

Overview:

- Pages 2-7 are runs from last time and some new ones with the same tables/graphs as last report
- Pages 8-9 are graphs of the price/performance values of the runs from the previous pages
- Page 10 has a graph of non participating customers in the previous runs and two more runs that have shifted prices
- Pages 11-13 are charts that show the relationship between profit and number of customers
- Pages 14-15 are my observations and plans for next week

\*\*All of this is looking at what happens when the two companies have the same performance value set, but different price sets that only vary by 0.5

Run 1:

--Asynchronous

--1,000 theta values from [0,1) that are uniformly distributed

--performancesA = [0.5, 1, 1.5, 2, 2.5, 3, 3.5, 4, 4.5, 5]

--pricesA = [1, 2, 3, 4, 5, 6, 7, 8, 9, 10]

--performancesB = performancesA

--pricesB = [1.5, 2.5, 3.5, 4.5, 5.5, 6.5, 7.5, 8.5, 9.5, 10.5]

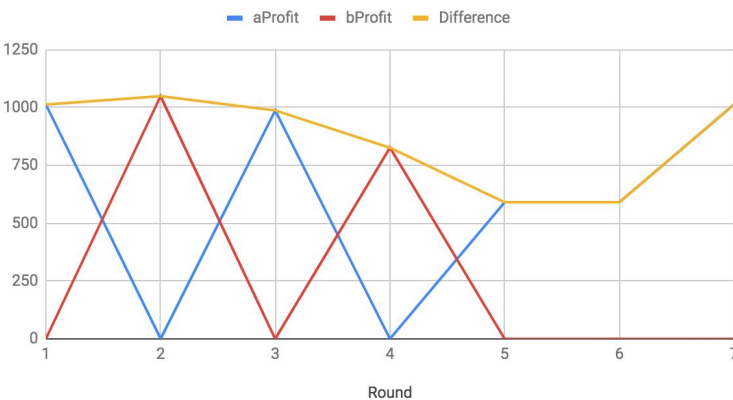
\*Note: Same performances, B's prices are 0.5 higher

Round	A Perform	A Price	B Perform	B Price	A Cost	A Profit	B Cost	B Profit	A Num C	B Num C	Non Parti
1	5	3	0	0	184.0475	1012.9525	0	0	399	0	601
2	5	3	5	2.5	0	0	198.2927	1049.2073	0	499	501
3	5	2	5	2.5	210.7405	2240306	0	0	599	0	401
4	5	2	5	1.5	0	0	221.8702	826.6298	0	699	301
5	4.5	1	5	1.5	186.1652	590.8347	0	0	777	0	223
6	4.5	1	0.5	1.5	186.1652	590.8347	0	0	777	0	223
7	5	3	0.5	1.5	184.0475	1012.9525	0	0	399	0	601

\*weird glitch in A Profit for round three: checked the actual document this is from and it's 987.259042240306 and for some reason is not showing the left side of the number



\*\*This graph plots the number of customers of A (blue), number of customers of B (red), A's profit (yellow), B's profit (green) over the three rounds.



\*\*This graph plots A's profit (blue), B's profit (red), and the difference between the two profits (yellow) over the three rounds.

Run 2:

--Asynchronous

--1,000 theta values from [0,1) that are uniformly distributed

--performancesA = [1, 2, 3, 4, 5, 6, 7, 8, 9, 10]

--pricesA = [1, 2, 3, 4, 5, 6, 7, 8, 9, 10]

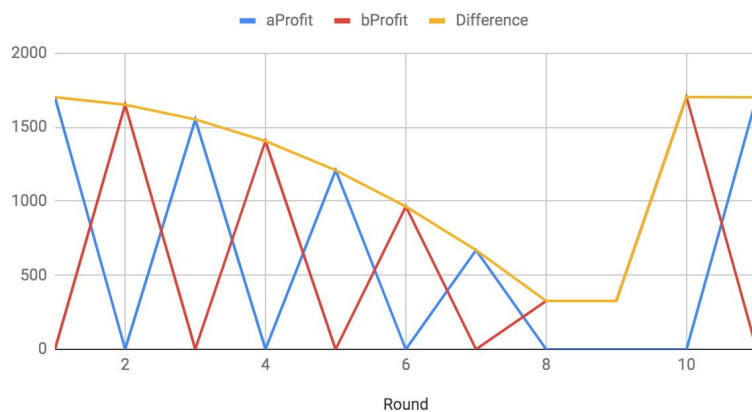
--performancesB = performancesA

--pricesB = [1.5, 2.5, 3.5, 4.5, 5.5, 6.5, 7.5, 8.5, 9.5, 10.5]

Round	A Perform	A Price	B Perform	B Price	A Cost	A Profit	B Cost	B Profit	A Num C	B Num C	Non Parti
1	10	5	0	0	793.1710	1701.828	0	0	499	0	501
2	10	5	10	4.5	0	0	818.8244	1651.675	0	549	451
3	10	4	10	4.5	842.9638	1553.036	0	0	599	0	401
4	10	4	10	3.5	0	0	865.7946	1405.705	0	649	351
5	10	3	10	3.5	887.4809	1209.519	0	0	699	0	301
6	10	3	10	2.5	0	0	908.1563	964.3436	0	749	251
7	10	2	10	2.5	927.9308	670.0691	0	0	799	0	201
8	10	2	10	1.5	0	0	946.8966	326.6033	0	849	151
9	1	1	10	1.5	0	0	946.8966	326.6033	0	849	151
10	1	1	10	5.5	0	0	765.7413	1703.758	0	449	551
11	10	5	10	5.5	793.1710	1701.828	0	0	499	0	501



\*\*This graph plots the number of customers of A (blue), number of customers of B (red), A's profit (yellow), B's profit (green) over the three rounds.



