

Assessing Business Efficiencies: Guidance

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For: AugustMoon

By: James Ellis, Unpaid Mathematician

Unpaid Mathematician from Students of WSU

Preface:

I have been working on this over the course of this month, and I have had to go through six iterations to make certain that I can give adequate guidance regarding AugustMoon's wish to increase business efficiency. The guidance provided may not be completely accurate and it does not get all sites up to 100% efficiency but the scores of all sites based off of this guidance will be above 90%. Considering that most sites from my scoring method originally scored below 50%, I believe this should prove its effectiveness. Additionally, I have left the weighting generated for each location's score so that if you wished to you can create your own guidance as needed. Code used for the final 'Run Through' is included in the report. After the 'Summary of Each Run Through' there is a table of contents that includes where to find the specifics detailing my process resulting in the following guidance.

Guidance:

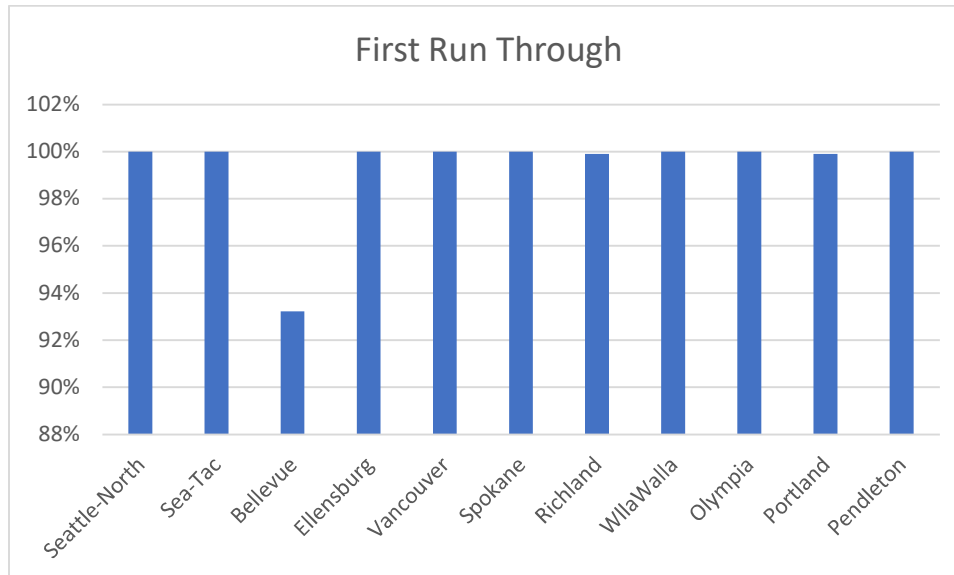
I suggest moving cars from the following locations: Sea-Tac 114, Portland 30, and Vancouver 50. To the following locations: Bellevue 50, Ellensburg 40, Spokane 36, WallaWalla 48, and Olympia 30. I chose the locations to take from because they have large fleets and their scores would not be impacted from the loss of vehicles. Additionally, the locations I previously mentioned should also hire more employees. The hiring should be: Bellevue two new employees at \$2000 salary each, Ellensburg three employees with a \$1500 salary each, Spokane five employees with \$1100 salary each, WallaWalla four employees with salaries of \$1000 each, and Olympia five employees with a salary of \$1000 each.

These changes will put all branches above the 90% relative scoring efficiency used on the 'Sixth Run Through' detailed further down. If you wish to improve the scores of the remaining below 100% locations, I would recommend a combination of moving additional surplus vehicles to said locations and employing more while attempting to bring the salary per employee down. Optionally some of the sites may require you to potentially lower their advertising costs by a little, but I would not recommend that because those sites don't get many advance bookings to begin with and already have a small budget for said advertisements. Otherwise, if it is at all possible, try to lower the maintenance costs each site has per vehicle. This could be achieved by removing problematic vehicles from your fleets that take more than the average cost per vehicle found from each site.

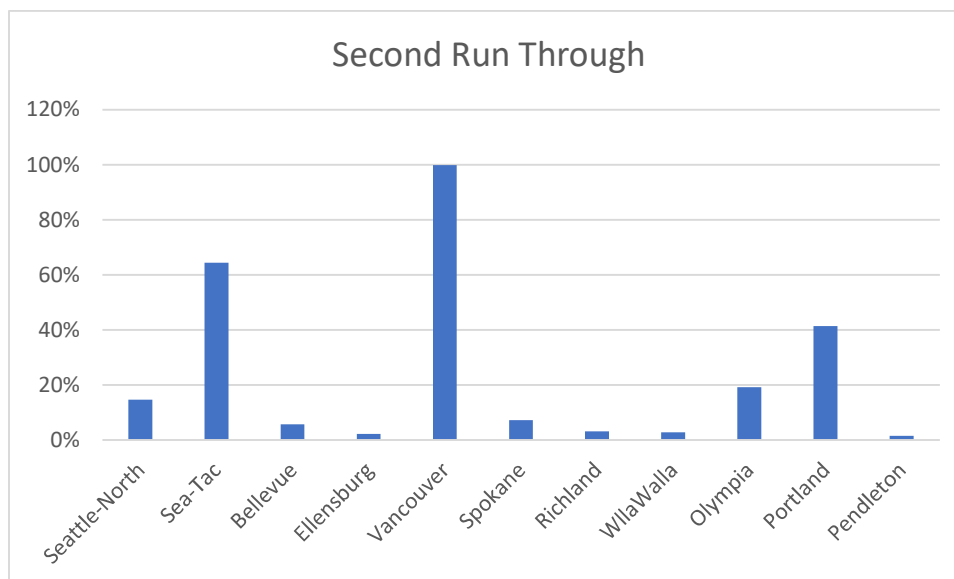
To further improve the results, I would compile a list of sites whose scores would not be impacted by the loss of vehicles, and create a separate LP based off that for more exact numbers and potentially better guidance. The LP created would give an ideal vehicle amount that could be taken from each location to not overly stress the sites being taken from and keep in regard the amount of parking the destination sites would have. Additionally, I would recommend figuring out if those sites could hire

more employees at the significantly lower rate or if it is possible to go lower than guidance my has suggested.

Summary of Each Run Through:

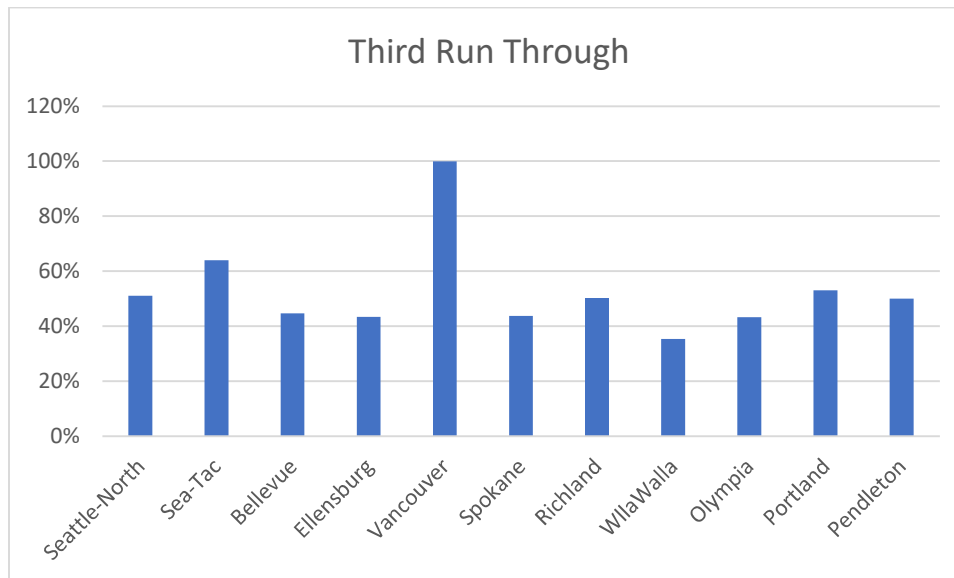


First run through results look excellent on the surface however, there is problem with these results. The problem is that many weights for the data that could make a large difference towards the outcomes were zero, as in they played no part in the resulting score the site received for its relative efficiency score. Hence why I started changing my scoring to be relative to each term. The numerator data is as follows: fleet, employees, rentals, revenue, and advanceBookings. The denominator data is as follows: salaries, maintenanceCosts, advertizingCosts, and complaints.

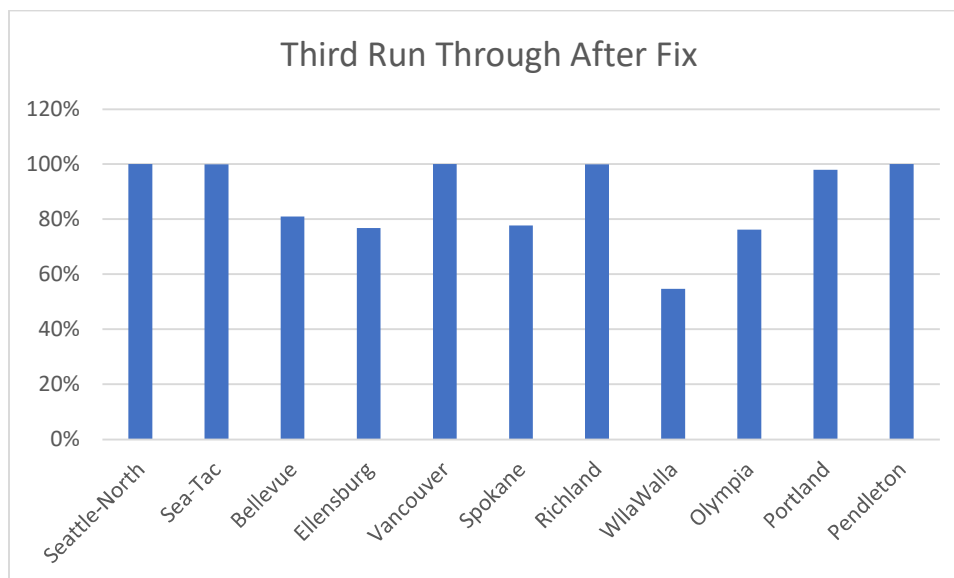


Second run through results look horrible which means I did not tune the system of equations properly or Vancouver is just that much better than the rest. I generated a new set of data from the

original data so that there are less data points and more are connected to each other. The new data has the data more related to each other, where a rate could apply between correlated data. The relations I made were: maintenance costs per car, salaries per employee, advertising costs per advance booking, and complaints per rental. Revenue will be treated separately on its own as a numerator. Notably all of the relations were put in the denominator so the data is to be expected to be significantly worse than the reality.

