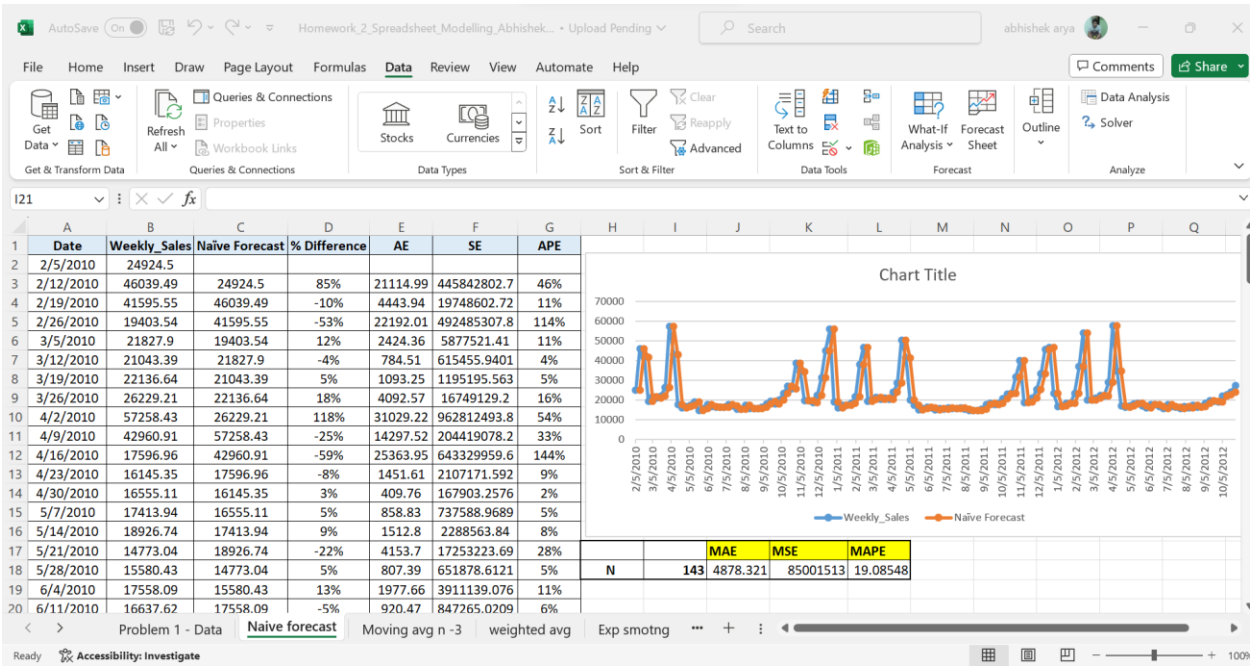
HOMEWORK 2 : 6332.001 Spreadsheet Modelling and analytics

Submitted by :

Abhishek Arya

NET ID : axa220149

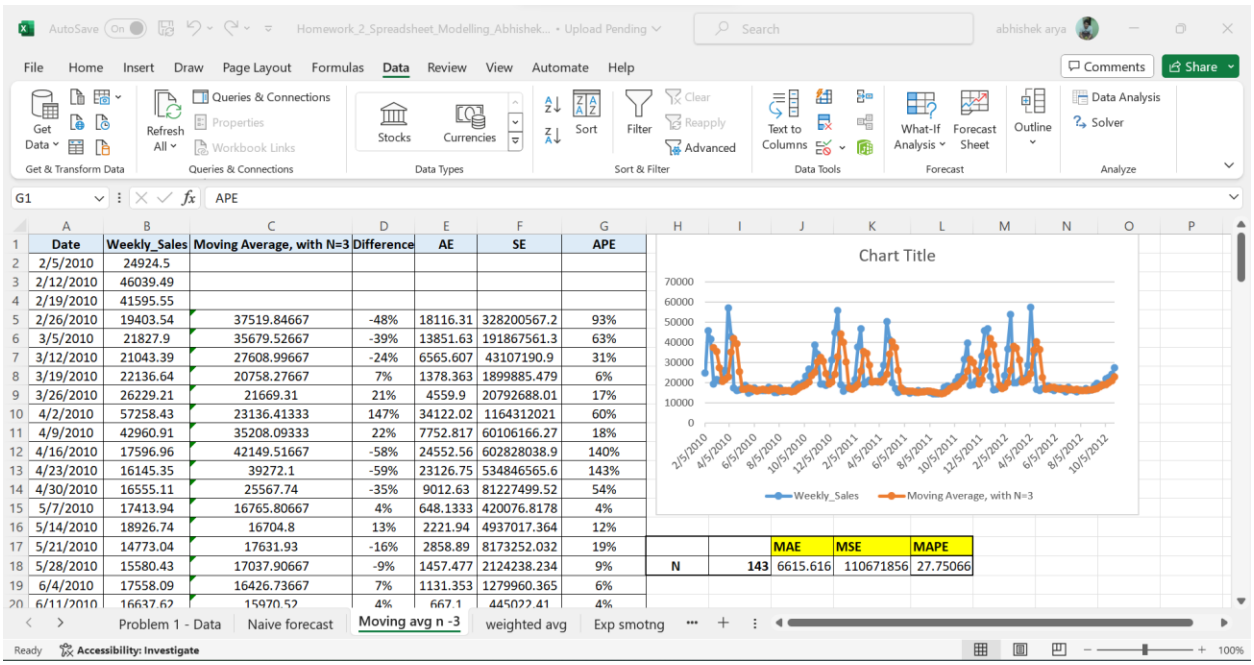
Answer 1.1



Date	Weekly_Sales	Naïve Forecast	% Difference	AE	SE	APE
2/5/2010	24924.5					
2/12/2010	46039.49	24924.5	85%	21114.99	445842802.7	46%
2/19/2010	41595.55	46039.49	-10%	4443.94	19748602.72	11%
2/26/2010	19403.54	41595.55	-53%	22192.01	492485307.8	114%
3/5/2010	21827.9	19403.54	12%	2424.36	5877521.41	11%
3/12/2010	21043.39	21827.9	-4%	784.51	615455.9401	4%
3/19/2010	22136.64	21043.39	5%	1093.25	1195195.563	5%
3/26/2010	26229.21	22136.64	18%	4092.57	16749129.2	16%
4/2/2010	57258.43	26229.21	118%	31029.22	962812493.8	54%
4/9/2010	42960.91	57258.43	-25%	14297.52	204419078.2	33%
4/16/2010	17596.96	42960.91	-59%	25363.95	643329959.6	144%
4/23/2010	16145.35	17596.96	-8%	1451.61	2107171.592	9%
4/30/2010	16555.11	16145.35	3%	409.76	167903.2576	2%
5/7/2010	17413.94	16555.11	5%	858.83	737588.9689	5%
5/14/2010	18926.74	17413.94	9%	1512.8	2288563.84	8%
5/21/2010	14773.04	18926.74	-22%	4153.7	17253223.69	28%
5/28/2010	15580.43	14773.04	5%	807.39	651878.6121	5%
6/4/2010	17558.09	15580.43	13%	1977.66	3911139.076	11%
6/11/2010	16637.62	17558.09	-5%	920.47	847265.0209	6%

