

MG-GY 9753: Business Analytics

Fall 2017 Short Case 1

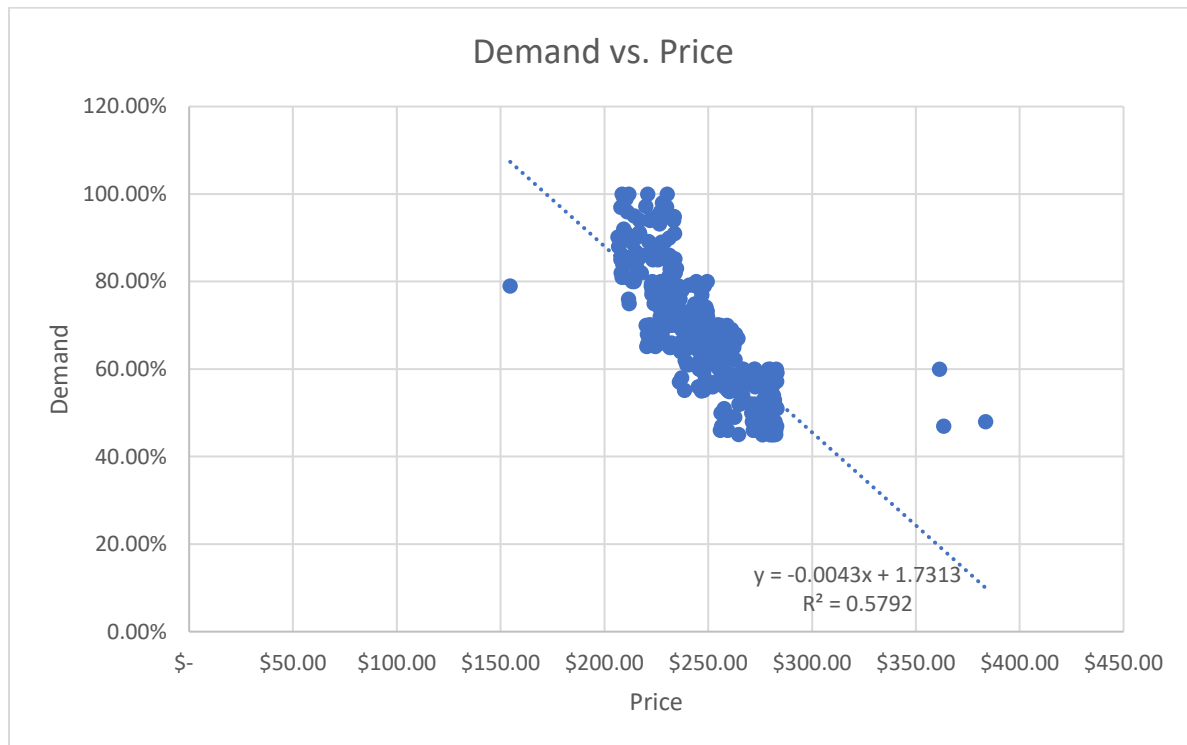
Report Submitted By

Rushi Thakar

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- 1) Effects of Price on Demand
- 2) Effects of Various Costs on Total Cost
- 3) Effects of Customer Segments on Profit
- 4) Effects of Seasons on Demand:

Scatter chart:



Initial Regression analysis:

<i>Regression Statistics</i>	
Multiple R	0.761043
R Square	0.579186
Adjusted R Square	0.577863
Standard Error	0.090192
Observations	320

<i>ANOVA</i>					
	<i>df</i>	<i>SS</i>	<i>MS</i>	<i>F</i>	<i>Significance F</i>
Regression	1	3.560364	3.560364	437.6785	9.96E-62
Residual	318	2.58682	0.008135		
Total	319	6.147184			

	<i>Coefficients</i>	<i>Standard Error</i>	<i>t Stat</i>	<i>P-value</i>	<i>Lower 95%</i>	<i>Upper 95%</i>	<i>Lower 95.0%</i>	<i>Upper 95.0%</i>
Intercept	1.731303	0.050231	34.46683	2.1E-109	1.632476	1.83013	1.632476	1.83013
Price	-0.00425	0.000203	-20.9208	9.96E-62	-0.00465	0.00385	-0.00465	0.00385