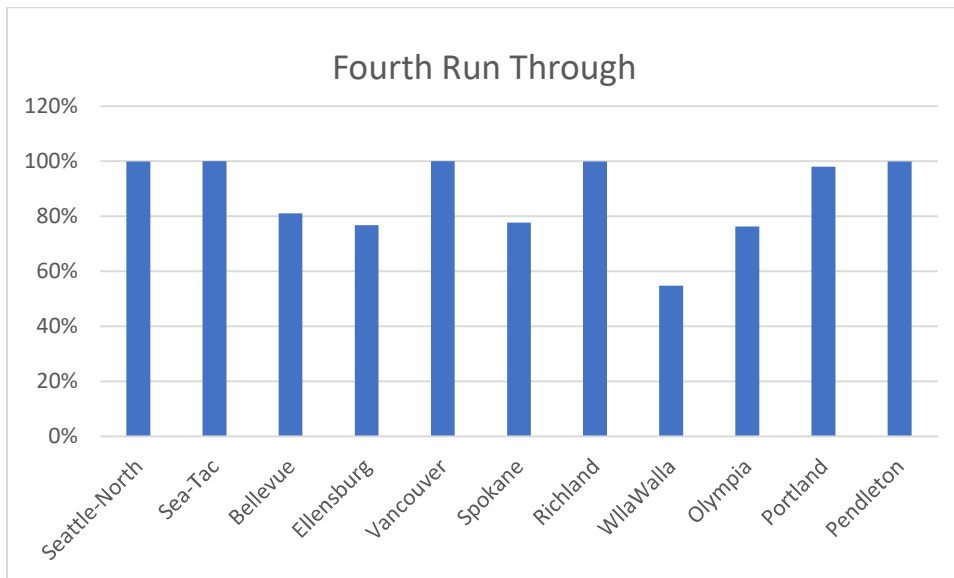


Third run through I inverted complaints per rental to rental per complaint, making it a numerator term, due to it never effecting the weighting according to the second run through's results. I additionally inverted maintenance costs per car to cars per maintenance cost making it a numerator term as well for similar reasons.

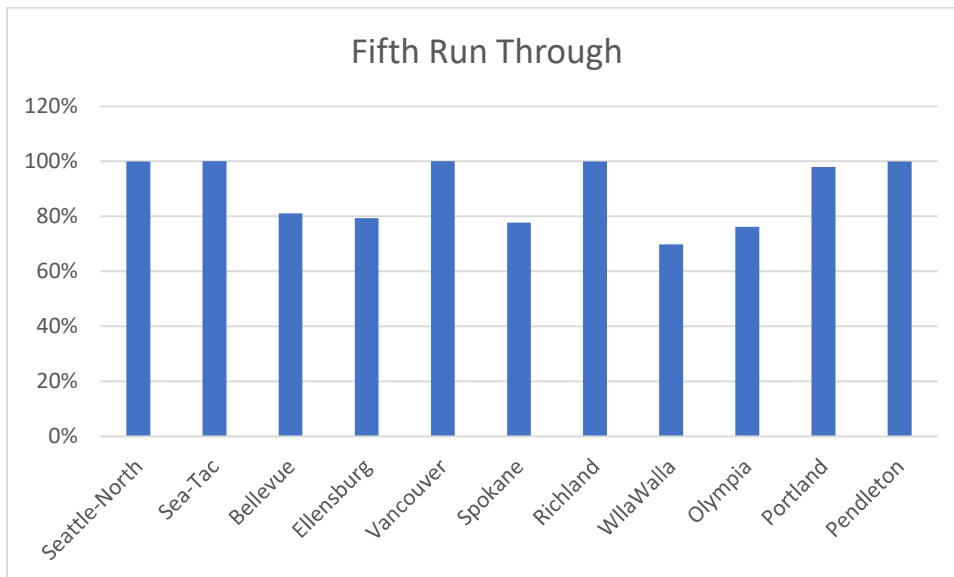


Third run through had an error in what terms it treated as a numerator, as in it did not properly include the change from the second run through. Which made the change in results lower than it should

have been. Notably I did this half way through my changes for the fourth run through. But I noticed revenue no longer being used in any of the sites' weighting. Thus, I made revenue become related to how many rentals said site receives.

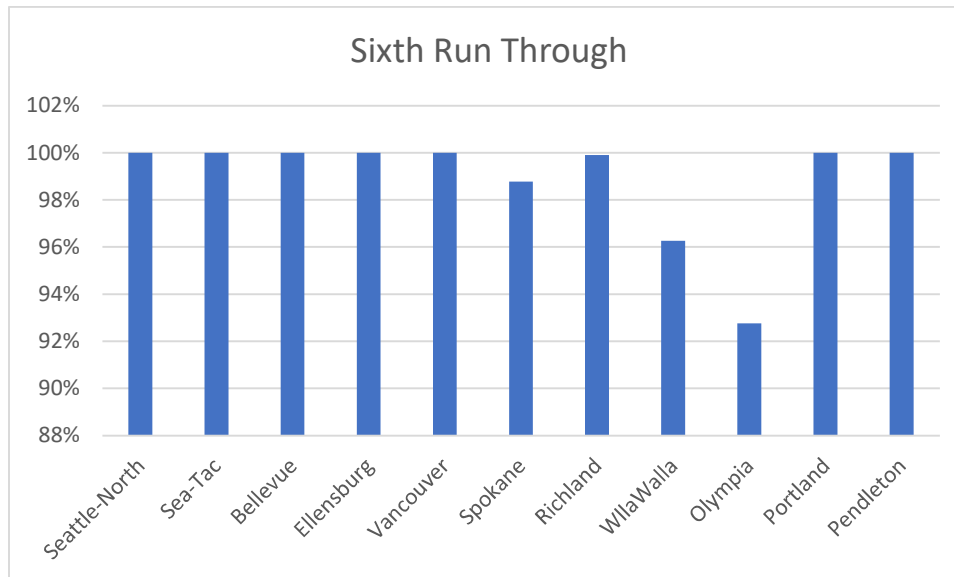


In the fourth run through, all weighting terms were used by at least one site and this means that the scoring system is properly set up hence no more modifications to the scoring process. From the weighting of the lowest scoring areas, I determined that they could increase their score with more vehicles and a lower salary per employee.



In the fifth run through, I gave WallaWalla 23 cars from Sea-Tac and Ellensburg 25 from Sea-Tac, to get them up to 100 cars each. I also had the location hire two employees salaried at \$2000 each for both locations since they had a lower than 10 employee count each. And it can be seen that both locations scores improved without lowering the scores of the other sites. Which proved to me that there

could be significant improvement to all the lower scoring locations without harming the better performing locations.



In the sixth run through, I moved cars from the following locations: Sea-Tac 114, Portland 30, and Vancouver 50. To the following locations: Bellevue 50, Ellensburg 40, Spokane 36, WallaWalla 48, and Olympia 30. I chose the locations to take from because they have large fleets and their scores would not be impacted from the loss of vehicles. Additionally, the locations hired more employees: Bellevue two new employees at \$2000 salary each, Ellensburg three employees with a \$1500 salary each, Spokane five employees with \$1100 salary each, WallaWalla four employees with salaries of \$1000 each, and Olympia five employees with a salary of \$1000 each. It can be seen that all sites are above 90% efficiency with these changes and the best performing locations did not score lower with these changes as well.

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First Run Through:

The output data analyzed here is on a separate page attached to this document. The data shows some favorable results for the company with only three exceptions: Bellevue at 93%, Richland at 99%, and Portland at 99%. This is the result from the original unmodified data treating positive aspects of each data category as the numerator and the negative aspects of each data category as the denominator. The numerator data is as follows: fleet, employees, rentals, revenue, and advanceBookings. The denominator data is as follows: salaries, maintenanceCosts, advertizingCosts, and complaints. The problem I have with the results is that many weights for the data that could make a large difference towards the outcomes were zero, as in they played no part in the resulting score the site received for its relative efficiency score.

Changes 1:

I will generate a new set of data from the original data so that there are less data points and more are connected to each other. The new data will have related data where a rate could apply between correlated data. Some that I will do are: maintenance costs per car, salaries per employee, advertising costs per advance booking, and complaints per rental. Revenue will be treated separately on its own as a numerator.

Second Run Through:

The output data analyzed here is on a separate page attached to this document. The data shows very bad results for all sites with the exception of three branches whose scores are above 40%: Portland at 41%, Sea-Tac at 64%, and Vancouver at 99%. Looking at the weights I find that the sites that have slightly better score than the rest typically have lower advertising costs per advance booking resulting in the weighting heavily going towards that. Vancouver appears to have scored the highest between its high revenue of \$907,000 and the salary per employee of \$2,720 which results in a greater than 333 times difference between the two. Comparing it to the lowest scoring site Pendleton with a score of 1.5% we find a lower disparity between the two where the revenue is \$8,220 and the employee salary is \$1,625 which results in only a slightly greater than 5 times difference between the two. Data showing the two sites of extremes. I also note that the way the data has been laid out still does not use all the data available in the scoring of sites for their efficiency score.

```

      site revenue costs/car salarie/employee \
4  Vancouver   907000  47.979798          2720.0

      advertisingCosts/advanceBooking complaints/rental
4                                1.764706          0.004703
Vancouver   99.99999999999999 %
revenue      Wiegthing: 1.1025358324145534e-06
costs/car    Wiegthing: 0.0
salarie/employee Wiegthing: 0.0003676470588235294
advertisingCosts/advanceBooking Wiegthing: 0.0
complaints/rental Wiegthing: 0.0

```

```

      site revenue costs/car  salarie/employee \
10 Pendleton      8220       70.0          1625.0

      advertisingCosts/advanceBooking  complaints/rental
10                                     3.333333          0.009524
Pendleton      1.5169807480281572 %
revenue        Wiegthing: 1.845475362564668e-06
costs/car      Wiegthing: 0.0
salarie/employee Wiegthing: 0.0006153846153846154
advertisingCosts/advanceBooking Wiegthing: 0.0
complaints/rental Wiegthing: 0.0

```

Changes 2:

I am thinking about inverting complaints per rental to rental per complaint and bringing that up to the numerator since it never got a weighting ever on my code. I will additionally invert costs per car to cars per cost and bring it up to the numerator for similar reasons.

Third Run Through:

The output data analyzed here is on a separate page attached to this document. The numbers have gotten significantly less volatile this run. The lowest score is found in Walla Walla at 35% efficiency. The highest score again goes to Vancouver at 99% efficiency. Vancouver keeps the score again with only two weights being used for its score those being revenue and salary per employee. Walla Walla on the other hand gains its score from the massive number of rentals they have per complaint, but they are in the red from a revenue compared to how much they pay per employee hence where their lower score comes from. Interestingly enough the next highest efficiency is found in Sea-Tac at 64% efficiency just like the second run through placing it at the second highest efficient site for the second time in a row.

```

      site revenue cars/cost  salarie/employee \
4 Vancouver      907000    0.020842          2720.0

      advertisingCosts/advanceBooking  rentals/complaint
4                                     1.764706          212.608696
Vancouver      99.99999999999999 %
revenue        Wiegthing: 1.1025358324145534e-06
cars/cost      Wiegthing: 0.0
salarie/employee Wiegthing: 0.0003676470588235294
advertisingCosts/advanceBooking Wiegthing: 0.0
rentals/complaint Wiegthing: 0.0

```

```

      site revenue cars/cost  salarie/employee \
7 WallaWalla      24000    0.010694          2571.428571

      advertisingCosts/advanceBooking  rentals/complaint
7                                     3.0          110.0
WallaWalla      35.37027355658809 %
revenue        Wiegthing: 0.0
cars/cost      Wiegthing: 0.0
salarie/employee Wiegthing: 0.000251337825057713
advertisingCosts/advanceBooking Wiegthing: 0.0
rentals/complaint Wiegthing: 0.003215479414235281

```


Changes 3:

I notice that advertising costs can be fairly high for some sites and lower for others, and I believe I should make advance Booking a beneficial term instead of punishing for fewer gained. So, I will do advance bookings per advertising cost, instead of the opposite that was previously used. Notably that leaves salary per employee as the only denominator term, which it usually becomes the largest weight in the denominator regardless of the existence of others.

