MG-GY 9753: Business Analytics
Fall-2017

Short Case 2 Report

Submitted by
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Contents

1) Predicting Advertisement Rate:

1) Scatter Chart with trendline (with Equation and R-square):

Price vs Week

y = -0.0004x + 1.4543
R² = 0.004
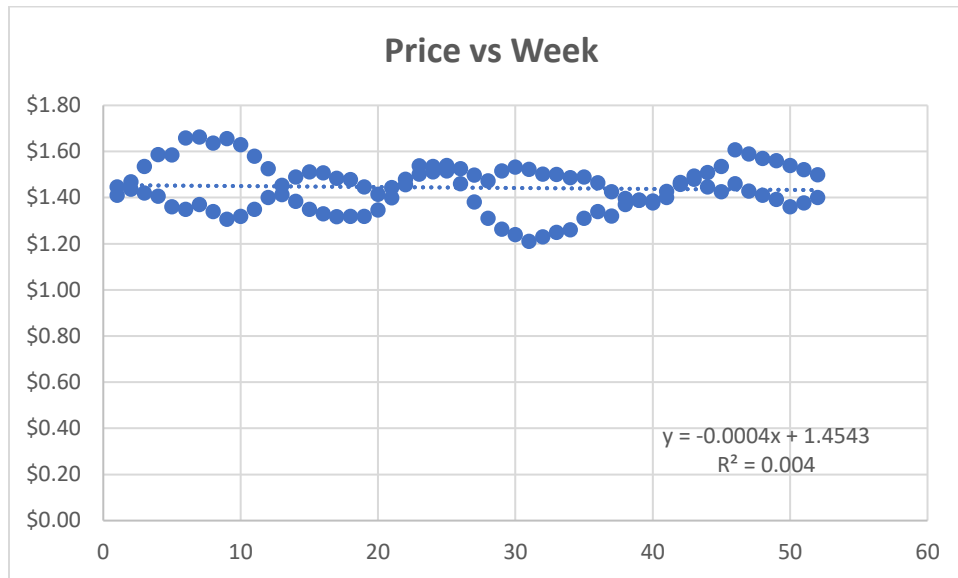
2) Details of three smoothing models using three different K:
1) K=2

K=2

Week	Rate	Forecast	Error	Absolute Deviation	Squared Error	Absolute % Error
40						
41						
42	$1.47	$1.41	$0.06	0.0595	0.0035	4.0587
43	$1.49	$1.45	$0.05	0.0475	0.0023	3.1794
44	$1.51	$1.48	$0.03	0.0290	0.0008	1.9218
45	$1.54	$1.50	$0.03	0.0335	0.0011	2.1824
46	$1.61	$1.52	$0.09	0.0850	0.0072	5.2894
47	$1.59	$1.57	$0.02	0.0190	0.0004	1.1950
48	$1.57	$1.60	-$0.03	0.0285	0.0008	1.8153
49	$1.56	$1.58	-$0.02	0.0200	0.0004	1.2821
50	$1.54	$1.57	-$0.02	0.0250	0.0006	1.6234
51	$1.52	$1.55	-$0.03	0.0290	0.0008	1.9066
52	$1.50	$1.53	-$0.03	0.0315	0.0010	2.1014