RESIDUAL OUTPUT

<i>Observation</i>	<i>Predicted</i>	<i>Residuals</i>	<i>Standard Residuals</i>
1	0.578034	-0.09803	-1.08865
2	0.722209	0.057791	0.641762
3	0.829978	-0.07998	-0.88814
4	0.851881	0.028119	0.312259
5	0.841206	0.150794	1.674544
6	0.74981	-0.00981	-0.10894
7	0.634853	-0.16485	-1.83067
8	0.693714	0.096286	1.069239
9	0.684017	-0.07402	-0.82195
10	0.194377	0.405623	4.504378
11	0.776179	-0.12418	-1.37898
12	0.549157	0.002843	0.031573
13	0.747726	-0.00591	-0.06561
14	0.736456	0.115544	1.283096
15	0.836485	0.152606	1.694662
16	0.695713	0.053378	0.592753
17	0.727057	-0.15615	-1.734
18	0.628517	-0.07652	-0.8497
19	0.751724	0.098276	1.091337
20	0.641743	-0.06174	-0.68565
21	0.673683	0.018317	0.20341
22	0.81386	0.01614	0.179237
23	0.809096	0.102904	1.142729
24	0.565828	-0.10401	-1.15502
25	0.606997	0.063003	0.699641
26	0.686399	-0.0864	-0.95945
27	0.750406	-0.01041	-0.11555
28	0.724761	-0.08476	-0.94125
29	0.634641	0.015359	0.170561

30	0.529934	-0.06993	-0.7766
31	0.621074	0.018926	0.21017
32	0.59764	-0.05764	-0.64009
33	0.581649	-0.06165	-0.68461
34	0.625242	-0.07615	-0.84564
35	0.546392	0.035426	0.393397
36	0.707621	0.024379	0.270722
37	0.834189	0.125811	1.397115
38	0.747684	0.112316	1.247252
39	0.725739	0.034261	0.380466
40	0.761846	-0.07185	-0.79784
41	0.527637	-0.05764	-0.64005
42	0.746536	-0.09654	-1.07201
43	0.718977	-0.06807	-0.75588
44	0.765759	-0.07576	-0.84129
45	0.57157	-0.01157	-0.12848
46	0.681423	-0.08142	-0.90419
47	0.805141	0.014859	0.165006
48	0.677043	-0.12504	-1.38858
49	0.626092	-0.04609	-0.51185
50	0.573611	-0.11361	-1.26163
51	0.555068	0.034022	0.377814
52	0.632855	-0.06285	-0.69799
53	0.728376	0.061624	0.68433
54	0.731182	-0.08027	-0.89142
55	0.692566	0.107434	1.193039
56	0.847032	0.003877	0.043049
57	0.816454	0.043546	0.483573
58	0.538737	0.001263	0.014024
59	0.781963	-0.00196	-0.02179
60	0.823471	-0.02347	-0.26064
61	0.612908	0.00891	0.098942

62	0.759252	-0.05016	-0.55703
63	0.574122	0.025878	0.287376
64	0.543756	-0.02376	-0.2638
65	0.755084	-0.02417	-0.26846
66	0.552517	0.027483	0.305198
67	0.786471	-0.08647	-0.96024
68	0.751852	0.200148	2.222614
69	0.707579	-0.09758	-1.0836
70	0.808458	0.100633	1.117509
71	0.640467	-0.17047	-1.89301
72	0.549242	-0.06924	-0.76892
73	0.78141	0.09859	1.09483
74	0.775966	-0.09597	-1.06569
75	0.733309	-0.03331	-0.36989
76	0.796125	0.175875	1.953065
77	0.84716	0.12284	1.364118
78	0.676107	-0.10611	-1.1783
79	0.606146	-0.15524	-1.72388
80	0.663731	-0.09373	-1.04087
81	0.531762	-0.01176	-0.13062
82	0.78158	0.06842	0.759796
83	0.700817	0.019183	0.213029
84	0.741772	-0.01177	-0.13073
85	0.566636	-0.08664	-0.96208
86	0.688228	-0.12823	-1.42395
87	0.778985	-0.02899	-0.32188
88	0.710811	-0.02081	-0.2311
89	0.559024	-0.04902	-0.5444
90	0.613716	-0.12372	-1.37385
91	0.654289	-0.04429	-0.49183
92	0.766992	-0.02699	-0.29974
93	0.629367	0.070633	0.784366

94	0.626603	-0.0366	-0.40647
95	0.728928	-0.00893	-0.09915
96	0.60504	-0.08504	-0.94436
97	0.749768	0.030232	0.335724
98	0.76712	-0.00712	-0.07906
99	0.533038	-0.02104	-0.23363
100	0.723612	-0.06179	-0.68621
101	0.792552	-0.11255	-1.24988
102	0.59679	-0.03679	-0.40854
103	0.572378	0.027622	0.306739
104	0.819346	0.130654	1.450893
105	0.706813	-0.05681	-0.6309
106	0.710641	0.009359	0.103932
107	0.620436	0.070473	0.782592
108	0.642254	-0.14225	-1.5797
109	0.735691	0.084309	0.936242
110	0.578757	-0.07876	-0.87459
111	0.735393	0.014607	0.16221
112	0.676872	-0.00778	-0.08641
113	0.558088	0.011912	0.132281
114	0.755892	-0.05589	-0.62067
115	0.783664	-0.01275	-0.14164
116	0.816454	0.083546	0.927766
117	0.745685	-0.00568	-0.06313
118	0.598363	0.001637	0.018175
119	0.696138	-0.00523	-0.05807
120	0.751724	0.028276	0.313999
121	0.85001	0.04999	0.555136
122	0.742027	0.097973	1.087969
123	0.712895	-0.02289	-0.25424
124	0.81118	0.04082	0.453297
125	0.666665	-0.03757	-0.41726