Looking at the data from the previous run specifically I find some interesting points. Those being that the top three sights for the last two changes have been the sites with the highest revenue. In order to balance out a little more before I start changing the baseline numbers, I might need to use rentals as a divisor on revenue. This is because each site could have different rental costs per vehicle that I have not paid attention to in the data so far.

	site	revenue	cars/cost	salarie/employee
0	Seattle-North	85050	0.022857	3095.238095
1	Sea-Tac	214600	0.013789	2818.181818
2	Bellevue	51200	0.018595	2733.333333
3	Ellensburg	18500	0.011207	2500.000000
4	Vancouver	907000	0.020842	2720.000000
5	Spokane	61800	0.016800	2600.000000
6	Richland	22100	0.026154	2416.666667
7	WallaWalla	24000	0.010694	2571.428571
8	Olympia	99400	0.012766	2886.363636
9	Portland	155000	0.014516	2845.945946
10	Pendleton	8220	0.014286	1625.000000

	advertisingCosts/advanceBooking	rentals/complaint
0	1.132075	50.845070
1	0.648148	107.333333
2	2.000000	82.000000
3	1.935484	150.000000
4	1.764706	212.608696
5	1.909091	91.333333
6	3.333333	39.300000
7	3.000000	110.000000
8	1.010101	103.500000
9	0.728155	104.477612
10	3.333333	105.000000

Found an error in my code for my third run through where I did not correctly clear out the numerator data completely when creating linear program.

Third Run Through After Fix:

I notice that the revenue is not being used in the weighting for the scores of any site unlike before. The sites at 100% have increased in number and are now the following: Seattle-North, Vancouver, and Pendleton. And there are now several sites at beyond the 90% score mark as well. But I will specifically take notice of the sites below the 80% score mark, which are the following: Ellensburg at 76%, Spokane at 77%, WallaWalla at 54%, and Olympia at 76%.

Looking at WallaWalla compared to the next lowest of Olympia, the most notable thing I find that the advertising costs per advance booking are three times higher according to the data. Interestingly

enough though it can be seen in the weightings that WallaWalla is not penalized for having a higher advertising cost compared to the rest however, it is penalized at almost two times the value for its salary per employee compared to Olympia. Who in comparison has a weighting penalizing it for its advertising costs additionally. But I find it extremely telling that there is only one numerator term being weighted for WallaWalla while Olympia has two. WallaWalla is only getting its score from a good rentals per complaint, while on the other hand Olympia gets its score from both rentals per complaint and how much each car costs to maintain. Notably, they have very similar car per cost between the two but WallaWalla has the lowest score in that section compared to every other site.

	site	revenue	cars/cost	salarie/employee	\
0	Seattle-North	85050	0.022857	3095.238095	
1	Sea-Tac	214600	0.013789	2818.181818	
2	Bellevue	51200	0.018595	2733.333333	
3	Ellensburg	18500	0.011207	2500.000000	
4	Vancouver	907000	0.020842	2720.000000	
5	Spokane	61800	0.016800	2600.000000	
6	Richland	22100	0.026154	2416.666667	
7	WallaWalla	24000	0.010694	2571.428571	
8	Olympia	99400	0.012766	2886.363636	
9	Portland	155000	0.014516	2845.945946	
10	Pendleton	8220	0.014286	1625.000000	
	advertisingCosts/advanceBooking			rentals/complaint	
0		1.132075		50.845070	
1		0.648148		107.333333	
2		2.000000		82.000000	
3		1.935484		150.000000	
4		1.764706		212.608696	
5		1.909091		91.333333	
6		3.333333		39.300000	
7		3.000000		110.000000	
8		1.010101		103.500000	
9		0.728155		104.477612	
10		3.333333		105.000000	

	site	revenue	cars/cost	salarie/employee	\
7	WallaWalla	24000	0.010694	2571.428571	
	advertisingCosts/advanceBooking			rentals/complaint	
7			3.0	110.0	
	WallaWalla	54.72756191774597	%		
	revenue	Wiegthing: 0.0			
	cars/cost	Wiegthing: 0.0			
	salarie/employee	Wiegthing: 0.00038888888888888887			
	advertisingCosts/advanceBooking	Wiegthing: 0.0			
	rentals/complaint	Wiegthing: 0.00497523290161327			

```

      site revenue cars/cost salarie/employee \
8 Olympia 99400 0.012766 2886.363636

      advertisingCosts/advanceBooking rentals/complaint
8 1.010101 103.5
Olympia 76.22384529680726 %
revenue Wiegthing: 0.0
cars/cost Wiegthing: 43.49058231792318
salarie/employee Wiegthing: 0.00017881534534942785
advertisingCosts/advanceBooking Wiegthing: 0.4790351506640099
rentals/complaint Wiegthing: 0.0020003819300535523

```

Changes 3.5:

Since revenue is no longer being used in any of the sites' weighting, I will make revenue become related to how many rentals said site receives. I am almost satisfied with how every weighting is used in some cases, but revenue must be included in some cases as well or it becomes meaningless.

Fourth Run Through:

Every weighting is now used in the scoring system of sites. Additionally, most sites are close to the scores they had previously. While, others got lifted out of the 80% score range into the 90% score range. The places with 100% score or rounds up from 99.99% are the following: Seattle-North, Sea-Tac, Vancouver, Richland, and Pendleton. While the lowest score has been kept by WallaWalla at 54% and the second lowest is still Olympia at 76%. I do find it gratifying that the revenue per rental with the highest score, found with Vancouver, finds itself at a 100% score and additionally uses it in its weighting for said score.

I will not mess with the scoring system further since I have reached the point where every different weighting option has been used on at least one site.

```

      site cars/cost salarie/employee advertisingCosts/advanceBooking \
4 Vancouver 0.020842 2720.0 1.764706

      revenue/rental rentals/complaint
4 185.480573 212.608696
Vancouver 100.0 %
cars/cost Wiegthing: 0.0
salarie/employee Wiegthing: 0.0003676470588235294
advertisingCosts/advanceBooking Wiegthing: 0.0
revenue/rental Wiegthing: 0.0053914002205071665
rentals/complaint Wiegthing: 0.0

```

```

      site cars/cost  salarie/employee  advertisingCosts/advanceBooking \
7 WallaWalla  0.010694      2571.428571      3.0

      revenue/rental  rentals/complaint
7      27.272727      110.0
WallaWalla  54.72756191774597 %
cars/cost  Wiegthing: 0.0
salarie/employee  Wiegthing: 0.00038888888888888887
advertisingCosts/advanceBooking  Wiegthing: 0.0
revenue/rental  Wiegthing: 0.0
rentals/complaint  Wiegthing: 0.00497523290161327

```

```

      site cars/cost  salarie/employee \
0  Seattle-North  0.022857      3095.238095
1    Sea-Tac      0.013789      2818.181818
2    Bellevue     0.018595      2733.333333
3    Ellensburg   0.011207      2500.000000
4    Vancouver    0.020842      2720.000000
5    Spokane      0.016800      2600.000000
6    Richland     0.026154      2416.666667
7    WallaWalla   0.010694      2571.428571
8    Olympia      0.012766      2886.363636
9    Portland     0.014516      2845.945946
10   Pendleton    0.014286      1625.000000

```

```

      advertisingCosts/advanceBooking  revenue/rental  rentals/complaint
0      1.132075      23.559557      50.845070
1      0.648148      22.215321      107.333333
2      2.000000      24.975610      82.000000
3      1.935484      30.833333      150.000000
4      1.764706      185.480573      212.608696
5      1.909091      22.554745      91.333333
6      3.333333      28.117048      39.300000
7      3.000000      27.272727      110.000000
8      1.010101      24.009662      103.500000
9      0.728155      22.142857      104.477612
10     3.333333      39.142857      105.000000

```

Analysis:

The places that scored the best (Seattle-North, Sea-Tac, Vancouver, Richland, and Pendleton) most if not all are affected the most by their salary per employee, and the same is true with most sites according to my scoring system. WallaWalla is hurt by having relatively middle of the pack numbers along side a lower fleet size for its maintenance costs. Even though it wasn't used against it additionally has relatively high advertising costs compared to how many bookings it gets in advance. So, to bolster the lowest scoring location I believe it needs a slightly larger fleet while maintaining its current repair costs and either a lower salary total or more employees at its location. Additionally, lowering the amount of spending on advertising may help the relative score compared to the rest.

I believe I can take some of the fleet from Sea-Tac to bolster the smaller lower scoring fleets, I think bolstering them up to 80 would be a good starting point. I will additionally increase the employees in those locations by no more than 2 and increase the salary by \$2000 per employee given in this manner, I will assume they are recruited locally instead of transferred from elsewhere for simplicity.


```
Seattle-North 99.9999999999997 %  
cars/cost Wiegthing: 42.701390588765754  
salarie/employee Wiegthing: 0.00027013418596750485  
advertisingCosts/advanceBooking Wiegthing: 0.14475216614440142  
revenue/rental Wiegthing: 0.0  
rentals/complaint Wiegthing: 0.00047139702855642873
```

```
Sea-Tac 100.0 %  
cars/cost Wiegthing: 0.0  
salarie/employee Wiegthing: 0.0  
advertisingCosts/advanceBooking Wiegthing: 1.542857142857143  
revenue/rental Wiegthing: 0.0  
rentals/complaint Wiegthing: 0.009316770186335404
```

```
Vancouver 100.0 %  
cars/cost Wiegthing: 0.0  
salarie/employee Wiegthing: 0.0003676470588235294  
advertisingCosts/advanceBooking Wiegthing: 0.0  
revenue/rental Wiegthing: 0.0053914002205071665  
rentals/complaint Wiegthing: 0.0
```

```
Richland 99.9999999999997 %  
cars/cost Wiegthing: 35.647380009320926  
salarie/employee Wiegthing: 0.0004137931034482759  
advertisingCosts/advanceBooking Wiegthing: 0.0  
revenue/rental Wiegthing: 0.0004911016521925594  
rentals/complaint Wiegthing: 0.0013708798613486866
```

```
Pendleton 99.9999999999999 %  
cars/cost Wiegthing: 43.4175907970302  
salarie/employee Wiegthing: 0.0006153846153846154  
advertisingCosts/advanceBooking Wiegthing: 0.0  
revenue/rental Wiegthing: 0.0  
rentals/complaint Wiegthing: 0.003616654313329224
```

```
WallaWalla 54.72756191774597 %  
cars/cost Wiegthing: 0.0  
salarie/employee Wiegthing: 0.0003888888888888887  
advertisingCosts/advanceBooking Wiegthing: 0.0  
revenue/rental Wiegthing: 0.0  
rentals/complaint Wiegthing: 0.00497523290161327
```

	site	fleet	employees	salaries	maintenanceCosts	\
0	Seattle-North	320	21	65000	14000	
1	Sea-Tac	524	55	155000	38000	
2	Bellevue	225	15	41000	12100	
3	Ellensburg	65	6	15000	5800	
4	Vancouver	396	25	68000	19000	
5	Spokane	210	20	52000	12500	
6	Richland	102	6	14500	3900	
7	WallaWalla	77	7	18000	7200	
8	Olympia	300	22	63500	23500	
9	Portland	450	37	105300	31000	
10	Pendleton	50	4	6500	3500	

	advertisingCosts	rentals	revenue	advanceBookings	Complaints
0	1200	3610	85050	1060	71
1	3500	9660	214600	5400	90
2	1200	2050	51200	600	25
3	300	600	18500	155	4
4	1500	4890	907000	850	23
5	2100	2740	61800	1100	30
6	300	786	22100	90	20
7	300	880	24000	100	8
8	1000	4140	99400	990	40
9	3000	7000	155000	4120	67
10	300	210	8220	90	2

Fifth Run Through:

I have given WallaWalla 23 cars from Sea-Tac and Ellensburg 25 from Sea-Tac, to get them up to 100 cars each. I have additionally given two employees salaried at \$2000 each for both locations since they have a lower than 10 employee count each. However, due to their already low advertising costs and not being affected by it score wise currently, I will not lower those at this time. I will see how the numbers change before I look at possibly recruiting more employees for the other lower scoring sites.