1	$1.45	$1.51	-$0.06	0.0630	0.0040	4.3538
2	$1.44	$1.47	-$0.04	0.0360	0.0013	2.5052
3	$1.42	$1.44	-$0.02	0.0220	0.0005	1.5493
4	$1.41	$1.43	-$0.02	0.0225	0.0005	1.6003
5	$1.36	$1.41	-$0.05	0.0530	0.0028	3.8971
6	$1.35	$1.38	-$0.03	0.0330	0.0011	2.4444
7	$1.37	$1.36	$0.02	0.0150	0.0002	1.0949
8	$1.34	$1.36	-$0.02	0.0200	0.0004	1.4925
9	$1.31	$1.36	-$0.05	0.0480	0.0023	3.6725
10	$1.32	$1.32	$0.00	0.0045	0.0000	0.3412
11	$1.35	$1.31	$0.04	0.0370	0.0014	2.7407
12	$1.40	$1.33	$0.07	0.0655	0.0043	4.6786
13	$1.41	$1.38	$0.04	0.0380	0.0014	2.6893
14	$1.49	$1.41	$0.08	0.0835	0.0070	5.6040
15	$1.51	$1.45	$0.06	0.0595	0.0035	3.9378
16	$1.51	$1.50	$0.01	0.0075	0.0001	0.4973
17	$1.48	$1.51	-$0.03	0.0255	0.0007	1.7183
18	$1.48	$1.50	-$0.02	0.0180	0.0003	1.2179
19	$1.45	$1.48	-$0.03	0.0340	0.0012	2.3497
20	$1.42	$1.46	-$0.05	0.0475	0.0023	3.3569
21	$1.44	$1.43	$0.01	0.0130	0.0002	0.9003
22	$1.46	$1.43	$0.03	0.0265	0.0007	1.8201
23	$1.50	$1.45	$0.05	0.0520	0.0027	3.4621
24	$1.54	$1.48	$0.06	0.0560	0.0031	3.6482
25	$1.54	$1.52	$0.02	0.0205	0.0004	1.3320
26	$1.53	$1.54	-$0.01	0.0120	0.0001	0.7869
27	$1.50	$1.53	-$0.03	0.0340	0.0012	2.2697
28	$1.47	$1.51	-$0.04	0.0385	0.0015	2.6137
29	$1.52	$1.49	$0.03	0.0305	0.0009	2.0119
30	$1.53	$1.49	$0.04	0.0375	0.0014	2.4478
31	$1.52	$1.52	$0.00	0.0010	0.0000	0.0657
32	$1.50	$1.53	-$0.03	0.0255	0.0007	1.6977
33	$1.50	$1.51	-$0.01	0.0115	0.0001	0.7662
34	$1.49	$1.50	-$0.01	0.0145	0.0002	0.9751
35	$1.49	$1.49	$0.00	0.0050	0.0000	0.3358
36	$1.46	$1.49	-$0.02	0.0240	0.0006	1.6393
37	$1.43	$1.48	-$0.05	0.0515	0.0027	3.6140
38	$1.40	$1.44	-$0.05	0.0485	0.0024	3.4742
39	$1.39	$1.41	-$0.02	0.0225	0.0005	1.6210
40	$1.38	$1.39	-$0.02	0.0150	0.0002	1.0893
41	$1.40	$1.38	$0.02	0.0175	0.0003	1.2500
42	$1.46	$1.39	$0.07	0.0695	0.0048	4.7668
43	$1.48	$1.43	$0.05	0.0510	0.0026	3.4459
44	$1.45	$1.47	-$0.02	0.0230	0.0005	1.5906
45	$1.43	$1.46	-$0.04	0.0370	0.0014	2.5947