		MAE	MSE	MAPE
N	143	4878.321	85001513	19.08548

Answer 1.2



Date	Weekly_Sales	Moving Average, with N=3	Difference	AE	SE	APE
2/5/2010	24924.5					
2/12/2010	46039.49					
2/19/2010	41595.55					
2/26/2010	19403.54	37519.84667	-48%	18116.31	328200567.2	93%
3/5/2010	21827.9	35679.52667	-39%	13851.63	191867561.3	63%
3/12/2010	21043.39	27608.99667	-24%	6565.607	43107190.9	31%
3/19/2010	22136.64	20758.27667	7%	1378.363	1899885.479	6%
3/26/2010	26229.21	21669.31	21%	4559.9	20792688.01	17%
4/2/2010	57258.43	23136.41333	147%	34122.02	1164312021	60%
4/9/2010	42960.91	35208.09333	22%	7752.817	60106166.27	18%
4/16/2010	17596.96	42149.51667	-58%	24552.56	602828038.9	140%
4/23/2010	16145.35	39272.1	-59%	23126.75	534846565.6	143%
4/30/2010	16555.11	25567.74	-35%	9012.63	81227499.52	54%
5/7/2010	17413.94	16765.80667	4%	648.1333	420076.8178	4%
5/14/2010	18926.74	16704.8	13%	2221.94	4937017.364	12%
5/21/2010	14773.04	17631.93	-16%	2858.89	8173252.032	19%
5/28/2010	15580.43	17037.90667	-9%	1457.477	2124238.234	9%
6/4/2010	17558.09	16426.73667	7%	1131.353	1279960.365	6%
6/11/2010	16637.62	15970.52	4%	667.1	445022.41	4%

		MAE	MSE	MAPE
N	143	6615.616	110671856	27.75066

Chart Title

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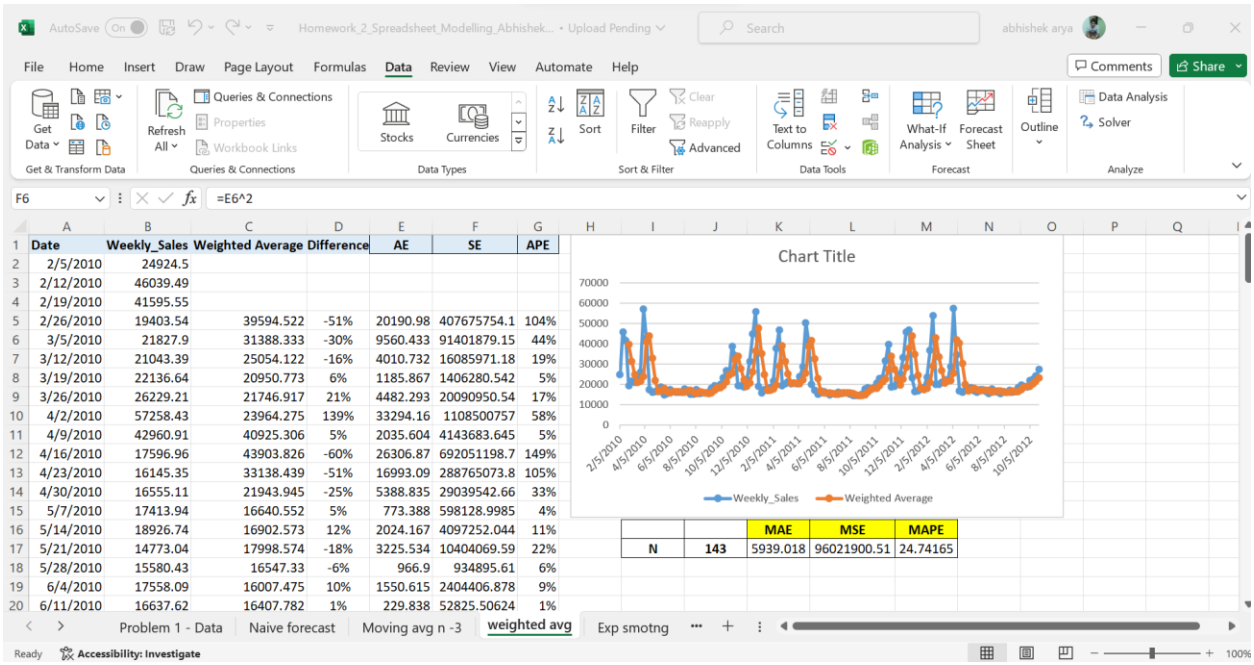
2/5/2010 4/5/2010 6/5/2010 8/5/2010 10/5/2010 12/5/2010 2/5/2011 4/5/2011 6/5/2011 8/5/2011 10/5/2011 12/5/2011 2/5/2012 4/5/2012 6/5/2012 8/5/2012 10/5/2012