After these changes, WallaWalla's score increases to 69.8% and Ellensburg increases to 79% with these changes. And the top sites don't shift in their scoring at all due to these changes which leads me to believe I can increase the changes further on the entirety of the below 80% category in similar ways as long as salaries don't surpass revenue.

	site	fleet	employees	salaries	maintenanceCosts	\
0	Seattle-North	320	21	65000	14000	
1	Sea-Tac	524	55	155000	38000	
2	Bellevue	225	15	41000	12100	
3	Ellensburg	65	6	15000	5800	
4	Vancouver	396	25	68000	19000	
5	Spokane	210	20	52000	12500	
6	Richland	102	6	14500	3900	
7	WallaWalla	100	11	26000	7200	
8	Olympia	300	22	63500	23500	
9	Portland	450	37	105300	31000	
10	Pendleton	50	4	6500	3500	

	advertisingCosts	rentals	revenue	advanceBookings	Complaints
0	1200	3610	85050	1060	71
1	3500	9660	214600	5400	90
2	1200	2050	51200	600	25
3	300	600	18500	155	4
4	1500	4890	907000	850	23
5	2100	2740	61800	1100	30
6	300	786	22100	90	20
7	300	880	24000	100	8
8	1000	4140	99400	990	40
9	3000	7000	155000	4120	67
10	300	210	8220	90	2

Changes 5:

I will increase the fleets of the under performing locations using some of the fleet from the highest performing locations. The under performing locations are: Bellevue at 81%, Ellensburg at 79%, Spokane at 77%, WallaWalla at 69% and Olympia at 76%.

Looking Bellevue first, I find their salary per employee rather high and the score weighting agrees. And the other increasable weight according to their weighting that can increase their score directly is fleet size.

site	cars/cost	salarie/employee	advertisingCosts/advanceBooking	\
2 Bellevue	0.018595	2733.333333		2.0

revenue/rental	rentals/complaint
2 24.97561	82.0

Bellevue 81.011001571424 %

cars/cost Wiegthing: 41.54352650530161

salarie/employee Wiegthing: 0.000262809397071054

advertisingCosts/advanceBooking Wiegthing: 0.14082715733622622

revenue/rental Wiegthing: 0.0

rentals/complaint Wiegthing: 0.00045861492284765434

In Ellensburg, I find their fleet size underperforming for their costs and wish to increase their fleet. Additionally, I will increase the employees and salaries at the site as well since the weightings tells me that is the most direct way to increase the score of the location.

```

      site cars/cost  salarie/employee  advertisingCosts/advanceBooking \
3 Ellensburg  0.015517          2500.0          1.935484

      revenue/rental  rentals/complaint
3      30.833333          150.0
Ellensburg  79.32156362367031 %
cars/cost  Wiegthing: 35.17405008021551
salarie/employee  Wiegthing: 0.0003904219790326721
advertisingCosts/advanceBooking  Wiegthing: 0.0123716104161319
revenue/rental  Wiegthing: 0.0
rentals/complaint  Wiegthing: 0.001649409405693659

```

In Spokane, the fleet size is already quite large so it will require more cars to directly boost the score compared to the previous locations. The salary is again manipulatable with new employees at lower rates but again larger site will require larger numbers to dilute, or I will get more at a significantly lower salary. I expect this to be the site whose score is one of the hardest to change due to the large fleet and employee count.

```

      site cars/cost  salarie/employee  advertisingCosts/advanceBooking \
5 Spokane  0.0168          2600.0          1.909091

      revenue/rental  rentals/complaint
5      22.554745          91.333333
Spokane  77.69922772563946 %
cars/cost  Wiegthing: 43.630995726320194
salarie/employee  Wiegthing: 0.00027601498103394336
advertisingCosts/advanceBooking  Wiegthing: 0.14790340678234373
revenue/rental  Wiegthing: 0.0
rentals/complaint  Wiegthing: 0.0004816592962140379

```

In WallaWalla, I will have to increase the fleet further to get the direct score increase. Additionally, I may need to recruit an additional employee and lower the rate at which I higher said employees.

```

      site cars/cost  salarie/employee  advertisingCosts/advanceBooking \
7 WallaWalla  0.013889          2363.636364          3.0

      revenue/rental  rentals/complaint
7      27.272727          110.0
WallaWalla  69.79292408730744 %
cars/cost  Wiegthing: 36.64229137728749
salarie/employee  Wiegthing: 0.0004067190409744463
advertisingCosts/advanceBooking  Wiegthing: 0.012888028323163516
revenue/rental  Wiegthing: 0.0
rentals/complaint  Wiegthing: 0.0017182593390876097

```

Finally in Olympia, the fleet size is small enough that a good number of cars added should help its score significantly. However, that large salary per employee has got to be lowered to see said results. Unfortunately, the site already has a significant employee count so this will require a larger number of much lower pay employees to correct.


```

      site cars/cost  salarie/employee  advertisingCosts/advanceBooking \
8 Olympia  0.012766      2886.363636      1.010101

      revenue/rental  rentals/complaint
8      24.009662      103.5
Olympia  76.22384529680718 %
cars/cost  Wiegthing: 43.490582317923206
salarie/employee  Wiegthing: 0.00017881534534942752
advertisingCosts/advanceBooking  Wiegthing: 0.4790351506640108
revenue/rental  Wiegthing: 0.0
rentals/complaint  Wiegthing: 0.002000381930053541

```

ERROR NOTICED:

The fleet size decrease that should be happening is not, and thus that may be the biggest reason why Sea-Tac's score has not changed even as I have tried to move cars away from there. Instead, the code is creating a situation where the company is instead buying new cars for specific site's fleets. I wanted to make certain that this bug was noticed and an attempt to correct has been made.

After checking Sea-Tac's score does not change, as to be expected. The bug has been fixed; I will proceed to continue manipulating the internal company resources.

Sixth Run Through:

The changes I have applied to each site that I previously mentioned have successfully made the lowest scoring place WallaWalla no longer the lowest at 96% and instead Olympia takes that place at 92%. Below is the data sheet after the changes.

	site	fleet	employees	salaries	maintenanceCosts	\
0	Seattle-North	320	21	65000	14000	
1	Sea-Tac	400	55	155000	38000	
2	Bellevue	275	17	45000	12100	
3	Ellensburg	105	9	19500	5800	
4	Vancouver	346	25	68000	19000	
5	Spokane	246	25	57500	12500	
6	Richland	102	6	14500	3900	
7	WallaWalla	125	11	22000	7200	
8	Olympia	330	27	68500	23500	
9	Portland	420	37	105300	31000	
10	Pendleton	50	4	6500	3500	
	advertingCosts	rentals	revenue	advanceBookings	Complaints	
0	1200	3610	85050	1060	71	
1	3500	9660	214600	5400	90	
2	1200	2050	51200	600	25	
3	300	600	18500	155	4	
4	1500	4890	907000	850	23	
5	2100	2740	61800	1100	30	
6	300	786	22100	90	20	
7	300	880	24000	100	8	
8	1000	4140	99400	990	40	
9	3000	7000	155000	4120	67	
10	300	210	8220	90	2	

	site	cars/cost	salarie/employee	\
0	Seattle-North	0.022857	3095.238095	
1	Sea-Tac	0.010526	2818.181818	
2	Bellevue	0.022727	2647.058824	
3	Ellensburg	0.018103	2166.666667	
4	Vancouver	0.018211	2720.000000	
5	Spokane	0.019680	2300.000000	
6	Richland	0.026154	2416.666667	
7	WallaWalla	0.017361	2000.000000	
8	Olympia	0.014043	2537.037037	
9	Portland	0.013548	2845.945946	
10	Pendleton	0.014286	1625.000000	

	advertisingCosts/advanceBooking	revenue/rental	rentals/complaint
0	1.132075	23.559557	50.845070
1	0.648148	22.215321	107.333333
2	2.000000	24.975610	82.000000
3	1.935484	30.833333	150.000000
4	1.764706	185.480573	212.608696
5	1.909091	22.554745	91.333333
6	3.333333	28.117048	39.300000
7	3.000000	27.272727	110.000000
8	1.010101	24.009662	103.500000
9	0.728155	22.142857	104.477612
10	3.333333	39.142857	105.000000

The changes done to Bellevue, now 100%, are as follows. Employee two new employees at \$2000 salary and take 50 cars from Vancouver. The changes to Ellensburg, now 100%, are as follows. Higher three employees with a \$1500 salary each, and take 40 cars from Sea-Tac. The changes to Spokane, now 98%, are as follows. Hire five employees with \$1100 salary each, and take 36 cars from Sea-Tac. The changes WallaWalla, now 96%, are as follows. Hire four employees with salaries of \$1000 each, and take 48 cars from Sea-Tac. Finally, the changes to Olympia, now 92%, are as follows. Hire five employees with a salary of \$1000 each, and take 30 cars from Portland.

site	cars/cost	salarie/employee	advertisingCosts/advanceBooking	\
5 Spokane	0.01968	2300.0	1.909091	

	revenue/rental	rentals/complaint
5 Spokane	22.554745	91.333333

Spokane 98.78956423324871 %
cars/cost Wiegthing: 46.436925835397275
salarie/employee Wiegthing: 0.0003124541347173392
advertisingCosts/advanceBooking Wiegthing: 0.1473766853167294
revenue/rental Wiegthing: 0.0
rentals/complaint Wiegthing: 0.0008104044732686365

```

      site cars/cost  salarie/employee  advertisingCosts/advanceBooking \
7 WallaWalla  0.017361          2000.0          3.0

      revenue/rental  rentals/complaint
7      27.272727          110.0
WallaWalla  96.26856056103318 %
cars/cost  Wiegthing: 43.200320466103655
salarie/employee  Wiegthing: 0.0004871736143213496
advertisingCosts/advanceBooking  Wiegthing: 0.008550923785766952
revenue/rental  Wiegthing: 0.0
rentals/complaint  Wiegthing: 0.0019334549269336262

      site cars/cost  salarie/employee  advertisingCosts/advanceBooking \
8 Olympia  0.014043          2537.037037          1.010101

      revenue/rental  rentals/complaint
8      24.009662          103.5
Olympia  92.76047107721598 %
cars/cost  Wiegthing: 44.584144061240146
salarie/employee  Wiegthing: 0.00018440072834744012
advertisingCosts/advanceBooking  Wiegthing: 0.5268468373006795
revenue/rental  Wiegthing: 0.0
rentals/complaint  Wiegthing: 0.0029133284666200045

```

I am not in charge of logistics, so there may be a more ideal shifting of cars between destinations. So, the total cars to move from are: Sea-Tac is 114, Portland 30, and Vancouver 50. I chose these locations because they have large fleets and their scores would not be impacted from the loss of vehicles. Additionally, I made certain that their respective fleets would stay close to their original X00 number so that the parking space for the vehicles still stays relatively full.

If you wish to improve the scores of the remaining below 100% locations, I would recommend a combination of moving additional surplus vehicles to said locations and employing more while attempting to bring the salary per employee down. Optionally some of the sites may require you to potentially lower their advertising costs by a little, but I would not recommend that because those sites don't get many advance bookings to begin with and already have a small budget for said advertisements.