46	$1.46	$1.44	$0.02	0.0240	0.0006	1.6438
47	$1.43	$1.44	-$0.01	0.0140	0.0002	0.9797
48	$1.41	$1.44	-$0.03	0.0345	0.0012	2.4468
49	$1.39	$1.42	-$0.03	0.0265	0.0007	1.9024
50	$1.36	$1.40	-$0.04	0.0415	0.0017	3.0515
51	$1.38	$1.38	$0.00	0.0005	0.0000	0.0363
52	$1.40	$1.37	$0.03	0.0315	0.0010	2.2500
1	$1.41	$1.39	$0.02	0.0225	0.0005	1.5946
2	$1.47	$1.41	$0.06	0.0635	0.0040	4.3227
3	$1.54	$1.44	$0.10	0.0950	0.0090	6.1889
4	$1.59	$1.50	$0.08	0.0840	0.0071	5.2963
5	$1.59	$1.56	$0.02	0.0245	0.0006	1.5457
6	$1.66	$1.59	$0.07	0.0735	0.0054	4.4304
7	$1.66	$1.62	$0.04	0.0410	0.0017	2.4654
8	$1.64	$1.66	-$0.02	0.0240	0.0006	1.4661
9	$1.66	$1.65	$0.01	0.0060	0.0000	0.3623
10	$1.63	$1.65	-$0.02	0.0165	0.0003	1.0123
11	$1.58	$1.64	-$0.06	0.0630	0.0040	3.9873
12	$1.53	$1.61	-$0.08	0.0790	0.0062	5.1769
13	$1.45	$1.55	-$0.10	0.0990	0.0098	6.8088
14	$1.38	$1.49	-$0.11	0.1060	0.0112	7.6590
15	$1.35	$1.42	-$0.07	0.0690	0.0048	5.1111
16	$1.33	$1.37	-$0.04	0.0370	0.0014	2.7820
17	$1.32	$1.34	-$0.02	0.0220	0.0005	1.6692
18	$1.32	$1.32	-$0.01	0.0050	0.0000	0.3791
19	$1.32	$1.32	$0.00	0.0005	0.0000	0.0379
20	$1.35	$1.32	$0.03	0.0280	0.0008	2.0787
21	$1.40	$1.33	$0.07	0.0660	0.0044	4.7177
22	$1.48	$1.37	$0.11	0.1070	0.0114	7.2297
23	$1.54	$1.44	$0.10	0.0985	0.0097	6.4044
24	$1.51	$1.51	$0.00	0.0020	0.0000	0.1324
25	$1.52	$1.52	-$0.01	0.0085	0.0001	0.5607
26	$1.46	$1.51	-$0.05	0.0535	0.0029	3.6644
27	$1.38	$1.49	-$0.11	0.1070	0.0114	7.7480
28	$1.31	$1.42	-$0.11	0.1105	0.0122	8.4351
29	$1.26	$1.35	-$0.08	0.0815	0.0066	6.4478
30	$1.24	$1.29	-$0.05	0.0470	0.0022	3.7903
31	$1.21	$1.25	-$0.04	0.0420	0.0018	3.4711
32	$1.23	$1.23	$0.00	0.0050	0.0000	0.4065
33	$1.25	$1.22	$0.03	0.0300	0.0009	2.4000
34	$1.26	$1.24	$0.02	0.0200	0.0004	1.5873
35	$1.31	$1.26	$0.06	0.0550	0.0030	4.1985
36	$1.34	$1.29	$0.05	0.0550	0.0030	4.1045
37	$1.32	$1.33	-$0.01	0.0050	0.0000	0.3788
38	$1.37	$1.33	$0.04	0.0400	0.0016	2.9197

Week	Rate	Forecast	Error	Absolute Deviation	Squared Error	Absolute % Error
39	$1.39	$1.35	$0.04	0.0450	0.0020	3.2374
40		$1.38		0.0391	0.0023	2.7160
				MAD	**MSE**	**MAPE**

2) K = 3

K=3

Week	Rate	Forecast	Error	Absolute Deviation	Squared Error	Absolute % Error
40						
41						
42						
43	$1.49	$1.43	$0.07	0.0677	0.0046	4.5292
44	$1.51	$1.46	$0.05	0.0467	0.0022	3.0926
45	$1.54	$1.49	$0.05	0.0453	0.0021	2.9533
46	$1.61	$1.51	$0.09	0.0943	0.0089	5.8702
47	$1.59	$1.55	$0.04	0.0397	0.0016	2.4948
48	$1.57	$1.58	-$0.01	0.0073	0.0001	0.4671
49	$1.56	$1.59	-$0.03	0.0290	0.0008	1.8590
50	$1.54	$1.57	-$0.03	0.0333	0.0011	2.1645
51	$1.52	$1.56	-$0.04	0.0357	0.0013	2.3449
52	$1.50	$1.54	-$0.04	0.0413	0.0017	2.7574
1	$1.45	$1.52	-$0.07	0.0730	0.0053	5.0449
2	$1.44	$1.49	-$0.05	0.0520	0.0027	3.6186
3	$1.42	$1.46	-$0.04	0.0410	0.0017	2.8873
4	$1.41	$1.43	-$0.03	0.0287	0.0008	2.0389
5	$1.36	$1.42	-$0.06	0.0610	0.0037	4.4853
6	$1.35	$1.40	-$0.05	0.0453	0.0021	3.3580
7	$1.37	$1.37	$0.00	0.0020	0.0000	0.1460
8	$1.34	$1.36	-$0.02	0.0200	0.0004	1.4925
9	$1.31	$1.35	-$0.05	0.0463	0.0021	3.5450