Weekly_Sales
Moving Average, with N=3

Problem 1 - Data | Naive forecast | Moving avg n -3 | weighted avg | Exp smotng

Ready | Accessibility: Investigate | 100%

Answer 1.3



Date	Weekly_Sales	Weighted Average	Difference	AE	SE	APE
2/5/2010	24924.5					
2/12/2010	46039.49					
2/19/2010	41595.55					
2/26/2010	19403.54	39594.522	-51%	20190.98	407675754.1	104%
3/5/2010	21827.9	31388.333	-30%	9560.433	91401879.15	44%
3/12/2010	21043.39	25054.122	-16%	4010.732	16085971.18	19%
3/19/2010	22136.64	20950.773	6%	1185.867	1406280.542	5%
3/26/2010	26229.21	21746.917	21%	4482.293	20090950.54	17%
4/2/2010	57258.43	23964.275	139%	33294.16	1108500757	58%
4/9/2010	42960.91	40925.306	5%	2035.604	4143683.645	5%
4/16/2010	17596.96	43903.826	-60%	26306.87	692051198.7	149%
4/23/2010	16145.35	33138.439	-51%	16993.09	288765073.8	105%
4/30/2010	16555.11	21943.945	-25%	5388.835	29039542.66	33%
5/7/2010	17413.94	16640.552	5%	773.388	598128.9985	4%
5/14/2010	18926.74	16902.573	12%	2024.167	4097252.044	11%
5/21/2010	14773.04	17998.574	-18%	3225.534	10404069.59	22%
5/28/2010	15580.43	16547.33	-6%	966.9	934895.61	6%
6/4/2010	17558.09	16007.475	10%	1550.615	2404406.878	9%
6/11/2010	16637.62	16407.782	1%	229.838	52825.50624	1%

		MAE	MSE	MAPE
N	143	5939.018	96021900.51	24.74165

Chart Title

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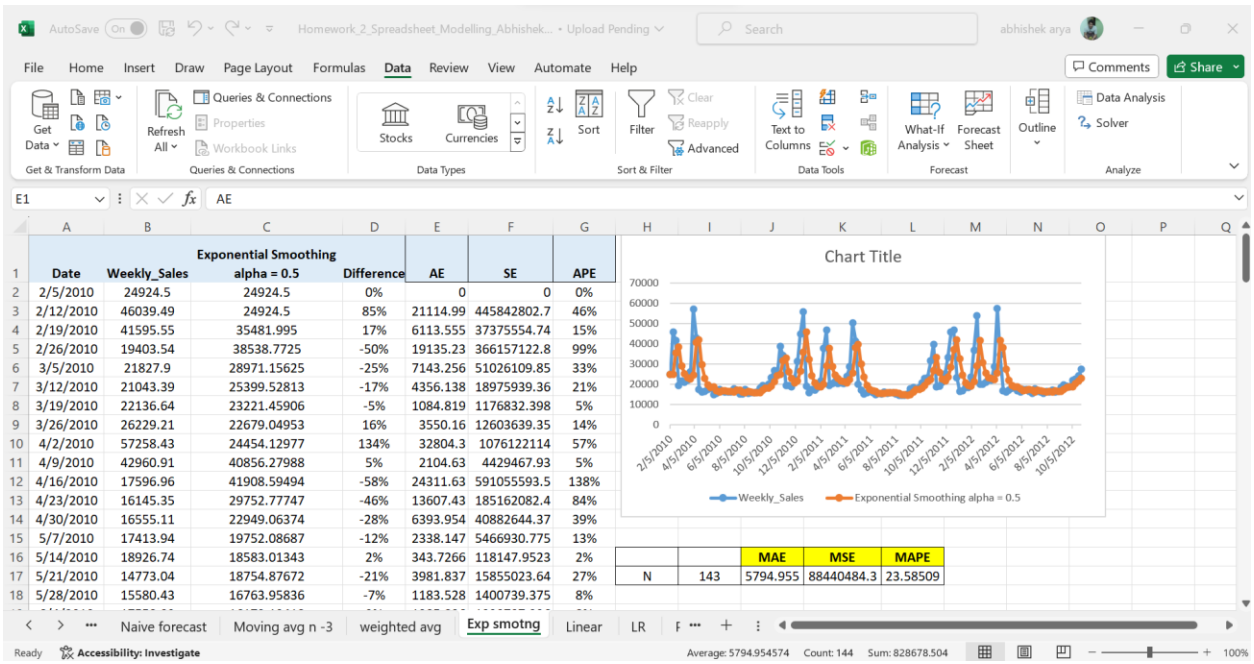
2/5/2010 4/5/2010 6/5/2010 8/5/2010 10/5/2010 12/5/2010 2/5/2011 4/5/2011 6/5/2011 8/5/2011 10/5/2011 12/5/2011 2/5/2012 4/5/2012 6/5/2012 8/5/2012 10/5/2012

Weekly_Sales
Weighted Average

Problem 1 - Data | Naive forecast | Moving avg n -3 | weighted avg | Exp smotng

Ready | Accessibility: Investigate | 100%

Answer 1.4



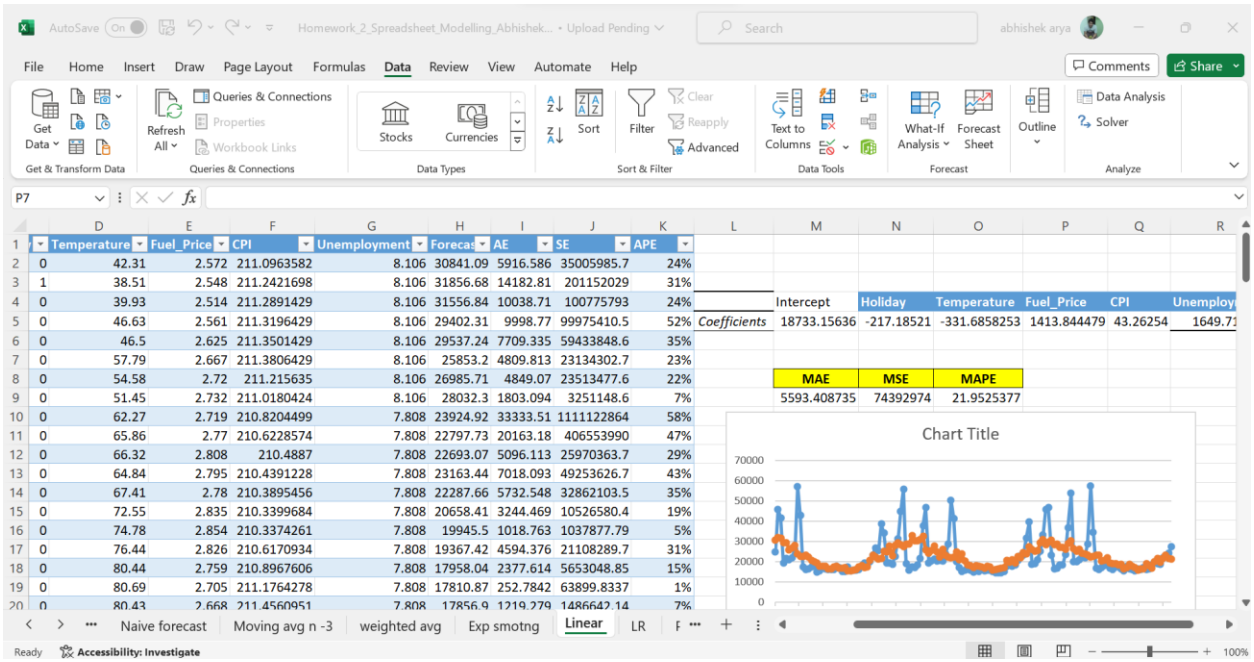
	Date	Weekly_Sales	Exponential Smoothing alpha = 0.5	Difference	AE	SE	APE
2	2/5/2010	24924.5	24924.5	0%	0	0	0%
3	2/12/2010	46039.49	24924.5	85%	21114.99	445842802.7	46%
4	2/19/2010	41595.55	35481.995	17%	6113.555	37375554.74	15%
5	2/26/2010	19403.54	38538.7725	-50%	19135.23	366157122.8	99%
6	3/5/2010	21827.9	28971.15625	-25%	7143.256	51026109.85	33%
7	3/12/2010	21043.39	25399.52813	-17%	4356.138	18975939.36	21%
8	3/19/2010	22136.64	23221.45906	-5%	1084.819	1176832.398	5%
9	3/26/2010	26229.21	22679.04953	16%	3550.16	12603639.35	14%
10	4/2/2010	57258.43	24454.12977	134%	32804.3	1076122114	57%
11	4/9/2010	42960.91	40856.27988	5%	2104.63	4429467.93	5%
12	4/16/2010	17596.96	41908.59494	-58%	24311.63	591055593.5	138%
13	4/23/2010	16145.35	29752.77747	-46%	13607.43	185162082.4	84%
14	4/30/2010	16555.11	22949.06374	-28%	6393.954	40882644.37	39%
15	5/7/2010	17413.94	19752.08687	-12%	2338.147	5466930.775	13%
16	5/14/2010	18926.74	18583.01343	2%	343.7266	118147.9523	2%
17	5/21/2010	14773.04	18754.87672	-21%	3981.837	15855023.64	27%
18	5/28/2010	15580.43	16763.95836	-7%	1183.528	1400739.375	8%