Final Formula Used:

For each site the following equation is used. There isn't enough room for everything to be shown. So, the following should be understood. The summation notation includes all sites being compared to each other. The three lines outside of it are the terms for the current site that is being scored.

$$\begin{aligned}
 &\text{maximize} && x_1 * \frac{\text{revenue}}{\text{rental}} + x_2 * \frac{\text{rentals}}{\text{complaint}} + x_3 * \frac{\text{cars}}{\text{maintenanc cost}} \\
 &\sum x_1 * \frac{\text{revenue}}{\text{rental}} + x_2 * \frac{\text{rentals}}{\text{complaint}} + x_3 * \frac{\text{cars}}{\text{maintance cost}} - x_4 * \frac{\text{salary}}{\text{employee}} - x_5 * \frac{\text{advertising costs}}{\text{advance bookingg}} && \leq 0 \\
 &S.T. && x_4 * \frac{\text{salary}}{\text{employee}} + x_5 * \frac{\text{advertising costs}}{\text{advance booking}} && \leq 1 \\
 &&& -x_4 * \frac{\text{salary}}{\text{employee}} - x_5 * \frac{\text{advertising costs}}{\text{advance booki}} && \leq -1 \\
 &&& x \in \mathbb{R}^5, 0 \leq x
 \end{aligned}$$

The formula is in two parts to create the scoring system for each site in the data. The numerator as I refer to it or all the positive terms that are wished to be maximized. Those terms are: revenue per rental, rentals per complaint, and cars per maintenance cost. The reasoning on why I have chosen these as numerator terms is, these are the gains the company can use to gauge proper success of said sites. Then there are the denominator terms which create the baseline maximum score of 1. The denominator terms are: salary per employee, and advertising costs per advance booking. The reasoning on why I have chosen these as denominator terms is, they cost the site consistently and are mandatory for upkeep to happen. The \sum line represents all sites where the numerator terms, which are positive, cannot exceed the denominator terms, which are negative, and thus the other sites can limit the current site's maximum score. Notably the perfect score would be a 1 out of 1, and for viewing purposes you multiply that by 100 to get the percentage score that I have been providing.

DATA-First Run Through Output Data:

Seattle-North 100.0 %

fleet Wiegthing: 0.0

employees Wiegthing: 0.045282362727085856

salaries Wiegthing: 0.0

maintenanceCosts Wiegthing: 6.62296246739501e-05

advertizingCosts Wiegthing: 6.065437880391549e-05

rentals Wiegthing: 1.3166479197282187e-06

revenue Wiegthing: 0.0

advanceBookings Wiegthing: 4.1808758246205797e-05

Complaints Wiegthing: 0.0

Sea-Tac 100.0 %

fleet Wiegthing: 0.0

employees Wiegthing: 0.018173805860352017

salaries Wiegthing: 1.592457997966998e-06

maintenanceCosts Wiegthing: 1.4300280568396204e-05

advertizingCosts Wiegthing: 3.437690604800334e-05

rentals Wiegthing: 0.0

revenue Wiegthing: 0.0

advanceBookings Wiegthing: 8.160697789613324e-08

Complaints Wiegthing: 0.0009937686394227536

Bellevue 93.22316761354541 %

fleet Wiegthing: 0.001744339294541937

employees Wiegthing: 0.02907034679600028

salaries Wiegthing: 1.0472855581243727e-05

maintenanceCosts Wiegthing: 4.159983289021339e-05
advertizingCosts Wiegthing: 0.0
rentals Wiegthing: 0.0
revenue Wiegthing: 0.0
advanceBookings Wiegthing: 0.00017283355487252345
Complaints Wiegthing: 0.0026901977278970058

Ellensburg 100.0 %
fleet Wiegthing: 0.0
employees Wiegthing: 0.16407630360025005
salaries Wiegthing: 1.807531828946628e-05
maintenanceCosts Wiegthing: 7.121777065098818e-05
advertizingCosts Wiegthing: 0.0009378290732191556
rentals Wiegthing: 0.0
revenue Wiegthing: 0.0
advanceBookings Wiegthing: 0.00010027211869999815
Complaints Wiegthing: 0.008614608479131923

Vancouver 100.0 %
fleet Wiegthing: 0.0
employees Wiegthing: 0.03524432358333967
salaries Wiegthing: 6.864615202844609e-06
maintenanceCosts Wiegthing: 2.7637363274409753e-05
advertizingCosts Wiegthing: 0.0
rentals Wiegthing: 0.0
revenue Wiegthing: 1.310825914184214e-07
advanceBookings Wiegthing: 0.0
Complaints Wiegthing: 0.00035201147794701324

Spokane 100.0 %
fleet Wiegthing: 0.0
employees Wiegthing: 0.04998765455184076
salaries Wiegthing: 4.380108432012728e-06
maintenanceCosts Wiegthing: 3.93333950268986e-05
advertizingCosts Wiegthing: 9.455481792273264e-05
rentals Wiegthing: 0.0
revenue Wiegthing: 0.0
advanceBookings Wiegthing: 2.2446269380435007e-07
Complaints Wiegthing: 0.0027333935353789024

Richland 99.9999999999997 %
fleet Wiegthing: 0.009803921568627449
employees Wiegthing: 0.0
salaries Wiegthing: 3.283041668938195e-05
maintenanceCosts Wiegthing: 7.215513638263464e-05
advertizingCosts Wiegthing: 0.0
rentals Wiegthing: 0.0
revenue Wiegthing: 0.0
advanceBookings Wiegthing: 0.0
Complaints Wiegthing: 0.012127696305584332

WallaWalla 100.0 %
fleet Wiegthing: 0.0
employees Wiegthing: 0.14285714285714285
salaries Wiegthing: 0.0

maintenanceCosts Wiegthing: 7.524578458834518e-05
advertizingCosts Wiegthing: 0.0012930924003588355
rentals Wiegthing: 0.0
revenue Wiegthing: 0.0
advanceBookings Wiegthing: 0.0
Complaints Wiegthing: 0.00878782885703301

Olympia 100.0 %
fleet Wiegthing: 0.0
employees Wiegthing: 0.02763833094795692
salaries Wiegthing: 1.3338472944256527e-05
maintenanceCosts Wiegthing: 0.0
advertizingCosts Wiegthing: 0.00015300696803971058
rentals Wiegthing: 8.164998404899797e-05
revenue Wiegthing: 0.0
advanceBookings Wiegthing: 5.4470490082925494e-05
Complaints Wiegthing: 0.0

Portland 99.99999999999999 %
fleet Wiegthing: 0.0
employees Wiegthing: 0.01615670540564255
salaries Wiegthing: 7.3283666616149104e-06
maintenanceCosts Wiegthing: 7.3652577590951584e-06
advertizingCosts Wiegthing: 0.0
rentals Wiegthing: 0.0
revenue Wiegthing: 0.0
advanceBookings Wiegthing: 9.762182038621978e-05
Complaints Wiegthing: 0.0

Pendleton 100.0 %
fleet Wiegthing: 0.0
employees Wiegthing: 0.2466090155700096
salaries Wiegthing: 2.7167460210098653e-05
maintenanceCosts Wiegthing: 0.00010704132117774116
advertizingCosts Wiegthing: 0.0014095704220823142
rentals Wiegthing: 0.0
revenue Wiegthing: 0.0
advanceBookings Wiegthing: 0.00015071041911068396
Complaints Wiegthing: 0.012947878943785192

DATA-Second Run Through Output Data:

Seattle-North 14.617193073480768 %

revenue Wiegthing: 1.718658797587392e-06

costs/car Wiegthing: 0.0

salarie/employee Wiegthing: 0.0

advertisingCosts/advanceBooking Wiegthing: 0.8833333333333333

complaints/rental Wiegthing: 0.0

Sea-Tac 64.419964237073 %

revenue Wiegthing: 3.0018622664060114e-06

costs/car Wiegthing: 0.0

salarie/employee Wiegthing: 0.0

advertisingCosts/advanceBooking Wiegthing: 1.542857142857143

complaints/rental Wiegthing: 0.0

Bellevue 5.617446957270014 %

revenue Wiegthing: 1.0971576088417996e-06

costs/car Wiegthing: 0.0

salarie/employee Wiegthing: 0.00036585365853658537

advertisingCosts/advanceBooking Wiegthing: 0.0

complaints/rental Wiegthing: 0.0

Ellensburg 2.2191841234840135 %

revenue Wiegthing: 1.1995589856670343e-06

costs/car Wiegthing: 0.0

salarie/employee Wiegthing: 0.0004

advertisingCosts/advanceBooking Wiegthing: 0.0

complaints/rental Wiegthing: 0.0

Vancouver 99.99999999999999 %

revenue Wiegthing: 1.1025358324145534e-06

costs/car Wiegthing: 0.0

salarie/employee Wiegthing: 0.0003676470588235294

advertisingCosts/advanceBooking Wiegthing: 0.0

complaints/rental Wiegthing: 0.0

Spokane 7.12814858790603 %

revenue Wiegthing: 1.1534221016029175e-06

costs/car Wiegthing: 0.0

salarie/employee Wiegthing: 0.0003846153846153846

advertisingCosts/advanceBooking Wiegthing: 0.0

complaints/rental Wiegthing: 0.0

Richland 3.0575880079738957 %

revenue Wiegthing: 1.3835239855085502e-06

costs/car Wiegthing: 0.026153846153846156

salarie/employee Wiegthing: 0.0

advertisingCosts/advanceBooking Wiegthing: 0.0

complaints/rental Wiegthing: 0.0

WallaWalla 2.798970966556413 %

revenue Wiegthing: 1.1662379027318388e-06

costs/car Wiegthing: 0.0

salarie/employee Wiegthing: 0.0003888888888888887

advertisingCosts/advanceBooking Wiegthing: 0.0

complaints/rental Wiegthing: 0.0

Olympia 19.146377845515275 %

revenue Wiegthing: 1.9261949542771907e-06

costs/car Wiegthing: 0.0

salarie/employee Wiegthing: 0.0

advertisingCosts/advanceBooking Wiegthing: 0.99

complaints/rental Wiegthing: 0.0

Portland 41.41643426940787 %

revenue Wiegthing: 2.672028017381153e-06

costs/car Wiegthing: 0.0

salarie/employee Wiegthing: 0.0

advertisingCosts/advanceBooking Wiegthing: 1.3733333333333333

complaints/rental Wiegthing: 0.0

Pendleton 1.5169807480281572 %

revenue Wiegthing: 1.845475362564668e-06

costs/car Wiegthing: 0.0

salarie/employee Wiegthing: 0.0006153846153846154

advertisingCosts/advanceBooking Wiegthing: 0.0

complaints/rental Wiegthing: 0.0

DATA-Third Run Through:

Seattle-North 51.09786590743486 %
revenue Wieghting: 2.5816952555787317e-07
cars/cost Wieghting: 21.39468366549725
salarie/employee Wieghting: 5.532514127920714e-05
advertisingCosts/advanceBooking Wieghting: 0.3000985205102233
rentals/complaint Wieghting: 0.0

Sea-Tac 64.419964237073 %
revenue Wieghting: 3.0018622664060114e-06
cars/cost Wieghting: 0.0
salarie/employee Wieghting: 0.0
advertisingCosts/advanceBooking Wieghting: 1.542857142857143
rentals/complaint Wieghting: 0.0

Bellevue 44.754739141895946 %
revenue Wieghting: 0.0
cars/cost Wieghting: 22.950829587509464
salarie/employee Wieghting: 0.00014518973697151425
advertisingCosts/advanceBooking Wieghting: 0.07780033042945068
rentals/complaint Wieghting: 0.0002533630104613792