10	$1.32	$1.34	$0.02	0.0200	0.0004	1.5163
11	$1.35	$1.32	$0.03	0.0280	0.0008	2.0741
12	$1.40	$1.33	$0.07	0.0747	0.0056	5.3333
13	$1.41	$1.36	$0.06	0.0567	0.0032	4.0104
14	$1.49	$1.39	$0.10	0.1023	0.0105	6.8680
15	$1.51	$1.43	$0.08	0.0767	0.0059	5.0739
16	$1.51	$1.47	$0.04	0.0367	0.0013	2.4315
17	$1.48	$1.50	-$0.02	0.0190	0.0004	1.2803
18	$1.48	$1.50	-$0.02	0.0230	0.0005	1.5562
19	$1.45	$1.49	-$0.04	0.0430	0.0018	2.9717
20	$1.42	$1.47	-$0.05	0.0547	0.0030	3.8634
21	$1.44	$1.45	$0.00	0.0027	0.0000	0.1847
22	$1.46	$1.44	$0.02	0.0207	0.0004	1.4194
23	$1.50	$1.44	$0.06	0.0637	0.0041	4.2388
24	$1.54	$1.47	$0.07	0.0677	0.0046	4.4083
25	$1.54	$1.50	$0.04	0.0413	0.0017	2.6857
26	$1.53	$1.53	$0.00	0.0003	0.0000	0.0219
27	$1.50	$1.53	-$0.03	0.0350	0.0012	2.3364
28	$1.47	$1.52	-$0.05	0.0477	0.0023	3.2360
29	$1.52	$1.50	$0.02	0.0173	0.0003	1.1434
30	$1.53	$1.50	$0.04	0.0363	0.0013	2.3716
31	$1.52	$1.51	$0.02	0.0160	0.0003	1.0506
32	$1.50	$1.52	-$0.02	0.0217	0.0005	1.4425
33	$1.50	$1.52	-$0.02	0.0180	0.0003	1.1992
34	$1.49	$1.51	-$0.02	0.0217	0.0005	1.4571
35	$1.49	$1.50	-$0.01	0.0077	0.0001	0.5149
36	$1.46	$1.49	-$0.03	0.0283	0.0008	1.9353
37	$1.43	$1.48	-$0.05	0.0550	0.0030	3.8596
38	$1.40	$1.46	-$0.06	0.0633	0.0040	4.5368
39	$1.39	$1.43	-$0.04	0.0403	0.0016	2.9059
40	$1.38	$1.40	-$0.03	0.0260	0.0007	1.8882