126	0.772351	-0.11235	-1.24764
127	0.786938	0.15488	1.719914
128	0.839037	0.000963	0.010695
129	0.636299	-0.0263	-0.29205
130	0.615758	0.034242	0.380254
131	0.637108	-0.03711	-0.41207
132	0.700008	-0.01001	-0.11114
133	0.732033	-0.08112	-0.90087
134	0.681125	0.088875	0.986938
135	0.745175	-0.09517	-1.0569
136	0.55426	-0.03426	-0.38046
137	0.748492	0.063508	0.705247
138	0.72021	0.00979	0.108717
139	1.073714	-0.28371	-3.1506
140	0.697627	0.002373	0.026354
141	0.595939	0.004061	0.045095
142	0.781282	-0.00128	-0.01424
143	0.711874	-0.03987	-0.4428
144	0.831126	-0.07113	-0.78985
145	0.534612	-0.08461	-0.9396
146	0.576078	-0.11608	-1.28903
147	0.762271	-0.08227	-0.91361
148	0.629792	-0.0007	-0.00779
149	0.835422	0.074578	0.828177
150	0.670366	0.129634	1.43957
151	0.761336	0.188664	2.095085
152	0.844268	-0.03427	-0.38054
153	0.681848	-0.00185	-0.02053
154	0.844651	0.155349	1.725128
155	0.830659	0.169341	1.880508
156	0.533336	-0.01334	-0.14809
157	0.782898	-0.0029	-0.03218

158	0.741092	0.038908	0.432069
159	0.531252	-0.05125	-0.56914
160	0.696181	0.013819	0.15346
161	0.567487	-0.10567	-1.17344
162	0.772393	0.096697	1.07381
163	0.672492	0.069326	0.769856
164	0.759337	0.032663	0.362718
165	0.690099	0.00081	0.008995
166	0.844863	0.055137	0.612282
167	0.659053	0.000947	0.01052
168	0.669345	0.050655	0.562518
169	0.541161	0.058839	0.653394
170	0.73854	0.032369	0.359453
171	0.715362	-0.09536	-1.05897
172	0.688951	0.051049	0.566893
173	0.625029	-0.07503	-0.83319
174	0.791659	-0.13166	-1.46205
175	0.840908	0.079092	0.878301
176	0.819856	-0.01986	-0.2205
177	0.787874	-0.08606	-0.95564
178	0.527084	-0.01708	-0.18972
179	0.791999	0.208001	2.309812
180	0.527042	0.064958	0.721353
181	0.722634	-0.02263	-0.25135
182	0.635194	-0.02319	-0.25756
183	0.635491	0.033599	0.373117
184	0.733309	0.096691	1.073738
185	0.772734	0.009085	0.100882
186	0.625327	-0.03533	-0.3923
187	0.544394	-0.01439	-0.15984
188	0.55677	-0.10677	-1.18566
189	0.753085	0.217824	2.4189

190	0.629495	0.050505	0.560852
191	0.622775	-0.04278	-0.47501
192	0.671897	-0.0119	-0.13211
193	0.746451	0.013549	0.150465
194	0.53576	0.03424	0.380229
195	0.534357	0.005643	0.062669
196	0.771245	0.078755	0.87456
197	0.724633	-0.07263	-0.80658
198	0.732203	0.049615	0.550966
199	0.766014	0.193986	2.154183
200	0.754276	0.025724	0.285662
201	0.845161	0.016657	0.184973
202	0.606316	-0.03432	-0.38108
203	0.706941	0.085059	0.944569
204	0.644508	-0.01542	-0.1712
205	0.748024	0.151976	1.687668
206	0.72795	-0.07795	-0.86562
207	0.703071	-0.05216	-0.57924
208	0.686442	-0.04644	-0.51573
209	0.536951	0.023049	0.255956
210	0.647782	0.042218	0.468819
211	0.565105	0.004895	0.054354
212	0.710258	-0.01935	-0.21487
213	0.652376	-0.08238	-0.91477
214	0.570634	-0.05063	-0.56228
215	0.772564	0.177436	1.970403
216	0.736881	0.173119	1.922454
217	0.743941	-0.04394	-0.48796
218	0.599809	-0.0689	-0.76513
219	0.766737	-0.04674	-0.51901
220	0.541629	-0.03981	-0.44209
221	0.846182	-0.02618	-0.29075