\*\*This graph plots A's profit (blue), B's profit (red), and the difference between the two profits (yellow) over the three rounds.

Run 3:

--Asynchronous

--1,000 theta values from [0,1) that are uniformly distributed

--performancesA = [5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15]

--pricesA = [1, 2, 3, 4, 5, 6, 7, 8, 9, 10]

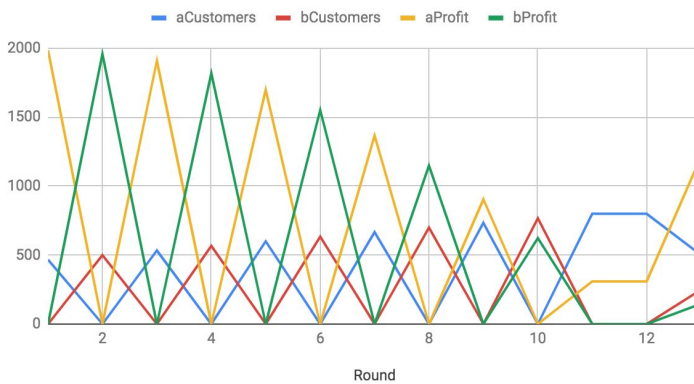
--performancesB = performancesA

--pricesB = [1.5, 2.5, 3.5, 4.5, 5.5, 6.5, 7.5, 8.5, 9.5, 10.5]

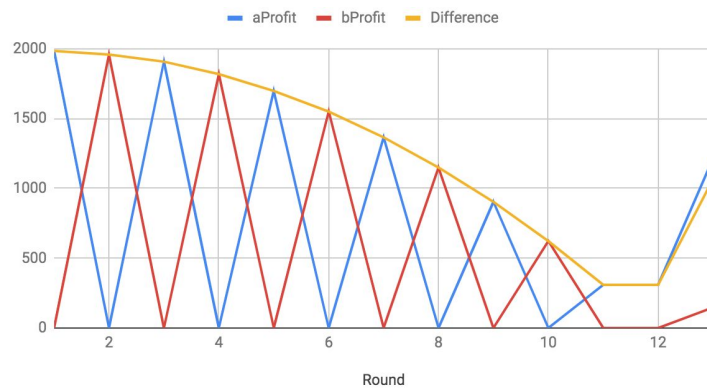
Round	A Perform	A Price	B Perform	B Price	A Cost	A Profit	B Cost	B Profit	A Num C	B Num C	Non Parti
1	15	8	0	0	1744.39	1983.60	0	0	466	0	534
2	15	8	15	7.5	0	0	1784.63	1957.86	0	499	501
3	15	7	15	7.5	1824.28	1906.71	0	0	533	0	467
4	15	7	15	6.5	0	0	1861.17	1817.82	0	566	434
5	15	6	15	6.5	1896.66	1697.33	0	0	599	0	401
6	15	6	15	5.5	0	0	1931.89	1549.60	0	633	367
7	15	5	15	5.5	1964.90	1365.09	0	0	666	0	334
8	15	5	15	4.5	0	0	1996.83	1148.66	0	699	301
9	15	4	15	4.5	2028.69	9757254	0	0	733	0	267
10	15	4	15	3.5	0	0	2058.69	4276223	0	766	234
11	15	3	15	3.5	2087.84	309.155	0	0	799	0	201
12	15	3	6	1.5	2087.84	309.155	0	0	799	0	201
13	15	6	6	1.5	1785.82	1214.17	226.483	147.016	500	249	251

\*A Profit for round nine: checked the actual document this is from and it's 903.303049757254

B Profit for round ten: 622.304534276223



\*\*This graph plots the number of customers of A (blue), number of customers of B (red), A's profit (yellow), B's profit (green) over the three rounds.



\*\*This graph plots A's profit (blue), B's profit (red), and the difference between the two profits (yellow) over the three rounds.

Run 4:

--Asynchronous

--1,000 theta values from [0,1) that are uniformly distributed

--performancesA = [10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20]

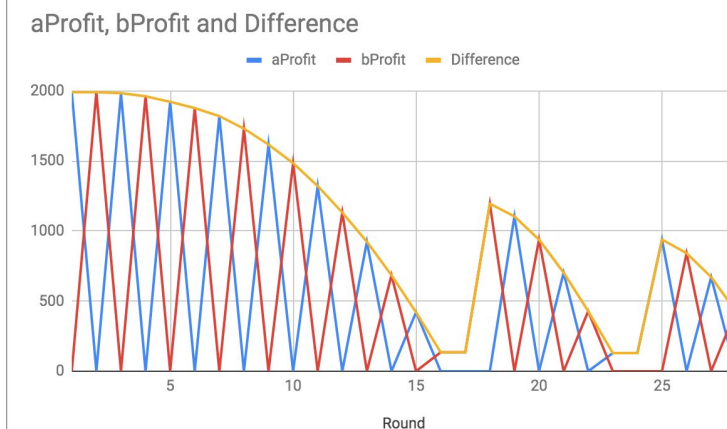
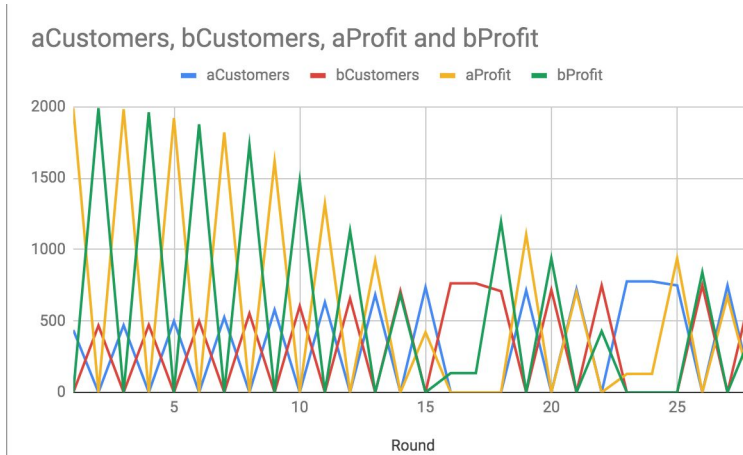
--pricesA = [1, 2, 3, 4, 5, 6, 7, 8, 9, 10]