		MAE	MSE	MAPE
N	143	5794.955	88440484.3	23.58509

Naive forecast | Moving avg n -3 | weighted avg | Exp smotng | Linear | LR

Ready | Accessibility: Investigate | Average: 5794.954574 | Count: 144 | Sum: 828678.504 | 100%

Answer 1.5



	Temperature	Fuel_Price	CPI	Unemployment	Forecas	AE	SE	APE
2	0	42.31	2.572	211.0963582	8.106	30841.09	5916.586	35005985.7	24%
3	1	38.51	2.548	211.2421698	8.106	31856.68	14182.81	201152029	31%
4	0	39.93	2.514	211.2891429	8.106	31556.84	10038.71	100775793	24%
5	0	46.63	2.561	211.3196429	8.106	29402.31	9998.77	99975410.5	52%
6	0	46.5	2.625	211.3501429	8.106	29537.24	7709.335	59433848.6	35%
7	0	57.79	2.667	211.3806429	8.106	25853.2	4809.813	23134302.7	23%
8	0	54.58	2.72	211.215635	8.106	26985.71	4849.07	23513477.6	22%
9	0	51.45	2.732	211.0180424	8.106	28032.3	1803.094	3251148.6	7%
10	0	62.27	2.719	210.8204499	7.808	23924.92	33333.51	1111122864	58%
11	0	65.86	2.77	210.6228574	7.808	22797.73	20163.18	406553990	47%
12	0	66.32	2.808	210.4887	7.808	22693.07	5096.113	25970363.7	29%
13	0	64.84	2.795	210.4391228	7.808	23163.44	7018.093	49253626.7	43%
14	0	67.41	2.78	210.3895456	7.808	22287.66	5732.548	32862103.5	35%
15	0	72.55	2.835	210.3399684	7.808	20658.41	3244.469	10526580.4	19%
16	0	74.78	2.854	210.3374261	7.808	19945.5	1018.763	1037877.79	5%
17	0	76.44	2.826	210.6170934	7.808	19367.42	4594.376	21108289.7	31%
18	0	80.44	2.759	210.8967606	7.808	17958.04	2377.614	5653048.85	15%
19	0	80.69	2.705	211.1764278	7.808	17810.87	252.7842	63899.8337	1%
20	0	80.43	2.668	211.4560951	7.808	17856.9	1219.279	1486642.14	7%

	Intercept	Holiday	Temperature	Fuel_Price	CPI	Unemploy
Coefficients	18733.15636	-217.18521	-331.6858253	1413.844479	43.26254	1649.71

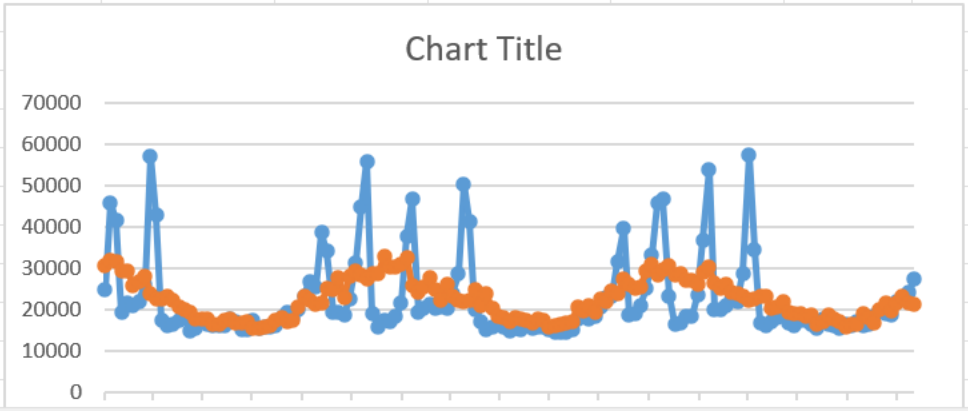
MAE	MSE	MAPE
5593.408735	74392974	21.9525377

