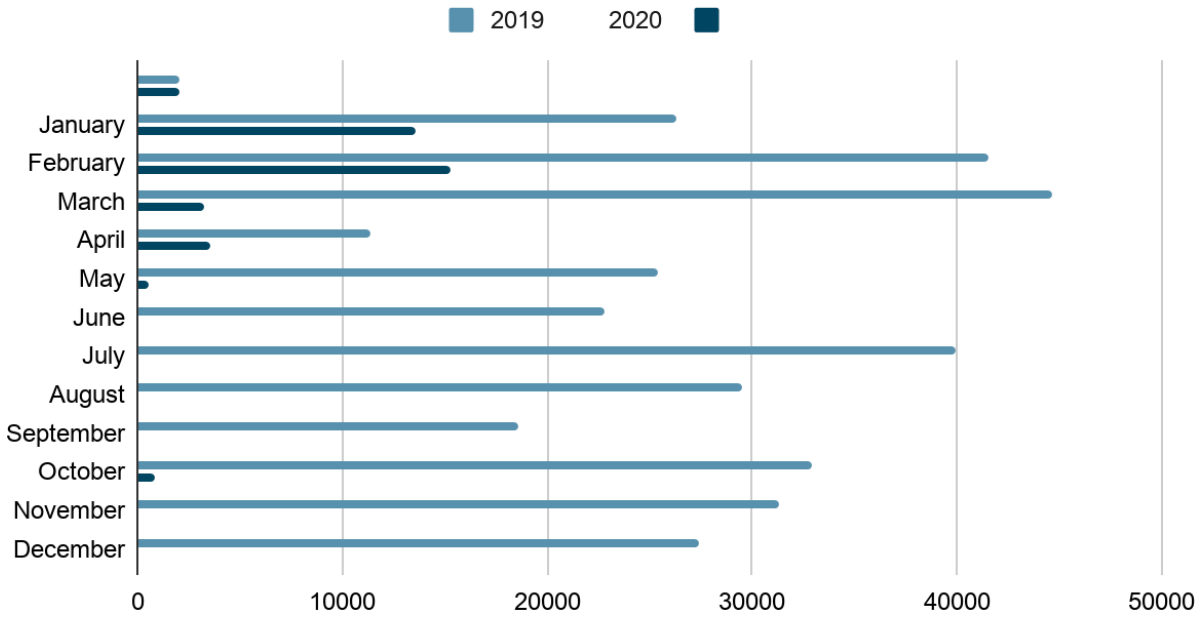


	Company	Month	19Total	20Total	Percentage Change
0	letsjumpfl	January	26263.03	13532.09	-94.079628
1	letsjumpfl	February	41491.70	15262.56	-171.852822
2	letsjumpfl	March	44613.15	3218.23	-1286.263567
3	letsjumpfl	April	11408.93	3533.50	-222.879015
4	letsjumpfl	May	25400.82	527.40	-4716.234357
5	letsjumpfl	June	22830.83	0.00	-inf
6	letsjumpfl	July	39919.61	0.00	-inf
7	letsjumpfl	August	29552.07	0.00	-inf
8	letsjumpfl	September	18582.59	0.00	-inf
9	letsjumpfl	October	32958.14	820.00	-3919.285366
10	letsjumpfl	November	31331.49	0.00	-inf
11	letsjumpfl	December	27393.28	0.00	-inf
12	Baj	January	37108.15	31156.23	-19.103467
13	Baj	February	60530.14	71465.44	15.301522
14	Baj	March	86107.24	29679.86	-190.120102
15	Baj	April	142653.01	9579.57	-1389.137926
16	Baj	May	203136.79	70547.27	-187.944225
17	Baj	June	317276.59	104930.22	-202.369127
18	Baj	July	240397.87	140453.47	-71.158370

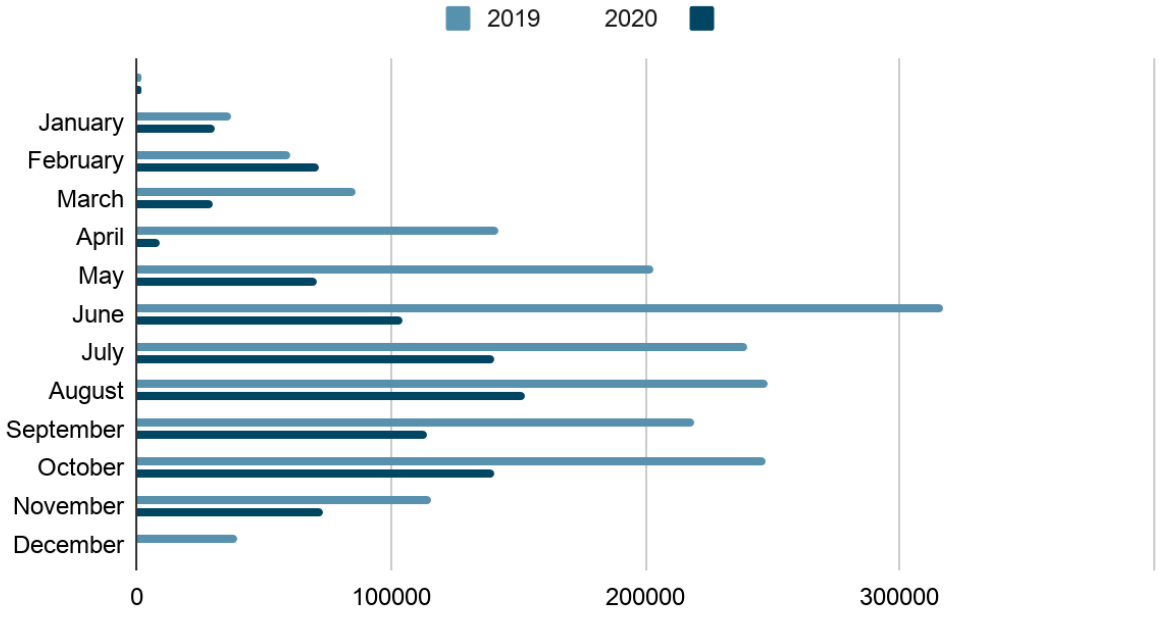


15	Baj	April	142653.01	9579.57	-1389.137926
16	Baj	May	203136.79	70547.27	-187.944225
17	Baj	June	317276.59	104930.22	-202.369127
18	Baj	July	240397.87	140453.47	-71.158370
19	Baj	August	247948.90	153094.35	-61.958230
20	Baj	September	219594.23	113885.00	-92.821030
21	Baj	October	247348.66	140448.82	-76.113021
22	Baj	November	115593.00	73622.57	-57.007559
23	Baj	December	39821.17	39361.11	-1.168819

Let's Jump Florida



Bay Area Jump



Significant Achievement:

While the actual results of the program were certainly an achievement, the most significant accomplishment was the process of completing the project. Converting raw, seemingly unworkable data into graphical results was representative of the work that went into the project as well as the product that came out of it.

Acknowledgements:

- ERS - Robert Weinstein and Corey Fiala - A big thank you to them for taking time out of their busy schedule to deal with our antics
- Tom Robey
- Albert Simon
- Chris Hoppe

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