--performancesB = performancesA

--pricesB = [1.5, 2.5, 3.5, 4.5, 5.5, 6.5, 7.5, 8.5, 9.5, 10.5]

Round	A Perform	A Price	B Perform	B Price	A Cost	A Profit	B Cost	B Profit	A Num C	B Num C	Non Part
1	16	9	0	0	1942.67	1990.32	0	0	437	0	563
2	16	9	16	8.5	0	0	1987.56	1990.43	0	468	532
3	17	9	16	8.5	2246.96	1983.03	0	0	470	0	530
4	17	9	18	9.5	0	0	2522.66	1961.33	0	472	528
5	18	9	18	9.5	2569.87	1921.12	0	0	499	0	501
6	18	9	19	9.5	0	0	2863.34	1877.15	0	499	501
7	19	9	19	9.5	2914.08	1819.91	0	0	526	0	474
8	19	9	19	8.5	0	0	2961.33	1730.66	0	552	448
9	19	8	19	8.5	3007.11	1616.88	0	0	578	0	422
10	19	8	19	7.5	0	0	3053.22	1484.27	0	605	395
11	19	7	19	7.5	3096.35	1320.64	0	0	631	0	369
12	19	7	19	6.5	0	0	3138.30	1132.19	0	657	343
13	19	6	19	6.5	3180.72	923.27	0	0	684	0	316
14	19	6	19	5.5	0	0	3220.52	684.47	0	710	290
15	19	5	19	5.5	3259.36	420.63	0	0	736	0	264
16	19	5	19	4.5	0	0	3298.74	134.75	0	763	237
17	10	3	19	4.5	0	0	3298.74	134.75	0	763	237
18	10	3	12	3.5	0	0	1283.43	1194.56	0	708	292
19	14	4	12	3.5	1751.81	1104.18	0	0	714	0	286
20	14	4	16	4.5	0	0	2292.35	938.64	0	718	282
21	18	5	16	4.5	2906.63	703.36	0	0	722	0	278
22	18	5	18	4.5	0	0	2942.42	428.07	0	749	251
23	18	4	18	4.5	2978.64	129.35	0	0	777	0	223
24	18	4	10	2.5	2978.64	129.35	0	0	777	0	223
25	12	3	10	2.5	1307.74	939.25	0	0	749	0	251
26	12	3	14	3.5	0	0	1779.98	841.51	0	749	251
27	16	4	14	3.5	2324.88	0670397	0	0	749	0	251
28	16	4	18	4.5	0	0	2942.42	428.07	0	749	251

\*A Profit Round 27 = 671.11984067039



Run 5:

--Asynchronous

--1,000 theta values from [0,1) that are uniformly distributed

--performancesA = [15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25]

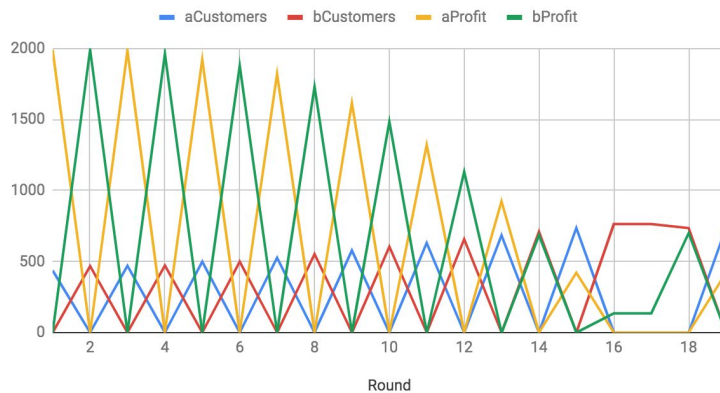
--pricesA = [1, 2, 3, 4, 5, 6, 7, 8, 9, 10]

--performancesB = performancesA

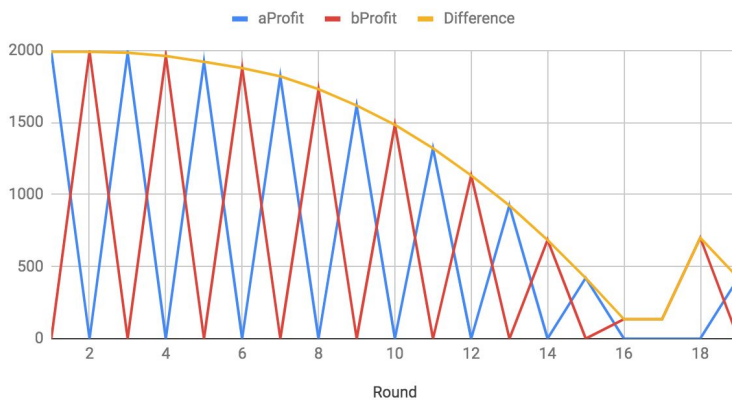
--pricesB = [1.5, 2.5, 3.5, 4.5, 5.5, 6.5, 7.5, 8.5, 9.5, 10.5]