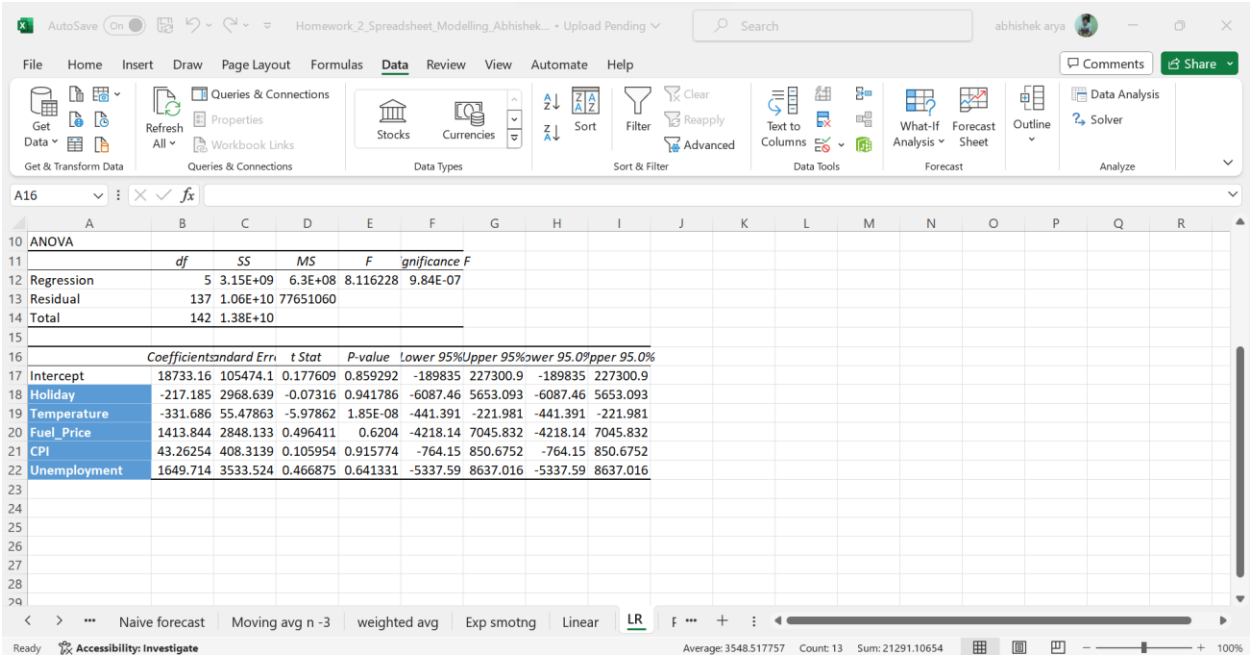
Naive forecast | Moving avg n -3 | weighted avg | Exp smotng | Linear | LR

Ready | Accessibility: Investigate | 100%

	Intercept	Holiday	Temperature	Fuel_Price	CPI	Unemployment
Coefficients	18733.15636	-217.18521	-331.6858253	1413.844479	43.26254	1649.714198

MAE	MSE	MAPE
5593.408735	74392974	21.9525377



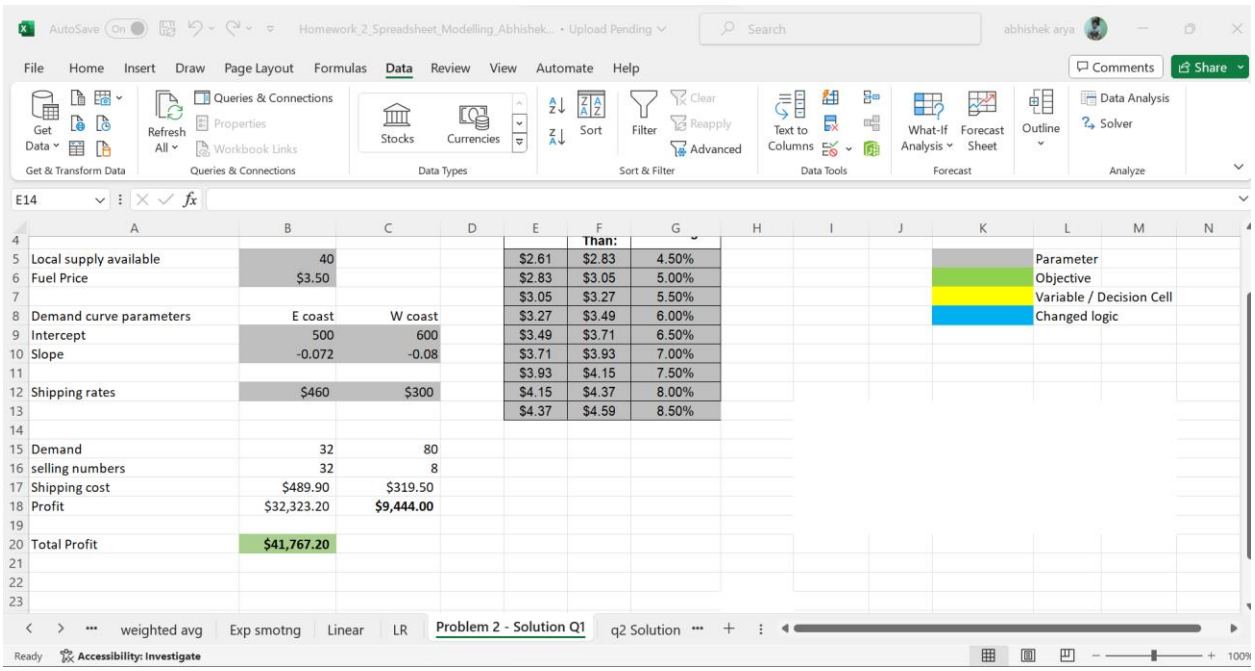


ANOVA

	df	SS	MS	F	Significance F
Regression	5	3.15E+09	6.3E+08	8.116228	9.84E-07
Residual	137	1.06E+10	77651060		
Total	142	1.38E+10			

	Coefficients	Standard Error	t Stat	P-value	Lower 95%	Upper 95%	Lower 95.0%	Upper 95.0%
Intercept	18733.16	105474.1	0.177609	0.859292	-189835	227300.9	-189835	227300.9
Holiday	-217.185	2968.639	-0.07316	0.941786	-6087.46	5653.093	-6087.46	5653.093
Temperature	-331.686	55.47863	-5.97862	1.85E-08	-441.391	-221.981	-441.391	-221.981
Fuel_Price	1413.844	2848.133	0.496411	0.6204	-4218.14	7045.832	-4218.14	7045.832
CPI	43.26254	408.3139	0.105954	0.915774	-764.15	850.6752	-764.15	850.6752
Unemployment	1649.714	3533.524	0.466875	0.641331	-5337.59	8637.016	-5337.59	8637.016