Ellensburg 43.42635013188949 %
revenue Wieghting: 0.0
cars/cost Wieghting: 0.0
salarie/employee Wieghting: 0.00022629459947244205
advertisingCosts/advanceBooking Wieghting: 0.0

rentals/complaint Wiegthing: 0.0028950900087926328

Vancouver 99.99999999999999 %

revenue Wiegthing: 1.1025358324145534e-06

cars/cost Wiegthing: 0.0

salarie/employee Wiegthing: 0.0003676470588235294

advertisingCosts/advanceBooking Wiegthing: 0.0

rentals/complaint Wiegthing: 0.0

Spokane 43.72513528623993 %

revenue Wiegthing: 0.0

cars/cost Wiegthing: 24.553283818253117

salarie/employee Wiegthing: 0.00015532705716656206

advertisingCosts/advanceBooking Wiegthing: 0.08323244207380615

rentals/complaint Wiegthing: 0.00027105311732569744

Richland 50.204975802569926 %

revenue Wiegthing: 1.8549846386418316e-07

cars/cost Wiegthing: 19.039273957840916

salarie/employee Wiegthing: 0.00020774472745891003

advertisingCosts/advanceBooking Wiegthing: 0.0

rentals/complaint Wiegthing: 0.0

WallaWalla 35.37027355658809 %

revenue Wiegthing: 0.0

cars/cost Wiegthing: 0.0

salarie/employee Wiegthing: 0.000251337825057713

advertisingCosts/advanceBooking Wiegthing: 0.0

rentals/complaint Wiegthing: 0.003215479414235281

Olympia 43.25399049624994 %

revenue Wiegthing: 0.0

cars/cost Wiegthing: 24.679169975364946

salarie/employee Wiegthing: 0.00010147057286614984

advertisingCosts/advanceBooking Wiegthing: 0.2718333321221024

rentals/complaint Wiegthing: 0.0011351369201394808

Portland 53.04927212086346 %

revenue Wiegthing: 1.2182061057200753e-06

cars/cost Wiegthing: 23.53732004329492

salarie/employee Wiegthing: 0.0

advertisingCosts/advanceBooking Wiegthing: 0.9041054692444217

rentals/complaint Wiegthing: 0.0

Pendleton 50.01864027765587 %

revenue Wiegthing: 4.535347361524597e-08

cars/cost Wiegthing: 26.711877303817737

salarie/employee Wiegthing: 0.0003078070170932668

advertisingCosts/advanceBooking Wiegthing: 0.0

rentals/complaint Wiegthing: 0.0011258604764385256

DATA-Third Run Through With Fix:

site revenue cars/cost salarie/employee \

0 Seattle-North 85050 0.022857 3095.238095

advertisingCosts/advanceBooking rentals/complaint

0 1.132075 50.84507

Seattle-North 100.0 %

revenue Wiegthing: 0.0

cars/cost Wiegthing: 43.75

salarie/employee Wiegthing: 0.0002688053601543627

advertisingCosts/advanceBooking Wiegthing: 0.14838534465731779

rentals/complaint Wiegthing: 0.0

site revenue cars/cost salarie/employee \

1 Sea-Tac 214600 0.013789 2818.181818

advertisingCosts/advanceBooking rentals/complaint

1 0.648148 107.333333

Sea-Tac 99.99999999999999 %

revenue Wiegthing: 0.0

cars/cost Wiegthing: 72.51908396946564

salarie/employee Wiegthing: 0.0

advertisingCosts/advanceBooking Wiegthing: 1.542857142857143

rentals/complaint Wiegthing: 0.0

site revenue cars/cost salarie/employee \

2 Bellevue 51200 0.018595 2733.333333

advertisingCosts/advanceBooking rentals/complaint

2 2.0 82.0

Bellevue 81.011001571424 %

revenue Wiegthing: 0.0

cars/cost Wiegthing: 41.54352650530161

salarie/employee Wiegthing: 0.000262809397071054

advertisingCosts/advanceBooking Wiegthing: 0.14082715733622622

rentals/complaint Wiegthing: 0.00045861492284765434

site revenue cars/cost salarie/employee \

3 Ellensburg 18500 0.011207 2500.0

advertisingCosts/advanceBooking rentals/complaint

3 1.935484 150.0

Ellensburg 76.76073619631903 %

revenue Wiegthing: 0.0

cars/cost Wiegthing: 0.0

salarie/employee Wiegthing: 0.0004

advertisingCosts/advanceBooking Wiegthing: 0.0

rentals/complaint Wiegthing: 0.005117382413087935

site revenue cars/cost salarie/employee \

4 Vancouver 907000 0.020842 2720.0

advertisingCosts/advanceBooking rentals/complaint

4 1.764706 212.608696

Vancouver 100.0 %

revenue Wiegthing: 0.0

cars/cost Wiegthing: 0.0

salarie/employee Wiegthing: 0.0003676470588235294

advertisingCosts/advanceBooking Wiegthing: 0.0

rentals/complaint Wiegthing: 0.004703476482617587

site revenue cars/cost salarie/employee \

5 Spokane 61800 0.0168 2600.0

advertisingCosts/advanceBooking rentals/complaint

5 1.909091 91.333333

Spokane 77.69922772563946 %

revenue Wiegthing: 0.0

cars/cost Wiegthing: 43.630995726320194

salarie/employee Wiegthing: 0.00027601498103394336

advertisingCosts/advanceBooking Wiegthing: 0.14790340678234373

rentals/complaint Wiegthing: 0.0004816592962140379

site revenue cars/cost salarie/employee \

6 Richland 22100 0.026154 2416.666667

advertisingCosts/advanceBooking rentals/complaint

6 3.333333 39.3

Richland 99.99999999999999 %

revenue Wiegthing: 0.0

cars/cost Wiegthing: 38.23529411764706

salarie/employee Wiegthing: 0.0004137931034482759

advertisingCosts/advanceBooking Wiegthing: 0.0

rentals/complaint Wiegthing: 0.0

site revenue cars/cost salarie/employee \

7 WallaWalla 24000 0.010694 2571.428571

advertisingCosts/advanceBooking rentals/complaint

7 3.0 110.0

WallaWalla 54.72756191774597 %

revenue Wiegthing: 0.0

cars/cost Wiegthing: 0.0

salarie/employee Wiegthing: 0.0003888888888888887

advertisingCosts/advanceBooking Wiegthing: 0.0

rentals/complaint Wiegthing: 0.00497523290161327

site revenue cars/cost salarie/employee \

8 Olympia 99400 0.012766 2886.363636

advertisingCosts/advanceBooking rentals/complaint

8 1.010101 103.5

Olympia 76.22384529680726 %

revenue Wiegthing: 0.0

cars/cost Wiegthing: 43.49058231792318

salarie/employee Wiegthing: 0.00017881534534942785

advertisingCosts/advanceBooking Wiegthing: 0.4790351506640099

rentals/complaint Wiegthing: 0.0020003819300535523

site revenue cars/cost salarie/employee \

9 Portland 155000 0.014516 2845.945946

advertisingCosts/advanceBooking rentals/complaint

9 0.728155 104.477612

Portland 97.971253452706 %

revenue Wiegthing: 0.0

cars/cost Wiegthing: 50.705414700119555

salarie/employee Wiegthing: 0.00020847976176559957

advertisingCosts/advanceBooking Wiegthing: 0.5585042709428769

rentals/complaint Wiegthing: 0.0023322335530142806

site revenue cars/cost salarie/employee \

10 Pendleton 8220 0.014286 1625.0

advertisingCosts/advanceBooking rentals/complaint

10 3.333333 105.0

Pendleton 100.00000000000003 %

revenue Wiegthing: 0.0

cars/cost Wiegthing: 53.486746139530204

salarie/employee Wiegthing: 0.0006153846153846154

advertisingCosts/advanceBooking Wiegthing: 0.0

rentals/complaint Wiegthing: 0.0022467012055060968

DATA-Fourth Run Through:

```

site cars/cost salarie/employee \
0 Seattle-North 0.022857 3095.238095

advertisingCosts/advanceBooking revenue/rental rentals/complaint
0 1.132075 23.559557 50.84507
Seattle-North 99.99999999999997 %
cars/cost Wiegthing: 42.701390588765754
salarie/employee Wiegthing: 0.00027013418596750485
advertisingCosts/advanceBooking Wiegthing: 0.14475216614440142
revenue/rental Wiegthing: 0.0
rentals/complaint Wiegthing: 0.00047139702855642873

site cars/cost salarie/employee advertisingCosts/advanceBooking \
1 Sea-Tac 0.013789 2818.181818 0.648148

revenue/rental rentals/complaint
1 22.215321 107.333333
Sea-Tac 100.0 %
cars/cost Wiegthing: 0.0
salarie/employee Wiegthing: 0.0
advertisingCosts/advanceBooking Wiegthing: 1.542857142857143
revenue/rental Wiegthing: 0.0
rentals/complaint Wiegthing: 0.009316770186335404

site cars/cost salarie/employee advertisingCosts/advanceBooking \
2 Bellevue 0.018595 2733.333333 2.0

```

revenue/rental rentals/complaint

2 24.97561 82.0

Bellevue 81.011001571424 %

cars/cost Wiegthing: 41.54352650530161

salarie/employee Wiegthing: 0.000262809397071054

advertisingCosts/advanceBooking Wiegthing: 0.14082715733622622

revenue/rental Wiegthing: 0.0

rentals/complaint Wiegthing: 0.00045861492284765434

site cars/cost salarie/employee advertisingCosts/advanceBooking \

3 Ellensburg 0.011207 2500.0 1.935484

revenue/rental rentals/complaint

3 30.833333 150.0

Ellensburg 76.76073619631903 %

cars/cost Wiegthing: 0.0

salarie/employee Wiegthing: 0.0004

advertisingCosts/advanceBooking Wiegthing: 0.0

revenue/rental Wiegthing: 0.0

rentals/complaint Wiegthing: 0.005117382413087935

site cars/cost salarie/employee advertisingCosts/advanceBooking \

4 Vancouver 0.020842 2720.0 1.764706

revenue/rental rentals/complaint

4 185.480573 212.608696

Vancouver 100.0 %

cars/cost Wiegthing: 0.0

salarie/employee Wiegthing: 0.0003676470588235294

advertisingCosts/advanceBooking Wiegthing: 0.0

revenue/rental Wiegthing: 0.0053914002205071665

rentals/complaint Wiegthing: 0.0

site cars/cost salarie/employee advertisingCosts/advanceBooking \

5 Spokane 0.0168 2600.0 1.909091

revenue/rental rentals/complaint

5 22.554745 91.333333

Spokane 77.69922772563946 %

cars/cost Wiegthing: 43.630995726320194

salarie/employee Wiegthing: 0.00027601498103394336

advertisingCosts/advanceBooking Wiegthing: 0.14790340678234373

revenue/rental Wiegthing: 0.0

rentals/complaint Wiegthing: 0.0004816592962140379

site cars/cost salarie/employee advertisingCosts/advanceBooking \

6 Richland 0.026154 2416.666667 3.333333

revenue/rental rentals/complaint

6 28.117048 39.3

Richland 99.99999999999997 %

cars/cost Wiegthing: 35.647380009320926

salarie/employee Wiegthing: 0.0004137931034482759

advertisingCosts/advanceBooking Wiegthing: 0.0

revenue/rental Wiegthing: 0.0004911016521925594

rentals/complaint Wiegthing: 0.0013708798613486866

site cars/cost salarie/employee advertisingCosts/advanceBooking \
 7 WallaWalla 0.010694 2571.428571 3.0