Round	A Perform	A Price	B Perform	B Price	A Cost	A Profit	B Cost	B Profit	A Num C	B Num C	Non Parti
1	16	9	0	0	1942.67	1990.32	0	0	437	0	563
2	16	9	16	8.5	0	0	1987.56	1990.43	0	468	532
3	17	9	16	8.5	2246.96	1983.03	0	0	470	0	530
4	17	9	18	9.5	0	0	2522.66	1961.33	0	472	528
5	18	9	18	9.5	2569.87	1921.12	0	0	499	0	501
6	18	9	19	9.5	0	0	2863.34	1877.15	0	499	501
7	19	9	19	9.5	2914.08	1819.91	0	0	526	0	474
8	19	9	19	8.5	0	0	2961.33	1730.66	0	552	448
9	19	8	19	8.5	3007.11	1616.88	0	0	578	0	422
10	19	8	19	7.5	0	0	3053.22	1484.27	0	605	395
11	19	7	19	7.5	3096.35	1320.64	0	0	631	0	369
12	19	7	19	6.5	0	0	3138.30	1132.19	0	657	343
13	19	6	19	6.5	3180.72	923.27	0	0	684	0	316
14	19	6	19	5.5	0	0	3220.52	684.47	0	710	290
15	19	5	19	5.5	3259.36	420.63	0	0	736	0	264
16	19	5	19	4.5	0	0	3298.74	134.75	0	763	237
17	15	4	19	4.5	0	0	3298.74	134.75	0	763	237
18	15	4	17	4.5	0	0	1453455	699.38	0	735	265
19	19	5	17	4.5	3259.36	420.63	0	0	736	0	264

aCustomers, bCustomers, aProfit and bProfit



aProfit, bProfit and Difference



Run 6:

--Asynchronous

--1,000 theta values from [0,1) that are uniformly distributed

--performancesA = [21, 22, 23, 24, 25, 26, 27, 28, 29, 30]

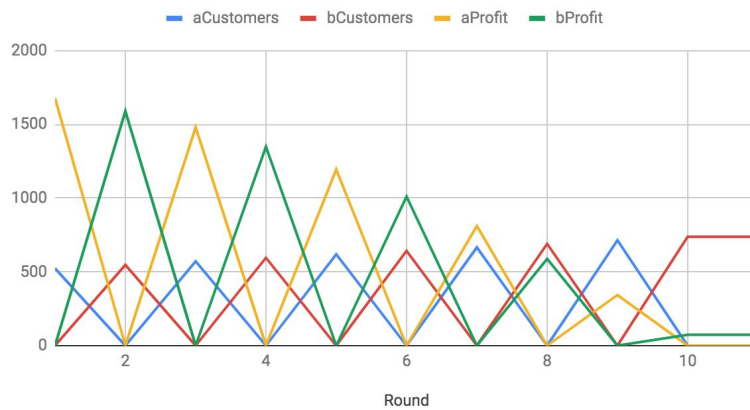
--pricesA = [1, 2, 3, 4, 5, 6, 7, 8, 9, 10]

--performancesB = performancesA

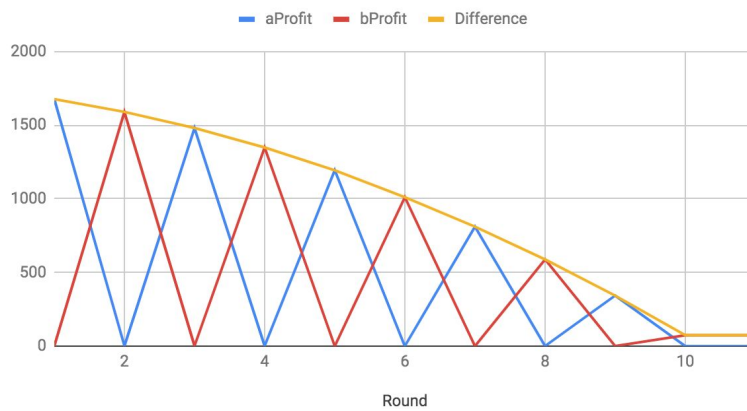
--pricesB = [1.5, 2.5, 3.5, 4.5, 5.5, 6.5, 7.5, 8.5, 9.5, 10.5]

Round	A Perform	A Price	B Perform	B Price	A Cost	A Profit	B Cost	B Profit	A Num C	B Num C	Non Parti
1	21	10	0	0	3553.086	1676.913	0	0	523	0	477
2	21	10	21	9.5	0	0	3606.625	1589.874	0	547	453
3	21	9	21	9.5	3658.615	1480.384	0	0	571	0	429
4	21	9	21	8.5	0	0	3709.177	1348.322	0	595	405
5	21	8	21	8.5	3758.392	1193.607	0	0	619	0	381
6	21	8	21	7.5	0	0	3804.377	1010.622	0	642	358
7	21	7	21	7.5	3851.205	810.7947	0	0	666	0	334
8	21	7	21	6.5	0	0	3896.921	588.0788	0	690	310
9	21	6	21	6.5	3941.588	342.4110	0	0	714	0	286
10	21	6	21	5.5	0	0	3985.266	73.73342	0	738	262