222	0.739008	0.200992	2.231985
223	0.574845	-0.09484	-1.05323
224	0.611845	0.068155	0.756849
225	0.633493	-0.06349	-0.70507
226	0.76359	-0.10359	-1.15035
227	0.636427	0.054482	0.605014
228	0.65195	0.02005	0.222649
229	0.545031	0.054969	0.610416
230	0.636895	-0.00489	-0.05436
231	0.528147	0.043853	0.486977
232	0.763675	0.126325	1.40282
233	0.693204	0.016796	0.186519
234	0.794168	-0.14217	-1.57876
235	0.767247	-0.01816	-0.20162
236	0.808246	0.131754	1.46311
237	0.824917	0.065083	0.722734
238	0.628432	-0.16843	-1.87041
239	0.676617	-0.00662	-0.07348
240	0.603084	-0.08308	-0.92264
241	0.669983	0.062017	0.688692
242	0.765036	0.034964	0.388271
243	0.528615	0.071385	0.792717
244	0.642721	0.057279	0.636069
245	0.751767	0.248233	2.756591
246	0.529806	-0.0789	-0.87614
247	0.722166	-0.03217	-0.3572
248	0.63698	0.024838	0.275824
249	0.769289	-0.10929	-1.21363
250	0.65497	-0.00497	-0.05519
251	0.558471	0.001529	0.016982
252	0.783961	-0.12214	-1.35638
253	0.757678	0.012322	0.136831

254	0.852816	0.049002	0.544156
255	0.650036	-0.02004	-0.2225
256	0.722379	-0.14238	-1.58109
257	0.677085	-0.08509	-0.94486
258	0.759039	-0.00904	-0.10038
259	0.648335	0.053483	0.593919
260	0.69465	-0.08374	-0.92993
261	0.71685	-0.16485	-1.83063
262	0.605338	-0.04534	-0.50347
263	0.625327	0.024673	0.273991
264	0.712257	-0.10226	-1.13555
265	0.610909	-0.05091	-0.56534
266	0.630558	-0.05056	-0.56144
267	0.817262	0.051829	0.575553
268	0.752702	0.097298	1.080475
269	0.763377	0.006623	0.073545
270	0.635364	-0.07536	-0.8369
271	0.656246	0.043754	0.485884
272	0.659095	-0.0991	-1.10044
273	0.685804	-0.0158	-0.1755
274	0.641616	-0.00962	-0.10678
275	0.53878	-0.04787	-0.5316
276	0.185488	0.284512	3.159456
277	0.614482	0.045518	0.505471
278	0.530997	-0.059	-0.65515
279	0.617331	-0.06533	-0.72549
280	0.743303	-0.0833	-0.92507
281	0.674236	-0.02424	-0.26913
282	0.761974	0.218026	2.421146
283	0.767928	0.164072	1.821995
284	0.677638	-0.01764	-0.19587
285	0.577822	-0.05782	-0.6421

286	0.541119	-0.09112	-1.01186
287	0.746238	0.082853	0.920069
288	0.790383	0.101617	1.128436
289	0.634768	0.057232	0.635547
290	0.532826	-0.00283	-0.03138
291	0.55409	-0.02318	-0.25742
292	0.612908	0.056183	0.623898
293	0.635321	-0.12532	-1.39167
294	0.787491	0.152509	1.693584
295	0.609421	-0.03742	-0.41555
296	0.621754	-0.03266	-0.36272
297	0.75721	0.133699	1.484702
298	0.543543	-0.00354	-0.03934
299	0.784684	0.005316	0.059029
300	0.617969	0.034031	0.377905
301	0.709237	-0.03924	-0.43572
302	0.675767	0.114233	1.268542
303	0.646166	-0.04617	-0.51267
304	0.735563	0.053528	0.594419
305	0.533974	0.036026	0.400064
306	0.718041	-0.06804	-0.75558
307	0.617629	-0.12672	-1.40721
308	0.801951	0.058049	0.644621
309	0.590963	-0.01096	-0.12174
310	0.771755	-0.10176	-1.12998
311	0.099919	0.380081	4.220735
312	0.643487	-0.18349	-2.03759
313	0.633833	-0.01383	-0.15361
314	0.843077	-0.00308	-0.03417
315	0.782983	0.017017	0.188968
316	0.737519	0.211572	2.349468
317	0.834954	-0.02495	-0.27711

318	0.66607	-0.03607	-0.40055
319	0.795274	-0.09527	-1.058
320	0.681636	-0.13164	-1.46179

Outlier Identification :

Using the rule of ± 3 standard residuals, the following three outliers are identified from the above residual analysis