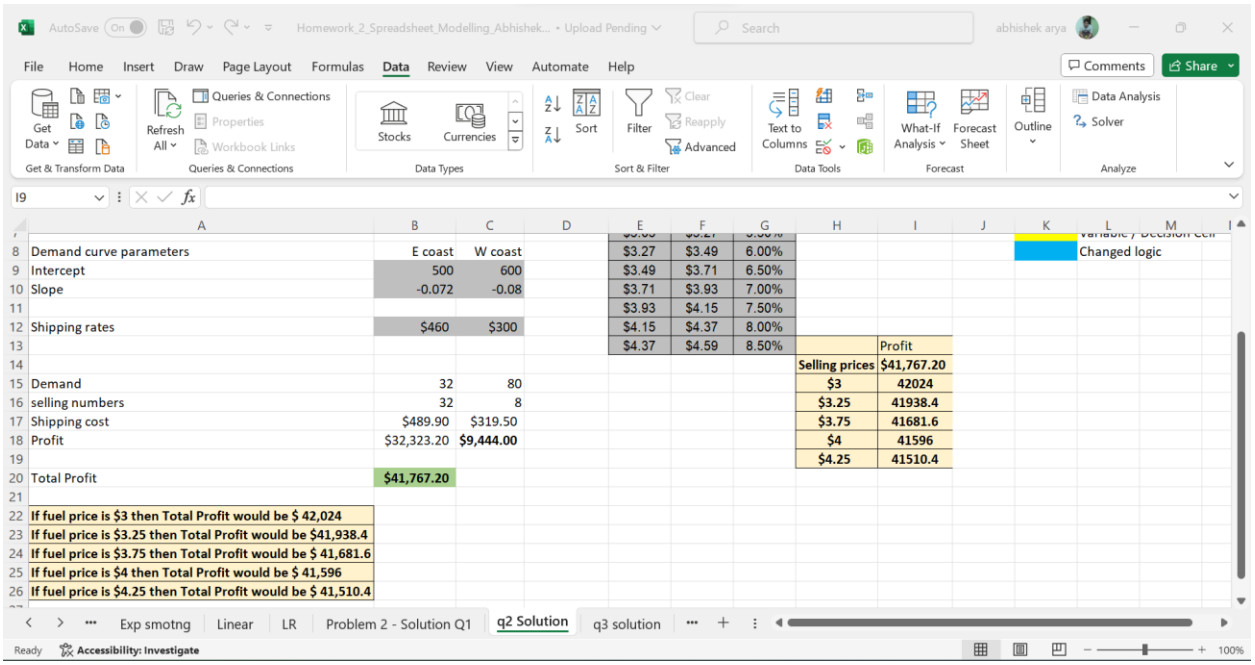
Answer 2.1



	A	B	C	D	E	F	G	H	I	J	K	L	M	N
4						Than:								
5	Local supply available	40			$2.61	$2.83	4.50%					Parameter		
6	Fuel Price	$3.50			$2.83	$3.05	5.00%					Objective		
7					$3.05	$3.27	5.50%					Variable / Decision Cell		
8	Demand curve parameters	E coast	W coast		$3.27	$3.49	6.00%					Changed logic		
9	Intercept	500	600		$3.49	$3.71	6.50%							
10	Slope	-0.072	-0.08		$3.71	$3.93	7.00%							
11					$3.93	$4.15	7.50%							
12	Shipping rates	$460	$300		$4.15	$4.37	8.00%							
13					$4.37	$4.59	8.50%							
14														
15	Demand	32	80											
16	selling numbers	32	8											
17	Shipping cost	$489.90	$319.50											
18	Profit	$32,323.20	**$9,444.00**											
19														
20	Total Profit	**$41,767.20**												
21														
22														
23														

weighted avg | Exp smotng | Linear | LR | Problem 2 - Solution Q1 | q2 Solution

Answer 2.2



	A	B	C	D	E	F	G	H	I	J	K	L	M
8	Demand curve parameters	E coast	W coast		$3.27	$3.49	6.00%					Changed logic	
9	Intercept	500	600		$3.49	$3.71	6.50%						
10	Slope	-0.072	-0.08		$3.71	$3.93	7.00%						
11					$3.93	$4.15	7.50%						
12	Shipping rates	$460	$300		$4.15	$4.37	8.00%						
13					$4.37	$4.59	8.50%		Profit				
14								**Selling prices**	**$41,767.20**				
15	Demand	32	80					**$3**	**42024**				
16	selling numbers	32	8					**$3.25**	**41938.4**				
17	Shipping cost	$489.90	$319.50					**$3.75**	**41681.6**				
18	Profit	$32,323.20	**$9,444.00**					**$4**	**41596**				
19								**$4.25**	**41510.4**				
20	Total Profit	**$41,767.20**											
21													
22	**If fuel price is $3 then Total Profit would be $ 42,024**												
23	**If fuel price is $3.25 then Total Profit would be $41,938.4**												
24	**If fuel price is $3.75 then Total Profit would be $ 41,681.6**												
25	**If fuel price is $4 then Total Profit would be $ 41,596**												
26	**If fuel price is $4.25 then Total Profit would be $ 41,510.4**												