aCustomers, bCustomers, aProfit and bProfit

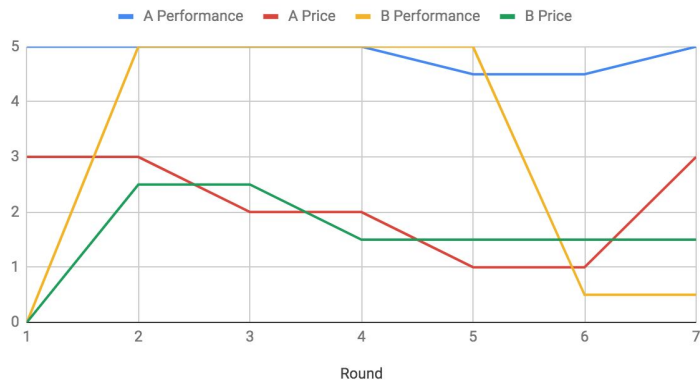


aProfit, bProfit and Difference



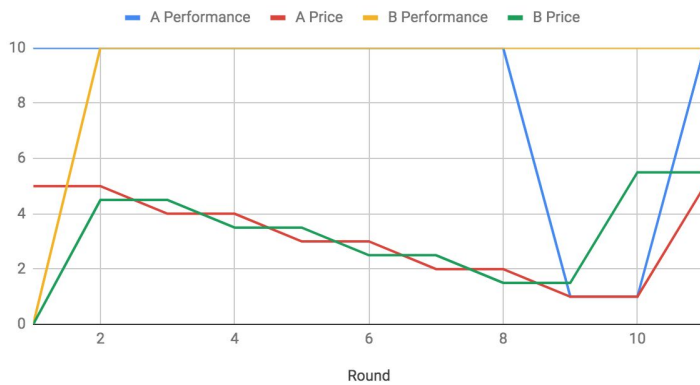
### Run 1:

A Performance, A Price, B Performance and B Price



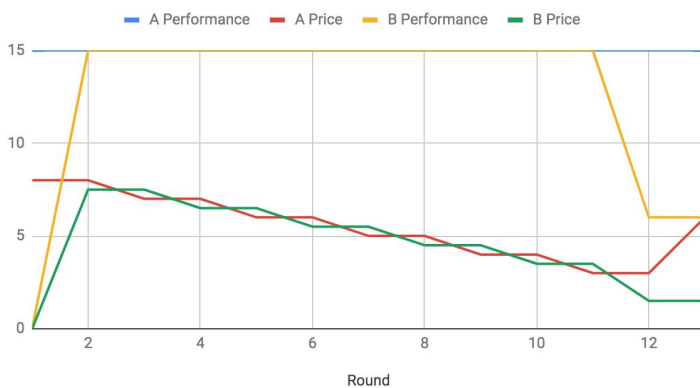
### Run 2:

A Performance, A Price, B Performance and B Price



### Run 3:

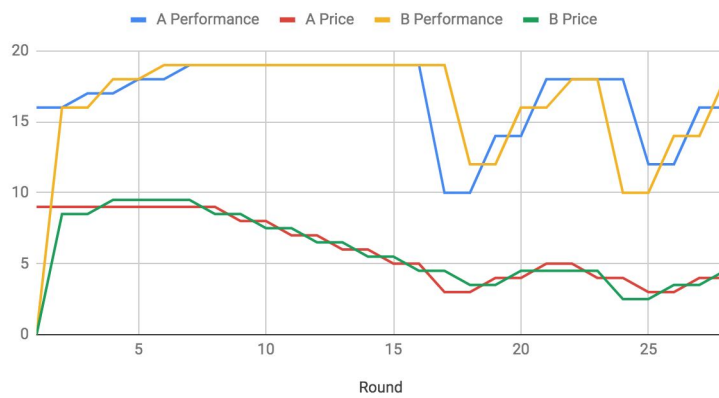
A Performance, A Price, B Performance and B Price





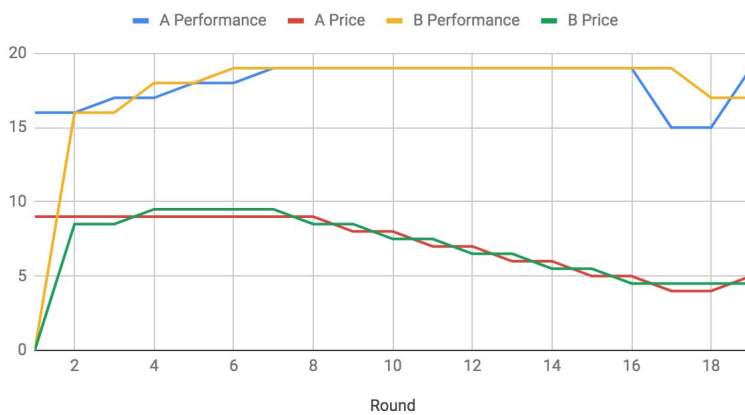
#### Run 4:

A Performance, A Price, B Performance and B Price



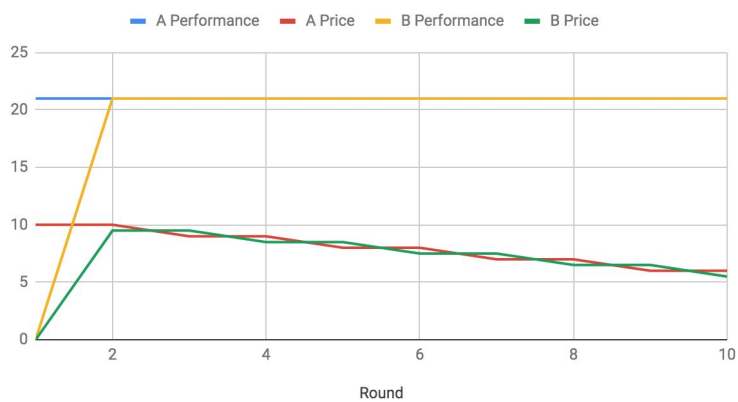
#### Run 5:

A Performance, A Price, B Performance and B Price

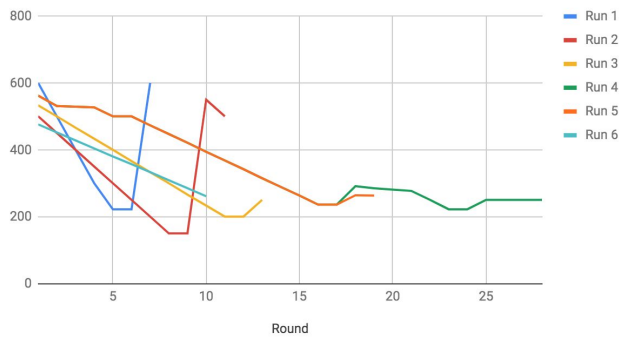


#### Run 6:

A Performance, A Price, B Performance and B Price



Number of Non Participating Customers



Run 7:

--Asynchronous

--1,000 theta values from [0,1) that are uniformly distributed

performancesA = [15, 16, 17, 18, 19, 20, 21, 22, 23, 24]

pricesA = [5, 6, 7, 8, 9, 10, 11, 12, 13, 14]

performancesB = performancesA

pricesB = [5.5, 6.5, 7.5, 8.5, 9.5, 10.5, 11.5, 12.5, 13.5, 14.5]

Round	A Perform	A Price	B Perform	B Price	A Cost	A Profit	B Cost	B Profit	A Num C	B Num C	Non Parti
1	16	9	0	0	1942.67	1990.32	0	0	437	0	563
2	16	9	16	8.5	0	0	1987.56	1990.43	0	468	532
3	17	9	16	8.5	2246.96	1983.03	0	0	470	0	530
4	17	9	18	9.5	0	0	2522.66	1961.33	0	472	528
5	18	9	18	9.5	2569.87	1921.12	0	0	499	0	501
6	18	9	19	9.5	0	0	2863.34	1877.15	0	499	501
7	19	9	19	9.5	2914.08	1819.91	0	0	526	0	474
8	19	9	19	8.5	0	0	2961.33	1730.66	0	552	448
9	19	8	19	8.5	3007.11	1616.88	0	0	578	0	422
10	19	8	19	7.5	0	0	3053.22	1484.27	0	605	395
11	19	7	19	7.5	3096.35	1320.64	0	0	631	0	369
12	19	7	19	6.5	0	0	3138.30	1132.19	0	657	343
13	19	6	19	6.5	3180.72	923.27	0	0	684	0	316
14	19	6	19	5.5	0	0	3220.52	684.47	0	710	290
15	19	5	19	5.5	3259.36	420.63	0	0	736	0	264
16	19	5	21	5.5	0	0	3985.26	73.73	0	738	262
17	15	5	21	5.5	0	0	3985.26	73.73	0	738	262
18	15	5	17	5.5	0	0	2536.37	1181.62	0	676	324
19	17	5	17	5.5	0091606	952.86	0	0	705	0	295
20	17	5	19	5.5	0	0	3220.52	684.47	0	710	290

Run 8:

--Asynchronous

--1,000 theta values from [0,1) that are uniformly distributed

performancesA = [10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20]

pricesA = [5, 6, 7, 8, 9, 10, 11, 12, 13, 14]

performancesB = performancesA

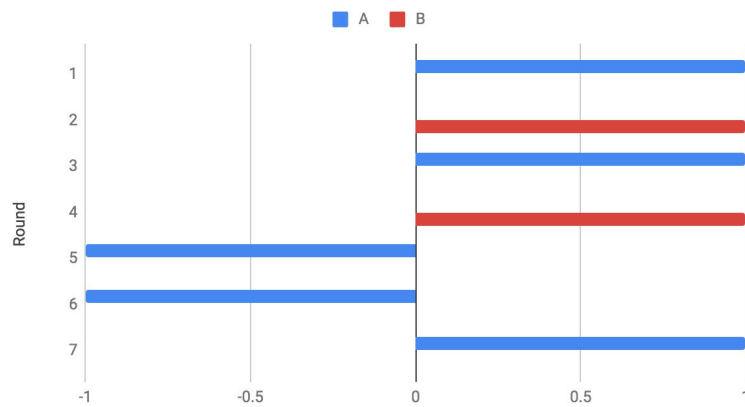
pricesB = [5.5, 6.5, 7.5, 8.5, 9.5, 10.5, 11.5, 12.5, 13.5, 14.5]