<i>Observation</i>	<i>Predicted</i>	<i>Residuals</i>	<i>Standard Residuals</i>
10	0.194376942	0.405623058	4.504378382
139	1.073713929	-0.283713929	-3.150597244
276	0.185488306	0.284511694	3.159456292
311	0.099919239	0.380080761	4.2207353



SUMMARY OUTPUT

<i>Regression Statistics</i>	
Multiple R	0.824290863
R Square	0.679455427
Adjusted R Square	0.678434584
Standard Error	0.078520422
Observations	316

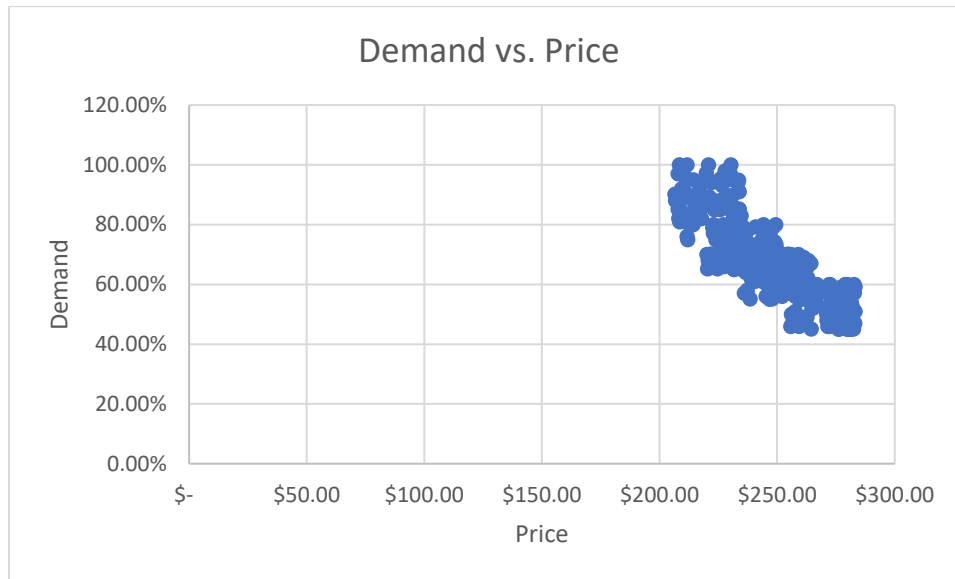
<i>ANOVA</i>					
	<i>df</i>	<i>SS</i>	<i>MS</i>	<i>F</i>	<i>Significance F</i>
Regression	1	4.103622891	4.103622891	665.5829538	1.44839E-79
Residual	314	1.935953408	0.006165457		
Total	315	6.039576298			

	<i>Coefficients</i>	<i>Standard Error</i>	<i>t Stat</i>	<i>P-value</i>	<i>Lower 95%</i>	<i>Upper 95%</i>
Intercept	2.00332989	0.051213011	39.11759637	9.5495E-123	1.902565849	2.104093932
	-		-		-	-
Average Price	0.005373592	0.000208288	25.79889443	1.44839E-79	0.005783408	0.004963776

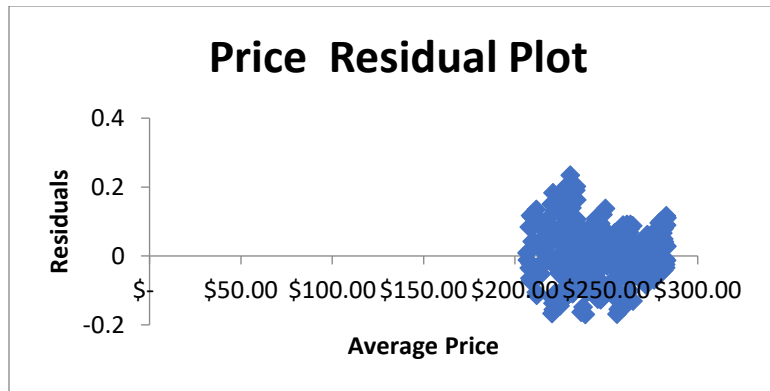
Testing Assumption:

Linearity

The scatter graph shows a linear trend.

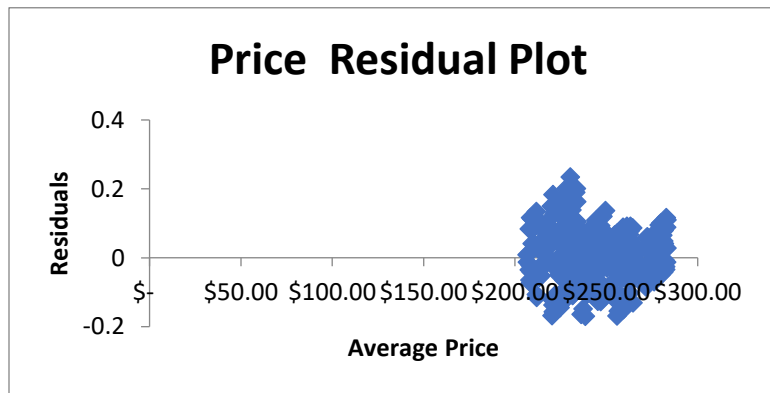


The residual plot show randomness in standard residuals without any pattern.