revenue/rental rentals/complaint
 7 27.272727 110.0
 WallaWalla 54.72756191774597 %
 cars/cost Wiegthing: 0.0
 salarie/employee Wiegthing: 0.0003888888888888887
 advertisingCosts/advanceBooking Wiegthing: 0.0
 revenue/rental Wiegthing: 0.0
 rentals/complaint Wiegthing: 0.00497523290161327

site cars/cost salarie/employee advertisingCosts/advanceBooking \
 8 Olympia 0.012766 2886.363636 1.010101

revenue/rental rentals/complaint
 8 24.009662 103.5
 Olympia 76.22384529680726 %
 cars/cost Wiegthing: 43.49058231792318
 salarie/employee Wiegthing: 0.00017881534534942785
 advertisingCosts/advanceBooking Wiegthing: 0.4790351506640099
 revenue/rental Wiegthing: 0.0
 rentals/complaint Wiegthing: 0.0020003819300535523

site cars/cost salarie/employee advertisingCosts/advanceBooking \
 9 Portland 0.014516 2845.945946 0.728155

revenue/rental rentals/complaint
 9 22.142857 104.477612
 Portland 97.971253452706 %
 cars/cost Wiegthing: 50.705414700119555
 salarie/employee Wiegthing: 0.00020847976176559957
 advertisingCosts/advanceBooking Wiegthing: 0.5585042709428769
 revenue/rental Wiegthing: 0.0
 rentals/complaint Wiegthing: 0.0023322335530142806

site cars/cost salarie/employee advertisingCosts/advanceBooking \
 10 Pendleton 0.014286 1625.0 3.333333

revenue/rental rentals/complaint
 10 39.142857 105.0
 Pendleton 99.99999999999999 %
 cars/cost Wiegthing: 43.4175907970302
 salarie/employee Wiegthing: 0.0006153846153846154
 advertisingCosts/advanceBooking Wiegthing: 0.0
 revenue/rental Wiegthing: 0.0
 rentals/complaint Wiegthing: 0.003616654313329224

DATA-Fifth Run Through:

```

site cars/cost salarie/employee \
0 Seattle-North 0.022857 3095.238095

advertisingCosts/advanceBooking revenue/rental rentals/complaint
0 1.132075 23.559557 50.84507
Seattle-North 99.99999999999997 %
cars/cost Wiegthing: 42.701390588765754
salarie/employee Wiegthing: 0.00027013418596750485
advertisingCosts/advanceBooking Wiegthing: 0.14475216614440142
revenue/rental Wiegthing: 0.0
rentals/complaint Wiegthing: 0.00047139702855642873

site cars/cost salarie/employee advertisingCosts/advanceBooking \
1 Sea-Tac 0.013789 2818.181818 0.648148

revenue/rental rentals/complaint
1 22.215321 107.333333
Sea-Tac 100.0 %
cars/cost Wiegthing: 0.0
salarie/employee Wiegthing: 0.0
advertisingCosts/advanceBooking Wiegthing: 1.542857142857143
revenue/rental Wiegthing: 0.0
rentals/complaint Wiegthing: 0.009316770186335404

site cars/cost salarie/employee advertisingCosts/advanceBooking \
2 Bellevue 0.018595 2733.333333 2.0

```

revenue/rental rentals/complaint

2 24.97561 82.0

Bellevue 81.011001571424 %

cars/cost Wiegthing: 41.54352650530161

salarie/employee Wiegthing: 0.000262809397071054

advertisingCosts/advanceBooking Wiegthing: 0.14082715733622622

revenue/rental Wiegthing: 0.0

rentals/complaint Wiegthing: 0.00045861492284765434

site cars/cost salarie/employee advertisingCosts/advanceBooking \

3 Ellensburg 0.015517 2500.0 1.935484

revenue/rental rentals/complaint

3 30.833333 150.0

Ellensburg 79.32156362367031 %

cars/cost Wiegthing: 35.17405008021551

salarie/employee Wiegthing: 0.0003904219790326721

advertisingCosts/advanceBooking Wiegthing: 0.0123716104161319

revenue/rental Wiegthing: 0.0

rentals/complaint Wiegthing: 0.001649409405693659

site cars/cost salarie/employee advertisingCosts/advanceBooking \

4 Vancouver 0.020842 2720.0 1.764706

revenue/rental rentals/complaint

4 185.480573 212.608696

Vancouver 100.0 %

cars/cost Wiegthing: 0.0

salarie/employee Wiegthing: 0.0003676470588235294

advertisingCosts/advanceBooking Wiegthing: 0.0

revenue/rental Wiegthing: 0.0053914002205071665

rentals/complaint Wiegthing: 0.0

site cars/cost salarie/employee advertisingCosts/advanceBooking \

5 Spokane 0.0168 2600.0 1.909091

revenue/rental rentals/complaint

5 22.554745 91.333333

Spokane 77.69922772563946 %

cars/cost Wiegthing: 43.630995726320194

salarie/employee Wiegthing: 0.00027601498103394336

advertisingCosts/advanceBooking Wiegthing: 0.14790340678234373

revenue/rental Wiegthing: 0.0

rentals/complaint Wiegthing: 0.0004816592962140379

site cars/cost salarie/employee advertisingCosts/advanceBooking \

6 Richland 0.026154 2416.666667 3.333333

revenue/rental rentals/complaint

6 28.117048 39.3

Richland 99.99999999999997 %

cars/cost Wiegthing: 35.647380009320926

salarie/employee Wiegthing: 0.0004137931034482759

advertisingCosts/advanceBooking Wiegthing: 0.0

revenue/rental Wiegthing: 0.0004911016521925594

rentals/complaint Wiegthing: 0.0013708798613486866

site cars/cost salarie/employee advertisingCosts/advanceBooking \

7 WallaWalla 0.013889 2363.636364 3.0

revenue/rental rentals/complaint

7 27.272727 110.0

WallaWalla 69.79292408730744 %

cars/cost Wiegthing: 36.64229137728749

salarie/employee Wiegthing: 0.0004067190409744463

advertisingCosts/advanceBooking Wiegthing: 0.012888028323163516

revenue/rental Wiegthing: 0.0

rentals/complaint Wiegthing: 0.0017182593390876097

site cars/cost salarie/employee advertisingCosts/advanceBooking \

8 Olympia 0.012766 2886.363636 1.010101

revenue/rental rentals/complaint

8 24.009662 103.5

Olympia 76.22384529680718 %

cars/cost Wiegthing: 43.490582317923206

salarie/employee Wiegthing: 0.00017881534534942752

advertisingCosts/advanceBooking Wiegthing: 0.4790351506640108

revenue/rental Wiegthing: 0.0

rentals/complaint Wiegthing: 0.002000381930053541

site cars/cost salarie/employee advertisingCosts/advanceBooking \

9 Portland 0.014516 2845.945946 0.728155

revenue/rental rentals/complaint
 9 22.142857 104.477612
 Portland 97.971253452706 %
 cars/cost Wiegthing: 50.705414700119555
 salarie/employee Wiegthing: 0.00020847976176559957
 advertisingCosts/advanceBooking Wiegthing: 0.5585042709428769
 revenue/rental Wiegthing: 0.0
 rentals/complaint Wiegthing: 0.0023322335530142806

site cars/cost salarie/employee advertisingCosts/advanceBooking \
 10 Pendleton 0.014286 1625.0 3.333333

revenue/rental rentals/complaint
 10 39.142857 105.0
 Pendleton 99.99999999999999 %
 cars/cost Wiegthing: 43.4175907970302
 salarie/employee Wiegthing: 0.0006153846153846154
 advertisingCosts/advanceBooking Wiegthing: 0.0
 revenue/rental Wiegthing: 0.0
 rentals/complaint Wiegthing: 0.003616654313329224

DATA-Sixth Run Through:

site cars/cost salarie/employee \

0 Seattle-North 0.022857 3095.238095

advertisingCosts/advanceBooking revenue/rental rentals/complaint

0 1.132075 23.559557 50.84507

Seattle-North 100.0 %

cars/cost Wiegthing: 41.90623846674212

salarie/employee Wiegthing: 0.0002645283721274186

advertisingCosts/advanceBooking Wiegthing: 0.16007917303257377

revenue/rental Wiegthing: 0.0

rentals/complaint Wiegthing: 0.0008288536215991126

site cars/cost salarie/employee advertisingCosts/advanceBooking \

1 Sea-Tac 0.010526 2818.181818 0.648148

revenue/rental rentals/complaint

1 22.215321 107.333333

Sea-Tac 100.0 %

cars/cost Wiegthing: 0.0

salarie/employee Wiegthing: 0.0

advertisingCosts/advanceBooking Wiegthing: 1.542857142857143

revenue/rental Wiegthing: 0.0

rentals/complaint Wiegthing: 0.009316770186335404

site cars/cost salarie/employee advertisingCosts/advanceBooking \

2 Bellevue 0.022727 2647.058824 2.0

revenue/rental rentals/complaint

2 24.97561 82.0

Bellevue 100.0 %

cars/cost Wiegthing: 41.393616775468686

salarie/employee Wiegthing: 0.00027851987356452776

advertisingCosts/advanceBooking Wiegthing: 0.13137075557636035

revenue/rental Wiegthing: 0.0

rentals/complaint Wiegthing: 0.0007223900289720926

site cars/cost salarie/employee advertisingCosts/advanceBooking \

3 Ellensburg 0.018103 2166.666667 1.935484

revenue/rental rentals/complaint

3 30.833333 150.0

Ellensburg 100.0 %

cars/cost Wiegthing: 21.74836360317751

salarie/employee Wiegthing: 0.0004615384615384616

advertisingCosts/advanceBooking Wiegthing: 0.0

revenue/rental Wiegthing: 0.0

rentals/complaint Wiegthing: 0.0040418641628348975

site cars/cost salarie/employee advertisingCosts/advanceBooking \

4 Vancouver 0.018211 2720.0 1.764706

revenue/rental rentals/complaint

4 185.480573 212.608696

Vancouver 100.0 %

cars/cost Wiegthing: 0.0

salarie/employee Wiegthing: 0.0003676470588235294

advertisingCosts/advanceBooking Wiegthing: 0.0

revenue/rental Wiegthing: 0.0053914002205071665

rentals/complaint Wiegthing: 0.0

site cars/cost salarie/employee advertisingCosts/advanceBooking \

5 Spokane 0.01968 2300.0 1.909091

revenue/rental rentals/complaint

5 22.554745 91.333333

Spokane 98.78956423324871 %

cars/cost Wiegthing: 46.436925835397275

salarie/employee Wiegthing: 0.0003124541347173392

advertisingCosts/advanceBooking Wiegthing: 0.1473766853167294

revenue/rental Wiegthing: 0.0

rentals/complaint Wiegthing: 0.0008104044732686365

site cars/cost salarie/employee advertisingCosts/advanceBooking \

6 Richland 0.026154 2416.666667 3.333333

revenue/rental rentals/complaint

6 28.117048 39.3

Richland 99.99999999999999 %

cars/cost Wiegthing: 35.45383824426836

salarie/employee Wiegthing: 0.0004137931034482759

advertisingCosts/advanceBooking Wiegthing: 0.0

revenue/rental Wiegthing: 0.002587247711805508

rentals/complaint Wiegthing: 0.0

site cars/cost salarie/employee advertisingCosts/advanceBooking \
 7 WallaWalla 0.017361 2000.0 3.0