Round	A Perform	A Price	B Perform	B Price	A Cost	A Profit	B Cost	B Profit	A Num C	B Num C	Non Parti
1	16	9	0	0	1942.67	1990.32	0	0	437	0	563
2	16	9	16	8.5	0	0	1987.56	1990.43	0	468	532
3	17	9	16	8.5	2246.96	1983.03	0	0	470	0	530
4	17	9	18	9.5	0	0	2522.66	1961.33	0	472	528
5	18	9	18	9.5	2569.87	1921.12	0	0	499	0	501
6	18	9	19	9.5	0	0	2863.34	1877.15	0	499	501
7	19	9	19	9.5	2914.08	1819.91	0	0	526	0	474
8	19	9	19	8.5	0	0	2961.33	1730.66	0	552	448
9	19	8	19	8.5	3007.11	1616.88	0	0	578	0	422
10	19	8	19	7.5	0	0	3053.22	1484.27	0	605	395
11	19	7	19	7.5	3096.35	1320.64	0	0	631	0	369
12	19	7	19	6.5	0	0	3138.30	1132.19	0	657	343
13	19	6	19	6.5	3180.72	923.27	0	0	684	0	316
14	19	6	19	5.5	0	0	3220.52	684.47	0	710	290
15	19	5	19	5.5	3259.36	420.63	0	0	736	0	264
16	19	5	10	5.5	3259.36	420.63	0	0	736	0	264
17	15	8	10	5.5	1744.39	1983.60	0	0	466	0	534
18	15	8	16	8.5	0	0	1987.56	1990.43	0	468	532

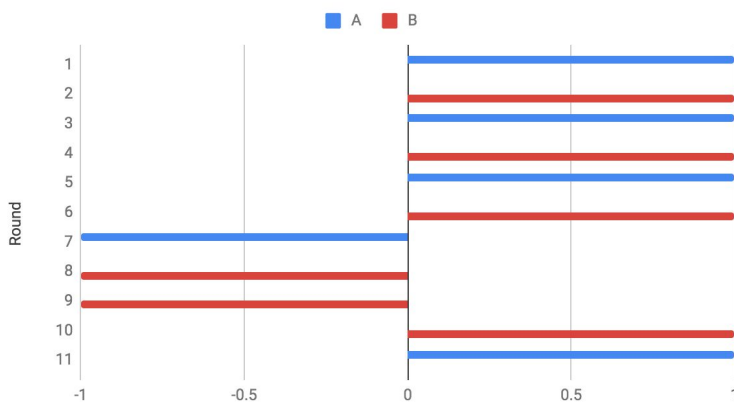
The following charts:

If profit is larger than the number of customers, the company is given a value of 1 for that round. If the two numbers are equal, the company is given a value of 0 (does not have a bar that round). Lastly, if the number of customers is larger than the profit, the company is given a value of -1 for that round.