Homoscedasticity

The plot of standard residuals show approximately equal spread of the data for different values of prices



Independence of Errors

Because our data is cross-sectional data, it is assumed that errors are independent of each other.

Predictive Model:

$$\text{Demand} = 2.0033 - 0.0053 * \text{Price}$$

Price has negative effects on demand. As price increases, the demand decreases.

Prediction of demand :

When the price is set at \$200,

the demand will be: $\text{Demand} = 2.0033 - 0.0053 * \200

$$= 94.33\%$$

When the price is set at \$300,

the demand will be: $\text{Demand} = 2.0033 - 0.0053 * \300

$$= 41.33\%$$

When the price is set at \$250,

the demand will be: $\text{Demand} = 2.0033 - 0.0053 * \250

$$= 67.83\%$$

2)Effects of Various Costs on Total Cost

Correlation Analysis:

	Fuel	Maintenance	Labor Cost	Airport Fees
Fuel	1			
Maintenance	0.914096906	1		
Labor Cost	0.033073007	0.031180293	1	
Airport Fees	-0.071315413	-0.070037801	-0.302946344	1

The correlation table shows that the independent variables Fuel and Maintenance are highly correlated. This suggest multicollinearity between the two variables. Other variables have relatively very low correlation between themselves.

Initial Regression Analysis:

Regression Statistics	
Multiple R	0.882853094
R Square	0.779429585
Adjusted R Square	0.776628691
Standard Error	5.931697399
Observations	320

ANOVA

	<i>df</i>	<i>SS</i>	<i>MS</i>	<i>F</i>	<i>Significance F</i>
Regression	4	39165.00228	9791.250571	278.2788433	5.0266E-102
Residual	315	11083.28572	35.18503403		
Total	319	50248.288			

	<i>Coefficients</i>	<i>Standard Error</i>	<i>t Stat</i>	<i>P-value</i>	<i>Lower 95%</i>	<i>Upper 95%</i>	<i>Lower 95.0%</i>	<i>Upper 95.0%</i>
Intercept	67.12606353	11.90651332	5.637759916	3.83047E-08	43.69971839	90.55240867	43.69971839	90.55240867
Fuel	1.064663684	0.089847396	11.84968886	4.89389E-27	0.887886819	1.24144055	0.887886819	1.24144055
Maintenance	0.718795331	0.413998825	1.736225534	0.083501704	0.095757099	1.53334776	0.095757099	1.53334776
Labor Cost	1.002511169	0.272636543	3.677097573	0.000277276	0.466092356	1.538929982	0.466092356	1.538929982
Airport Fees	1.191874573	0.277131126	4.300760402	2.27323E-05	0.646612561	1.737136585	0.646612561	1.737136585

The initial regression analysis shows that among the four independent variables, Maintenance has p-value of 0.2112, which is higher than the level of significance (α) at 0.05. Therefore, we can conclude that Maintenance has insignificant effect on Total Cost. Hence, we remove Maintenance from the model and rerun a regression analysis.

Regression analysis after removing Insignificant variable:

<i>Regression Statistics</i>	
Multiple R	0.881656836
R Square	0.777318776
Adjusted R Square	0.775204714
Standard Error	5.950574451
Observations	320

ANOVA

	<i>df</i>	<i>SS</i>	<i>MS</i>	<i>F</i>	<i>Significance F</i>
Regression	3	39058.93773	13019.64591	367.6896342	1.0777E-102
Residual	316	11189.35027	35.40933629		
Total	319	50248.288			

	<i>Coefficients</i>	<i>Standard Error</i>	<i>t Stat</i>	<i>P-value</i>	<i>Lower 95%</i>	<i>Upper 95%</i>	<i>Lower 95.0%</i>	<i>Upper 95.0%</i>
Intercept	68.73309572	11.90825868	5.77188467	1.8717E-08	45.3036025	92.16258895	45.3036025	92.16258895
Fuel	1.20718987	0.036638004	32.94911659	3.0805E-104	1.135104614	1.279275125	1.135104614	1.279275125
Labor Cost	1.001878381	0.273503938	3.66312233	0.000292054	0.463759516	1.539997247	0.463759516	1.539997247
Airport Fees	1.186181026	0.277993605	4.266936378	2.62227E-05	0.639228742	1.73313331	0.639228742	1.73313331

The new regression analysis shows that all independent variables are significant.