revenue/rental rentals/complaint
 7 27.272727 110.0
 WallaWalla 96.26856056103318 %
 cars/cost Wiegthing: 43.200320466103655
 salarie/employee Wiegthing: 0.0004871736143213496
 advertisingCosts/advanceBooking Wiegthing: 0.008550923785766952
 revenue/rental Wiegthing: 0.0
 rentals/complaint Wiegthing: 0.0019334549269336262

site cars/cost salarie/employee advertisingCosts/advanceBooking \
 8 Olympia 0.014043 2537.037037 1.010101

revenue/rental rentals/complaint
 8 24.009662 103.5
 Olympia 92.76047107721598 %
 cars/cost Wiegthing: 44.584144061240146
 salarie/employee Wiegthing: 0.00018440072834744012
 advertisingCosts/advanceBooking Wiegthing: 0.5268468373006795
 revenue/rental Wiegthing: 0.0
 rentals/complaint Wiegthing: 0.0029133284666200045

site cars/cost salarie/employee advertisingCosts/advanceBooking \
 9 Portland 0.013548 2845.945946 0.728155

revenue/rental rentals/complaint
 9 22.142857 104.477612
 Portland 100.0 %
 cars/cost Wiegthing: 27.464419239679692
 salarie/employee Wiegthing: 0.0001545587451191435
 advertisingCosts/advanceBooking Wiegthing: 0.769250921193615
 revenue/rental Wiegthing: 0.0
 rentals/complaint Wiegthing: 0.006009913560347528

site cars/cost salarie/employee advertisingCosts/advanceBooking \
 10 Pendleton 0.014286 1625.0 3.333333

revenue/rental rentals/complaint
 10 39.142857 105.0
 Pendleton 100.0 %
 cars/cost Wiegthing: 36.839020551893775
 salarie/employee Wiegthing: 0.0006153846153846154
 advertisingCosts/advanceBooking Wiegthing: 0.0
 revenue/rental Wiegthing: 0.00041198478623162386
 rentals/complaint Wiegthing: 0.004358114439977086

Final Code Used:

```

import numpy as np
import scipy.optimize as opt
import pandas as pd

pd.set_option('display.max_columns', None)

raw_data = pd.read_csv("math464_data_file.csv")
print(raw_data)
#[site, fleet, employees, salaries, maintenanceCosts, advertizingCosts, rentals, revenue, advanceBookings, Complaints]

def relativising_data(pandas_data):
    #car per cost, salaries per employee, advertising costs per advance
    booking, and rental per complaint
    pandas_data['cars/cost'] = pandas_data.apply(lambda row: row.fleet /
row.maintenanceCosts, axis = 1)
    pandas_data.drop('maintenanceCosts', inplace = True, axis = 1)
    pandas_data.drop('fleet', inplace = True, axis = 1)

    pandas_data['salarie/employee'] = pandas_data.apply(lambda row:
row.salaries / row.employees, axis = 1)
    pandas_data.drop('salaries', inplace = True, axis = 1)
    pandas_data.drop('employees', inplace = True, axis = 1)

    pandas_data['advertisingCosts/advanceBooking'] = pandas_data.apply(lambda
row: row.advertizingCosts / row.advanceBookings, axis = 1)
    pandas_data.drop('advertizingCosts', inplace = True, axis = 1)
    pandas_data.drop('advanceBookings', inplace = True, axis = 1)

    pandas_data['revenue/rental'] = pandas_data.apply(lambda row: row.revenue
/ row.rentals, axis = 1)
    pandas_data.drop('revenue', inplace = True, axis = 1)

    pandas_data['rentals/complaint'] = pandas_data.apply(lambda row:
row.rentals / row.Complaints, axis = 1)
    pandas_data.drop('Complaints', inplace = True, axis = 1)
    pandas_data.drop('rentals', inplace = True, axis = 1)

    print(pandas_data.columns)
    return pandas_data

#revenue is a positive and everything else is a negative
#[ 'site', 'revenue', 'costs/car', 'salarie/employee',
'advertisingCosts/advanceBooking', 'complaints/rental']

def remove_site(data_frame):
    new_data_frame = data_frame.copy()
    new_data_frame.drop('site', inplace = True, axis = 1)
    return new_data_frame

def negate(x):
    return -x

def negate_denom(data_frame):

```

```

    #denominator = ['costs/car', 'salarie/employee',
'advertisingCosts/advanceBooking', 'complaints/rental']
    data_frame['salarie/employee'] =
data_frame['salarie/employee'].apply(negate)
    data_frame['advertisingCosts/advanceBooking'] =
data_frame['advertisingCosts/advanceBooking'].apply(negate)
    return data_frame

def grab_site_data(data_frame, site):
    site_data_frame = data_frame[data_frame['site'] == site].copy()
    return site_data_frame

def relative_lp_site(data_frame, site):
    site_data = grab_site_data(data_frame, site)
    #proper pd.data_frame good...
    return site_data

def create_site_array(data_frame):
    site_array = data_frame['site'].copy()
    site_array = site_array.to_numpy()
    return site_array

def negate_copy(data_frame):
    columns = data_frame.columns

    temp = data_frame.copy()
    for item in columns:

        if(item != 'site'):
            temp[item] = temp[item].apply(negate)
    return temp

def clear_denom(data_frame):
    site_data = data_frame.copy()
    #numerator = 'costs/car', 'salarie/employee',
'advertisingCosts/advanceBooking', 'complaints/rental'
    for x in site_data:
        #print(x) #x is name of column
        if(x != 'revenue/rental' and x != 'rentals/complaint' and x !=
'cars/cost'):

            if(x == 'site'):
                site_data.drop(x, inplace = True, axis = 1)
            else:
                site_data[x] = 0
    return site_data

def clear_numer(data_frame):
    data_frame['revenue/rental'] = 0
    data_frame['rentals/complaint'] = 0
    data_frame['cars/cost'] = 0
    return data_frame

def combine_matrix(everything_array, site_array):
    """
    the everything array will have an answer <=0
    the site array will have an answer == 1

```

```

will need to remove 'site' from the data
"""

temp1 = everything_array.copy()

temp2 = site_array.copy()

temp1.insert(0, "answer", 0)
temp2.insert(0, "answer", 1)

temp3 = temp2.copy()
# #proceed to negate all terms in temp 3
temp3 = negate_copy(temp3)

output = pd.concat([temp1, temp2, temp3])
return output

def print_weighting_per_item(current_site, result_array):
    item = current_site.columns
    x = 0
    for y in item:
        if y != 'site':
            print(y, "\tWieghting:", result_array[x])
            x += 1
    print("\n")
    return

def data_loop(data_frame):
    site_array = create_site_array(data_frame)
    print("\nstarting data loop\n\n")
    for site in site_array:
        #run program that uses data_frame and site and returns lp result
        current_site = relative_lp_site(data_frame, site)
        print(current_site)
        matrix_A = data_frame.copy()
        matrix_A = negate_denom(matrix_A) #this sets up the majority
        temp = current_site.copy()
        temp = clear_numer(temp)

        matrix_A = combine_matrix(matrix_A, temp) #mixes the necessary bits
        matrix_A.drop('site', inplace = True, axis=1) #removes the 'site'
column
        matrix_B = matrix_A['answer'] #copies the answer column
        matrix_A.drop('answer', inplace = True, axis = 1) #removes the answer
column from matrix_A
        matrix_C = current_site.copy() #next need to create matrix_C
        matrix_C = clear_denom(matrix_C)
        #next need to make them convert to numpy arrays
        matrix_A = matrix_A.to_numpy()
        matrix_B = matrix_B.to_numpy()
        matrix_C = matrix_C.to_numpy() #may need an additional transform...
        matrix_C = matrix_C.flatten() #change from 2d array to 1d array

        result = opt.linprog(-matrix_C, matrix_A, matrix_B, None, None,
bounds=(0, None)) #currently maximized

```

```

        #don't know how to generate the bounds for this... since I DON'T want
        to hard-code a set (right now)
        print(site, "\t", -result['fun']*100,"%")
        print_weighting_per_item(current_site, result['x'])

    print("\n\nend data loop\n\n")
    return

def adding_employee(pandas_data, site, employee_increase, salary):
    temp = pandas_data.copy()
    print("changing values")
    print("site:", site)
    print("employee increase:", employee_increase)
    print("salary per employee:", salary)
    #location = temp['site'] == site
    temp.loc[temp['site'] == site, ['employees']] += employee_increase
    temp.loc[temp['site'] == site, ['salaries']] += employee_increase *
    salary
    return temp

def adding_car(pandas_data, site, ammount):
    temp = pandas_data.copy()
    print("changing values")
    print("site:", site)
    print("fleet increase:", ammount)
    temp_val = temp.loc[temp['site'] == site, ['fleet']]
    temp_val = temp_val + ammount
    temp.loc[temp['site'] == site, ['fleet']] = temp_val
    return temp

"""
#does not work therefore had to hard code in my values
def moving_cars(pandas_data, site_give, site_take, count):
    temp = pandas_data.copy()
    #temp = adding_car(pandas_data, site_take, ammount = count)#dead line?
    print("Exchange between", site_give, "and", site_take, "of", count)
    temp = adding_car(pandas_data, site_take, ammount = count)
    temp = adding_car(pandas_data, site_give, ammount = -count) #yes it was
    necessary
    temp = adding_car(pandas_data, site_take, ammount = count)
    return temp
"""

def data_changes(pandas_data):
    temp = pandas_data.copy()
    print("changing WallaWalla")
    temp = adding_employee(temp, 'WallaWalla', 4, 1000)
    #temp = moving_cars(temp, 'Sea-Tac', 'WallaWalla', 48)
    temp = adding_car(temp, 'WallaWalla', 48)
    temp = adding_car(temp, 'Sea-Tac', -48)
    print("changing Ellensburg")
    temp = adding_employee(temp, 'Ellensburg', 3, 1500)
    temp = adding_car(temp, 'Ellensburg', 40)
    temp = adding_car(temp, 'Sea-Tac', -40)
    print("changing Spokane")
    temp = adding_employee(temp, 'Spokane', 5, 1100)
    temp = adding_car(temp, 'Spokane', 36)

```

```
temp = adding_car(temp, 'Sea-Tac', -36)
print("changing Olympia")
temp = adding_employee(temp, 'Olympia', 5, 1000)
temp = adding_car(temp, 'Olympia', 30)
temp = adding_car(temp, 'Portland', -30)
print("changing Bellevue")
temp = adding_employee(temp, 'Bellevue', 2, 2000)
temp = adding_car(temp, 'Bellevue', 50)
temp = adding_car(temp, 'Vancouver', -50)

return temp
raw_data = data_changes(raw_data)
print(raw_data)

raw_data = relativising_data(raw_data)
print(raw_data)

data_loop(raw_data)
```


DATA-Original Data Used:

site	fleet	employees	salaries	maintenanceCosts
Seattle-North	320	21	65000	14000
Sea-Tac	524	55	155000	38000
Bellevue	225	15	41000	12100
Ellensburg	65	6	15000	5800
Vancouver	396	25	68000	19000
Spokane	210	20	52000	12500
Richland	102	6	14500	3900
WallaWalla	77	7	18000	7200
Olympia	300	22	63500	23500
Portland	450	37	105300	31000
Pendleton	50	4	6500	3500

advertizingCosts	rentals	revenue	advanceBookings	Complaints
1200	3610	85050	1060	71
3500	9660	214600	5400	90
1200	2050	51200	600	25
300	600	18500	155	4
1500	4890	907000	850	23
2100	2740	61800	1100	30
300	786	22100	90	20
300	880	24000	100	8
1000	4140	99400	990	40
3000	7000	155000	4120	67
300	210	8220	90	2