41	$1.40	$1.39	$0.01	0.0130	0.0002	0.9286
42	$1.46	$1.39	$0.07	0.0697	0.0049	4.7782
43	$1.48	$1.41	$0.07	0.0683	0.0047	4.6171
44	$1.45	$1.45	$0.00	0.0000	0.0000	0.0000
45	$1.43	$1.46	-$0.04	0.0353	0.0012	2.4778
46	$1.46	$1.45	$0.01	0.0093	0.0001	0.6393
47	$1.43	$1.44	-$0.01	0.0150	0.0002	1.0497
48	$1.41	$1.44	-$0.03	0.0283	0.0008	2.0095
49	$1.39	$1.43	-$0.04	0.0400	0.0016	2.8715
50	$1.36	$1.41	-$0.05	0.0507	0.0026	3.7255
51	$1.38	$1.39	-$0.01	0.0107	0.0001	0.7746
52	$1.40	$1.38	$0.02	0.0233	0.0005	1.6667
1	$1.41	$1.38	$0.03	0.0320	0.0010	2.2679
2	$1.47	$1.40	$0.07	0.0730	0.0053	4.9694
3	$1.54	$1.43	$0.11	0.1083	0.0117	7.0575
4	$1.59	$1.47	$0.11	0.1143	0.0131	7.2089
5	$1.59	$1.53	$0.05	0.0550	0.0030	3.4700
6	$1.66	$1.57	$0.09	0.0903	0.0082	5.4450
7	$1.66	$1.61	$0.05	0.0530	0.0028	3.1870
8	$1.64	$1.64	$0.00	0.0013	0.0000	0.0814
9	$1.66	$1.65	$0.00	0.0030	0.0000	0.1812
10	$1.63	$1.65	-$0.02	0.0220	0.0005	1.3497
11	$1.58	$1.64	-$0.06	0.0610	0.0037	3.8608
12	$1.53	$1.62	-$0.10	0.0960	0.0092	6.2910
13	$1.45	$1.58	-$0.12	0.1247	0.0155	8.5740
14	$1.38	$1.52	-$0.14	0.1360	0.0185	9.8266
15	$1.35	$1.45	-$0.10	0.1047	0.0110	7.7531
16	$1.33	$1.40	-$0.07	0.0660	0.0044	4.9624
17	$1.32	$1.35	-$0.04	0.0367	0.0013	2.7820
18	$1.32	$1.33	-$0.01	0.0137	0.0002	1.0361
19	$1.32	$1.32	$0.00	0.0033	0.0000	0.2527
20	$1.35	$1.32	$0.03	0.0283	0.0008	2.1034

	Rate	Forecast	Error	Absolute Deviation	Squared Error	Absolute % Error
21	$1.40	$1.33	$0.07	0.0707	0.0050	5.0512
22	$1.48	$1.36	$0.13	0.1250	0.0156	8.4459
23	$1.54	$1.41	$0.13	0.1293	0.0167	8.4092
24	$1.51	$1.47	$0.04	0.0387	0.0015	2.5590
25	$1.52	$1.51	$0.01	0.0063	0.0000	0.4178
26	$1.46	$1.52	-$0.06	0.0617	0.0038	4.2237
27	$1.38	$1.50	-$0.11	0.1147	0.0131	8.3032
28	$1.31	$1.45	-$0.14	0.1423	0.0203	10.8651
29	$1.26	$1.38	-$0.12	0.1197	0.0143	9.4673
30	$1.24	$1.32	-$0.08	0.0783	0.0061	6.3172
31	$1.21	$1.27	-$0.06	0.0613	0.0038	5.0689
32	$1.23	$1.24	-$0.01	0.0080	0.0001	0.6504
33	$1.25	$1.23	$0.02	0.0233	0.0005	1.8667
34	$1.26	$1.23	$0.03	0.0300	0.0009	2.3810
35	$1.31	$1.25	$0.06	0.0633	0.0040	4.8346
36	$1.34	$1.27	$0.07	0.0667	0.0044	4.9751
37	$1.32	$1.30	$0.02	0.0167	0.0003	1.2626
38	$1.37	$1.32	$0.05	0.0467	0.0022	3.4063
39	$1.39	$1.34	$0.05	0.0467	0.0022	3.3573
40		$1.36		0.0476	0.0034	3.3171
				MAD	**MSE**	**MAPE**

3) K = 4

K=4

Week	Rate	Forecast	Error	Absolute Deviation	Squared Error	Absolute % Error
40						
41						
42						
43						
44	$1.51	$1.44	$0.07	0.0658	0.0043	4.3572
45	$1.54	$1.47	$0.06	0.0610	0.0037	3.9739
46	$1.61	$1.50	$0.11	0.1060	0.0112	6.5961
47	$1.59	$1.54	$0.05	0.0538	0.0029	3.3805
48	$1.57	$1.56	$0.01	0.0098	0.0001	0.6210