Predictive Model

Total Cost = 68.7330 + 1.2071 * Fuel + 1.0018 * Labor Cost + 1.1861 * Airport Fees

Fuel, Labor cost and Airport Fees have positive effects on the total cost. As these three increase, the total cost increases.

Prediction of demand

Under the **Optimistic Scenario**,

when the fuel cost is \$60, Labor cost is \$30, and airport fees are \$10:

Total Cost = 68.7330 + 1.2071 * Fuel + 1.0018 * Labor Cost + 1.1861 * Airport Fees

= \$183.074

Under the **Pessimistic Scenario**,

when the fuel cost is \$110, Labor Cost is \$40, and airport fees are \$20:

$$\begin{aligned}\text{Total Cost} &= 68.7330 + 1.2071 * \text{Fuel} + 1.0018 * \text{Labor Cost} + 1.1861 * \text{Airport Fees} \\ &= \mathbf{\$265.308}\end{aligned}$$

Under the **Most Likely Scenario**,

when the fuel cost is \$90, Labor Cost is \$35, and airport fees are \$15:

$$\begin{aligned}\text{Total Cost} &= 68.7330 + 1.2071 * \text{Fuel} + 1.0018 * \text{Labor Cost} + 1.1861 * \text{Airport Fees} \\ &= \mathbf{\$230.2265}.\end{aligned}$$

3)Effects of Customer Segments on Profit :

	<i>Business</i>	<i>Leisure</i>	<i>Seniors</i>	<i>Students</i>
Business	1			
Leisure	-0.6951	1		
	-			
Seniors	0.22728	0.666182	1	
	-			
Students	0.39277	0.407238	0.320773	1

The correlation table shows that the independent variables Business and Leisure are highly correlated. This suggest multicollinearity between the two variables. Other variables have relatively very low correlation between themselves. (Assuming that 0.6951 is nearly equal to 0.7)

Initial Regression Analysis:

<i>Regression Statistics</i>	
Multiple R	0.40781924
R Square	0.166316533
Adjusted R Square	0.155730076
Standard Error	2980.990166
Observations	320

ANOVA

	<i>df</i>	<i>SS</i>	<i>MS</i>	<i>F</i>	<i>Significance F</i>
Regression	4	558426312.5	139606578.1	15.71031148	9.82141E-12
Residual	315	2799185246	8886302.369		
Total	319	3357611559			

	<i>Coefficients</i>	<i>Standard Error</i>	<i>t Stat</i>	<i>P-value</i>	<i>Lower 95%</i>	<i>Upper 95%</i>	<i>Lower 95.0%</i>	<i>Upper 95.0%</i>
Intercept	4277.937559	936.1103276	4.569907449	7.01546E-06	2436.118462	6119.756657	2436.118462	6119.756657
Business	30.41647503	10.40778382	2.922473751	0.003723875	9.938915449	50.89403462	9.938915449	50.89403462
Leisure	8.496622474	8.953276444	0.948995882	0.3433502	9.119159616	26.11240456	9.119159616	26.11240456
Seniors	-76.47782812	16.43046641	-4.654635251	4.7887E-06	108.8051574	44.15049883	108.8051574	44.15049883
Students	-6.843435906	15.60915373	-0.438424531	0.66137909	37.55481319	23.86794138	37.55481319	23.86794138

The initial regression analysis shows that three variables Leisure and Student have p-values greater than the level of significance at 0.05. So, these variables may be insignificant. Using the systematic method, we first remove the variable Student from the model and rerun a regression analysis.

Regression Analysis after dropping student:

<i>Regression Statistics</i>	
Multiple R	0.407195053
R Square	0.165807811

Adjusted R Square	0.157888265
Standard Error	2977.177608
Observations	320

ANOVA

	<i>df</i>	<i>SS</i>	<i>MS</i>	<i>F</i>	<i>Significance F</i>
Regression	3	556718222.4	185572740.8	20.93652954	2.1349E-12
Residual	316	2800893336	8863586.508		
Total	319	3357611559			

	<i>Coefficients</i>	<i>Standard Error</i>	<i>t Stat</i>	<i>P-value</i>	<i>Lower 95%</i>	<i>Upper 95%</i>	<i>Lower 95.0%</i>	<i>Upper 95.0%</i>
Intercept	4180.520227	908.1940586	4.603113385	6.03753E-06	2393.648854	5967.3916	2393.648854	5967.3916
Business	31.43027569	10.13467645	3.101260887	0.002100679	11.49030464	51.37024674	11.49030464	51.37024674
Leisure	8.405791822	8.939431361	0.940304979	0.347779366	9.182535079	25.99411872	9.182535079	25.99411872
Seniors	-77.6664572	16.18451906	-4.798811563	2.46544E-06	109.5094907	45.82342374	109.5094907	45.82342374