Exp smotng | Linear | LR | Problem 2 - Solution Q1 | q2 Solution | q3 solution

If fuel price is $3 then Total Profit would be $ 42,024

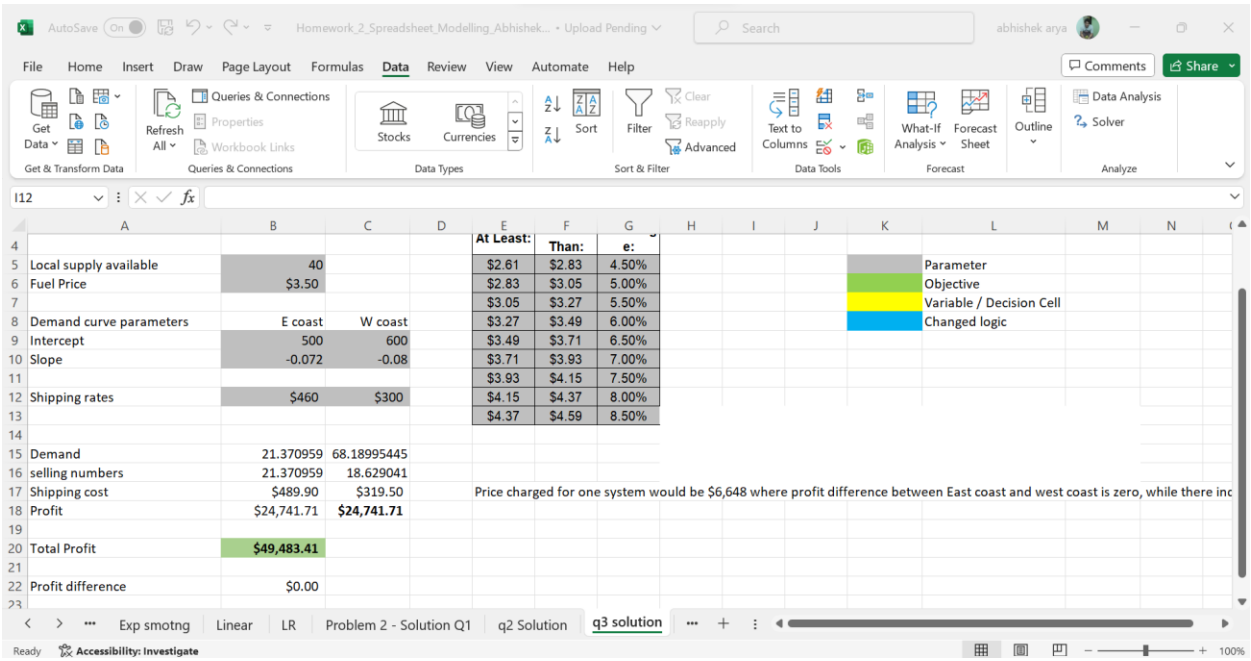
If fuel price is $3.25 then Total Profit would be $41,938.4

If fuel price is $3.75 then Total Profit would be $ 41,681.6

If fuel price is $4 then Total Profit would be $ 41,596

If fuel price is $4.25 then Total Profit would be $ 41,510.4

Answer 2.3

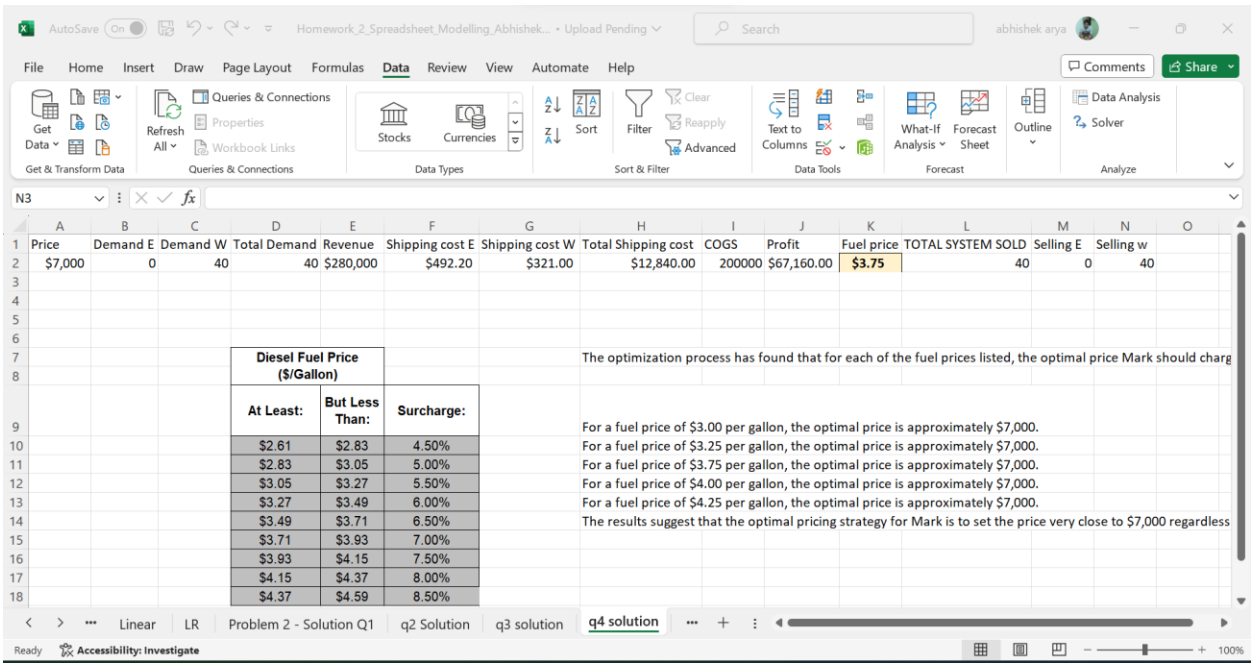


	A	B	C	D	E	F	G	H	I	J	K	L	M	N
4					At Least:	Than:	e:							
5	Local supply available	40			$2.61	$2.83	4.50%					Parameter		
6	Fuel Price	$3.50			$2.83	$3.05	5.00%					Objective		
7					$3.05	$3.27	5.50%					Variable / Decision Cell		
8	Demand curve parameters	E coast	W coast		$3.27	$3.49	6.00%					Changed logic		
9	Intercept	500	600		$3.49	$3.71	6.50%							
10	Slope	-0.072	-0.08		$3.71	$3.93	7.00%							
11					$3.93	$4.15	7.50%							
12	Shipping rates	$460	$300		$4.15	$4.37	8.00%							
13					$4.37	$4.59	8.50%							
14														
15	Demand	21.370959	68.18995445											
16	selling numbers	21.370959	18.629041											
17	Shipping cost	$489.90	$319.50		Price charged for one system would be $6,648 where profit difference between East coast and west coast is zero, while there inc									
18	Profit	$24,741.71	**$24,741.71**											
19														
20	Total Profit	**$49,483.41**												
21														
22	Profit difference	$0.00												

Price charged for one system would be $6,648 where profit difference between East coast and west coast is zero, while their individual profit is $ 24,741.71.