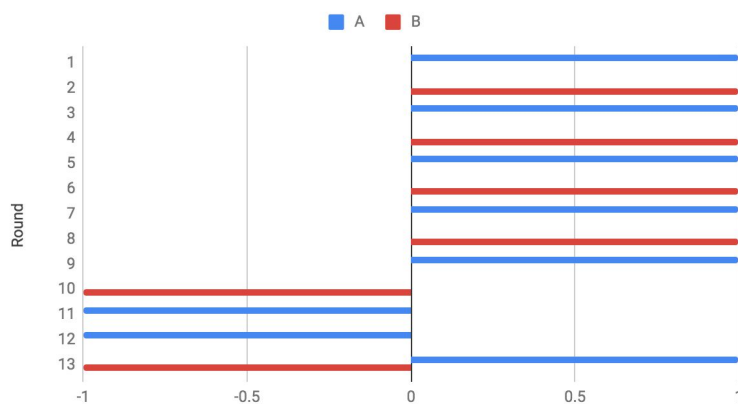
Run 1



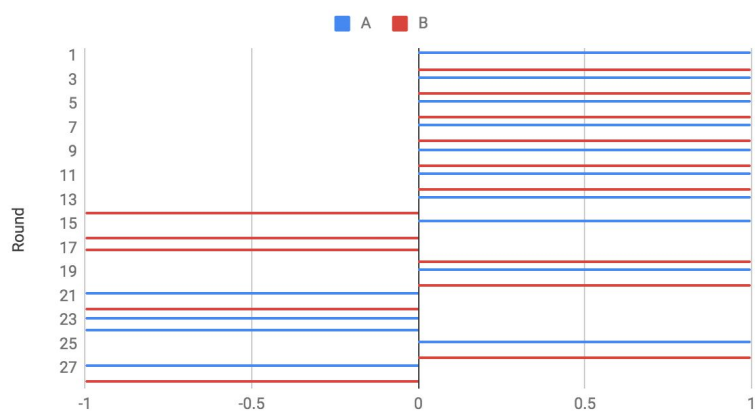
Run 2



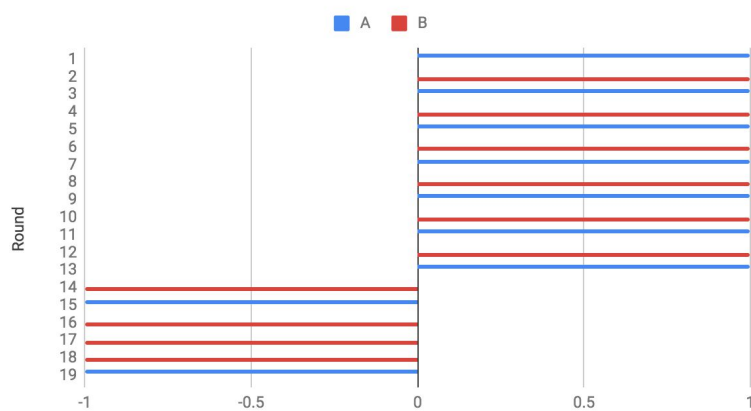
Run 3



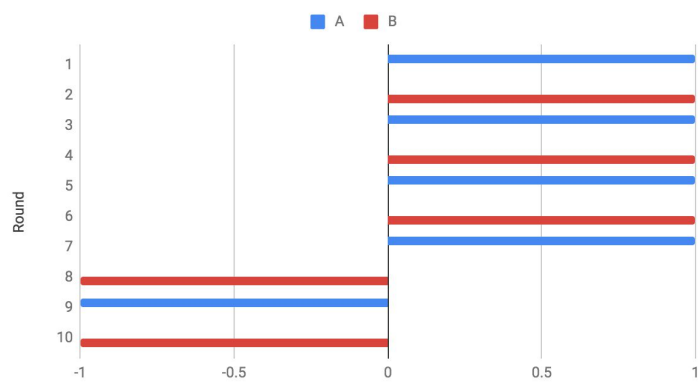
Run 4



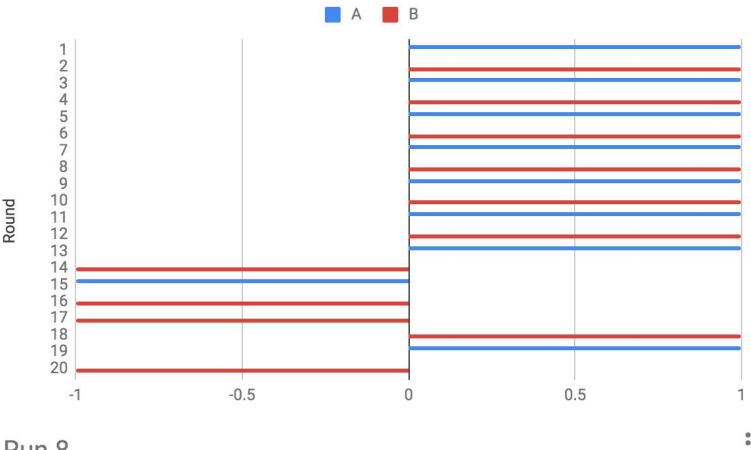
Run 5



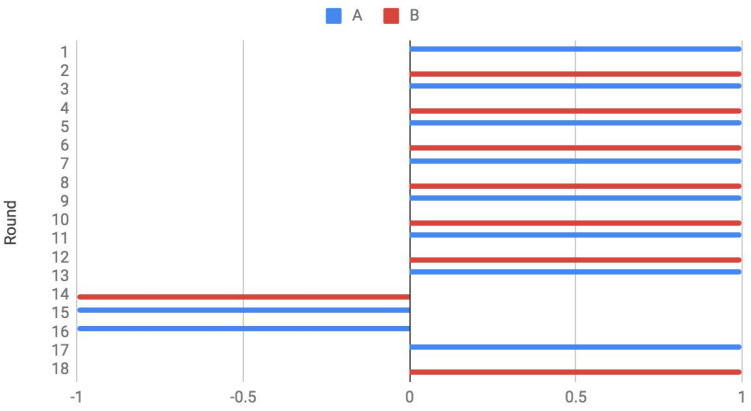
Run 6



Run 7



Run 8



## Observations:

As I began to see last week, the runs go in a cycle of one company completely dominating the market then the other company, which is followed by multiple rounds (except Run 6) of one company making zero profit in a row. This repeats as seen in Run 4. I have noted where the rounds get more complicated, which I will be calling the "points of interest":

Run 1: Rounds 5-7

Run 2: Rounds 8-10

Run 3: Rounds 11-13

Run 4: Rounds 16-18, 23-25

Run 5: Rounds 16-18

Run 6: Round 10

Run 7: Rounds 16-18

Run 8: Rounds 15-17

In pages 8 and 9, I graphed the price/performance values for the first six runs. As you can see, the two companies decrement their old price by 1 in each turn (so by 0.5 each round) until they get close to the points of interest (for Run 4, in between the two areas of interest, the companies increment their prices in this same fashion). The performance values act a little less consistently, but tend to have a long period of using the same value and some incrementing/decrementing like the prices.

On page 10, you can see through Runs 7 and 8 that all of the previously mentioned patterns also occur despite the price set shifts (still a 0.5 offset between the two sets). This makes me think that these patterns are not simply due to the particular sets originally picked, but I should test more.

I started to wonder if there was a pattern in when these points of interest were occurring. I looked back at the original graphs I had made for Runs 1-6 that had A and B's profits and number of customers. I noticed that the points of interest were around when the number of customers became larger than the profit. Pages 11-13 chart the relationship between profit and number of customers for all 8 runs. This is the pattern I found:

1. At the initial round in the point of interest the number of customers becomes larger than the profit
2. In the second round in the point of interest, the same company's number of customers remains larger than the profit
3. In the final round of the point of interest, the same company's profit becomes larger than the number of customers

This pattern is the case for all runs, besides Run 5 (Run 5 follows the first two steps, but the number of customers remains larger in the third round). The points of interest seem to be when a company's profits are less than the number of customers twice in a row (there is not a time when it happens twice in a row and a point of interest does not occur), which causes the company to stop decrementing its price.

The multiple rounds of zero profit in a row is interesting because the company with zero profit has to have a turn where they choose to make no money (meaning that zero is the maximum profit). This means that the other company switching its price/performance to make more money gives this zero profit company the opportunity to win back some of the market. This only occurs, however, when the non-zero profit company's profit is less than its number of customers.

Next week, I really want to focus on why one company having a larger number of customers than profits causes the other company to choose zero profit and then bounce back. I also want to see why the offset of 0.5 in prices could be the reason for this and check if these patterns exist with other offsets.