While R Square has gone down, the Adjusted R Square has improved slightly. Therefore, removing Student actually improved the model. The results. However, in the new model, still Seniors has p-values higher than the level of significance. Therefore, using the systematic method, we remove Leisure and rerun a regression analysis

Regression Analysis after removing Leisure :

<i>Regression Statistics</i>	
Multiple R	0.404318843

R Square	0.163473727
Adjusted R Square	0.158195958
Standard Error	2976.633652
Observations	320

ANOVA

	<i>df</i>	<i>SS</i>	<i>MS</i>	<i>F</i>	<i>Significance F</i>
Regression	2	548881274.5	274440637.2	30.97402498	5.16433E-13
Residual	317	2808730284	8860347.9		
Total	319	3357611559			

	<i>Coefficients</i>	<i>Standard Error</i>	<i>t Stat</i>	<i>P-value</i>	<i>Lower 95%</i>	<i>Upper 95%</i>	<i>Lower 95.0%</i>	<i>Upper 95.0%</i>
Intercept	4679.433469	736.9503204	6.349727166	7.46822E-10	3229.501653	6129.365286	3229.501653	6129.365286
Business	24.2962706	6.718186757	3.616492288	0.000347311	11.07840169	37.51413951	11.07840169	37.51413951
Seniors	-66.6194454	11.12969711	-5.985737503	5.82595E-09	88.51685355	44.72203725	88.51685355	44.72203725

The revised model shows that the remaining variables have p-values significantly lower than the level of significance. Therefore, this model is the final model.

Regression Analysis Using XLMiner :

Regression Model

Input Variables	Coefficient	Std. Error	t-Statistic	P-Value	CI Lower	CI Upper	RSS Reduction
Intercept	4277.938	936.110328	4.569907449	7.02E-06	2436.118	6119.757	4254079197
Business	30.41648	10.4077838	2.922473751	0.003724	9.938915	50.89403	231423396

Seniors	-76.4778	16.4304664	-4.65463525	4.79E-06	-108.805	-44.1505	317457879
Leisure	8.496622	8.95327644	0.948995882	0.34335	-9.11916	26.1124	7836947.9
Students	-6.84344	15.6091537	-0.43842453	0.661379	-37.5548	23.86794	1708090.11

Residual DF	315
R ²	0.16631653
Adjusted R ²	0.15573008
Std. Error Estimate	2980.99017
RSS	2799185246

ANOVA

Source	DF	SS	MS	F-Statistic	P-Value
Regression	4	558426312	139606578.1	15.7103	0
Error	315	2799185246	8886302.369		
Total	319	3357611559	148492880.5		

Model Predictors

Tolerance for Entering the Model	9.34882E-11
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Included		Excluded	
Predictor	Criteria	Predictor	Criteria
Intercept	3.184443		
Business	1315.756		
Seniors	181.579		
Leisure	913.6825		
Students	199.1652		

The resulting predictive models in both Excel and XLMiner are identical.

Explaining the Effects on Profit:

The predictive model shows that Business and Seniors customer segments have insignificant effects on profit, whereas Leisure and student segments have negative effects on profit. In other words, when the proportion of Leisure and Students travelling on a flight are high, the profit from that flight is relatively lower.

4)Effects of Seasons on Demand:

Regression Statistics	
Multiple R	0.890724074
R Square	0.793389375
Adjusted R Square	0.791427882
Standard Error	0.063397317
Observations	320

ANOVA					
	<i>df</i>	<i>SS</i>	<i>MS</i>	<i>F</i>	<i>Significance F</i>
Regression	3	4.877110228	1.625703409	404.4823333	7.8891E-108
Residual	316	1.270073462	0.00401922		
Total	319	6.14718369			

	<i>Coefficients</i>	<i>Standard Error</i>	<i>t Stat</i>	<i>P-value</i>	<i>Lower 95%</i>	<i>Upper 95%</i>	<i>Lower 95.0%</i>	<i>Upper 95.0%</i>
Intercept	0.633889683	0.006720102	94.32738774	1.6966E-233	0.620667886	0.647111481	0.620667886	0.647111481
Winter	-0.106851406	0.009901729	-10.79118625	2.54539E-23	0.126333054	0.087369758	0.126333054	0.087369758

Spring	0.08249027	0.009833017	8.389110499	1.65333E-15	0.063143813	0.101836727	0.063143813	0.101836727
Summer	0.237380683	0.009866987	24.05807181	2.10945E-73	0.21796739	0.256793975	0.21796739	0.256793975

The regression analysis shows that seasons have a significant effect on Demand. When looked at independently, the expected demand for each seasons is as follows.

Winter: 52.49%

Summer: 87.37%

Spring: 71.71%

Fall: 62.73%