Answer 2.4

USED SOLVER



Price	Demand E	Demand W	Total Demand	Revenue	Shipping cost E	Shipping cost W	Total Shipping cost	COGS	Profit	Fuel price	TOTAL SYSTEM SOLD	Selling E	Selling w
$7,000	0	40	40	$280,000	$492.20	$321.00	$12,840.00	200000	$67,160.00	$3.75	40	0	40

Diesel Fuel Price ($/Gallon)		
At Least:	But Less Than:	Surcharge:
$2.61	$2.83	4.50%
$2.83	$3.05	5.00%
$3.05	$3.27	5.50%
$3.27	$3.49	6.00%
$3.49	$3.71	6.50%
$3.71	$3.93	7.00%
$3.93	$4.15	7.50%
$4.15	$4.37	8.00%
$4.37	$4.59	8.50%

The optimization process has found that for each of the fuel prices listed, the optimal price Mark should charg

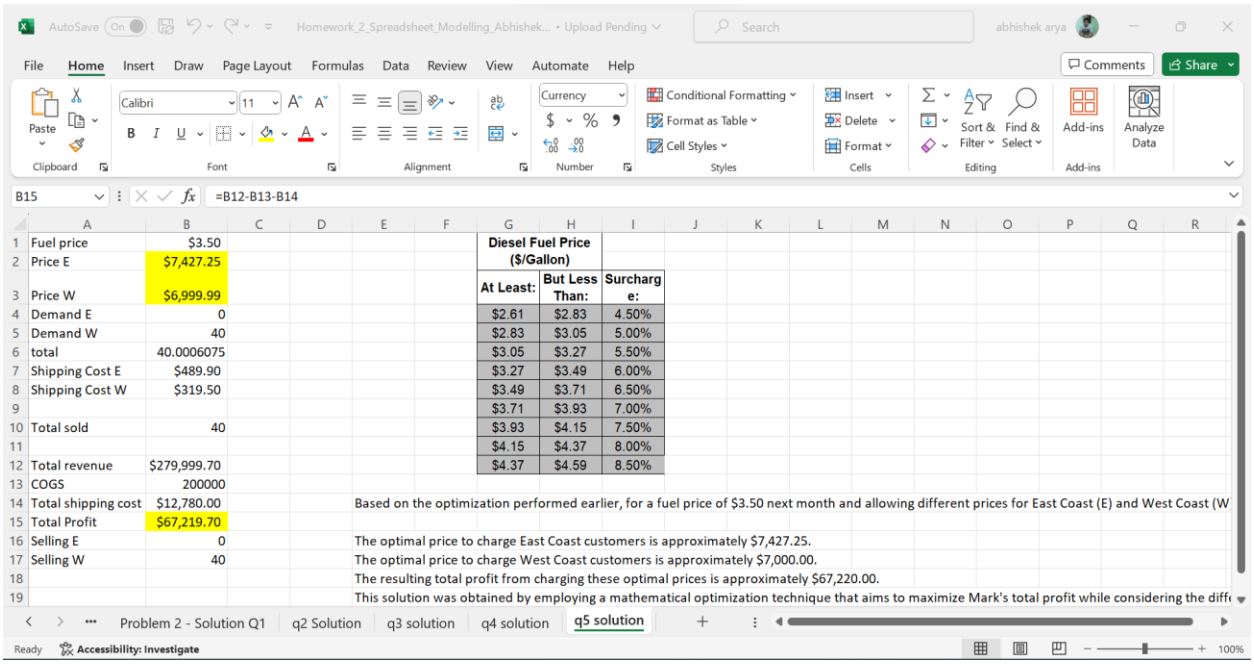
For a fuel price of $3.00 per gallon, the optimal price is approximately $7,000.
For a fuel price of $3.25 per gallon, the optimal price is approximately $7,000.
For a fuel price of $3.75 per gallon, the optimal price is approximately $7,000.
For a fuel price of $4.00 per gallon, the optimal price is approximately $7,000.
For a fuel price of $4.25 per gallon, the optimal price is approximately $7,000.
The results suggest that the optimal pricing strategy for Mark is to set the price very close to $7,000 regardless

The optimization process has found that for each of the fuel prices listed, the optimal price Mark should charge to maximize his profit is approximately $7,000. Here are the optimal prices corresponding to each fuel price:

For a fuel price of $3.00 per gallon, the optimal price is approximately $7,000.
For a fuel price of $3.25 per gallon, the optimal price is approximately $7,000.
For a fuel price of $3.75 per gallon, the optimal price is approximately $7,000.
For a fuel price of $4.00 per gallon, the optimal price is approximately $7,000.
For a fuel price of $4.25 per gallon, the optimal price is approximately $7,000.
The results suggest that the optimal pricing strategy for Mark is to set the price very close to $7,000 regardless of the slight variations in fuel price within the given range. This is likely due to the fact that the demand function is not highly sensitive to price within this optimal range and that the maximum capacity of 40 systems also creates a ceiling effect on how much revenue can be generated

Answer 2.5

USED SOLVER



	A	B	G	H	I
1	Fuel price	$3.50	Diesel Fuel Price ($/Gallon)		
2	Price E	$7,427.25			
3	Price W	$6,999.99	At Least:	But Less Than:	Surcharge:
4	Demand E	0	$2.61	$2.83	4.50%
5	Demand W	40	$2.83	$3.05	5.00%
6	total	40.0006075	$3.05	$3.27	5.50%
7	Shipping Cost E	$489.90	$3.27	$3.49	6.00%
8	Shipping Cost W	$319.50	$3.49	$3.71	6.50%
9			$3.71	$3.93	7.00%
10	Total sold	40	$3.93	$4.15	7.50%
11			$4.15	$4.37	8.00%
12	Total revenue	$279,999.70	$4.37	$4.59	8.50%
13	COGS	200000			
14	Total shipping cost	$12,780.00	Based on the optimization performed earlier, for a fuel price of $3.50 next month and allowing different prices for East Coast (E) and West Coast (W		
15	Total Profit	$67,219.70			
16	Selling E	0	The optimal price to charge East Coast customers is approximately $7,427.25.		
17	Selling W	40	The optimal price to charge West Coast customers is approximately $7,000.00.		
18			The resulting total profit from charging these optimal prices is approximately $67,220.00.		
19			This solution was obtained by employing a mathematical optimization technique that aims to maximize Mark's total profit while considering the diff		

Based on the optimization performed earlier, for a fuel price of $3.50 next month and allowing different prices for East Coast (E) and West Coast (W) customers, the solution provided was:

The optimal price to charge East Coast customers is approximately $7,427.25.
The optimal price to charge West Coast customers is approximately $7,000.00.
The resulting total profit from charging these optimal prices is approximately $67,220.00.
This solution was obtained by employing a mathematical optimization technique that aims to maximize Mark's total profit while considering the different demand sensitivities and shipping costs for the two geographical regions.