49	$1.56	$1.58	-$0.02	0.0155	0.0002	0.9936
50	$1.54	$1.58	-$0.04	0.0418	0.0017	2.7110
51	$1.52	$1.57	-$0.04	0.0440	0.0019	2.8928
52	$1.50	$1.55	-$0.05	0.0487	0.0024	3.2522
1	$1.45	$1.53	-$0.08	0.0830	0.0069	5.7360
2	$1.44	$1.50	-$0.06	0.0648	0.0042	4.5059
3	$1.42	$1.48	-$0.06	0.0560	0.0031	3.9437
4	$1.41	$1.45	-$0.04	0.0447	0.0020	3.1828
5	$1.36	$1.43	-$0.07	0.0675	0.0046	4.9632
6	$1.35	$1.41	-$0.06	0.0558	0.0031	4.1296
7	$1.37	$1.38	-$0.01	0.0140	0.0002	1.0219
8	$1.34	$1.37	-$0.03	0.0315	0.0010	2.3507
9	$1.31	$1.36	-$0.05	0.0480	0.0023	3.6725
10	$1.32	$1.34	-$0.02	0.0228	0.0005	1.7248
11	$1.35	$1.33	$0.02	0.0160	0.0003	1.1852
12	$1.40	$1.33	$0.07	0.0710	0.0050	5.0714
13	$1.41	$1.34	$0.07	0.0690	0.0048	4.8832
14	$1.49	$1.37	$0.12	0.1195	0.0143	8.0201
15	$1.51	$1.41	$0.10	0.0977	0.0096	6.4692
16	$1.51	$1.45	$0.05	0.0545	0.0030	3.6141
17	$1.48	$1.48	$0.00	0.0035	0.0000	0.2358
18	$1.48	$1.50	-$0.02	0.0202	0.0004	1.3701
19	$1.45	$1.50	-$0.05	0.0483	0.0023	3.3345
20	$1.42	$1.48	-$0.06	0.0643	0.0041	4.5406
21	$1.44	$1.46	-$0.01	0.0120	0.0001	0.8310
22	$1.46	$1.45	$0.01	0.0100	0.0001	0.6868
23	$1.50	$1.44	$0.06	0.0615	0.0038	4.0945
24	$1.54	$1.45	$0.08	0.0808	0.0065	5.2606
25	$1.54	$1.48	$0.05	0.0548	0.0030	3.5575
26	$1.53	$1.51	$0.02	0.0170	0.0003	1.1148
27	$1.50	$1.53	-$0.03	0.0273	0.0007	1.8191
28	$1.47	$1.52	-$0.05	0.0513	0.0026	3.4793
29	$1.52	$1.51	$0.01	0.0072	0.0001	0.4782
30	$1.53	$1.50	$0.03	0.0290	0.0008	1.8930
31	$1.52	$1.50	$0.02	0.0183	0.0003	1.1983
32	$1.50	$1.51	-$0.01	0.0090	0.0001	0.5992
33	$1.50	$1.52	-$0.02	0.0173	0.0003	1.1492
34	$1.49	$1.51	-$0.03	0.0275	0.0008	1.8494
35	$1.49	$1.50	-$0.01	0.0142	0.0002	0.9570
36	$1.46	$1.49	-$0.03	0.0307	0.0009	2.1004
37	$1.43	$1.49	-$0.06	0.0602	0.0036	4.2281
38	$1.40	$1.47	-$0.07	0.0702	0.0049	5.0322
39	$1.39	$1.44	-$0.06	0.0555	0.0031	3.9986
40	$1.38	$1.42	-$0.04	0.0413	0.0017	2.9956
41	$1.40	$1.40	$0.00	0.0035	0.0000	0.2500

42	$1.46	$1.39	$0.07	0.0678	0.0046	4.6468
43	$1.48	$1.41	$0.07	0.0743	0.0055	5.0169
44	$1.45	$1.43	$0.02	0.0173	0.0003	1.1929
45	$1.43	$1.45	-$0.02	0.0200	0.0004	1.4025
46	$1.46	$1.45	$0.01	0.0075	0.0001	0.5137
47	$1.43	$1.45	-$0.02	0.0240	0.0006	1.6795
48	$1.41	$1.44	-$0.03	0.0303	0.0009	2.1454
49	$1.39	$1.43	-$0.04	0.0383	0.0015	2.7459
50	$1.36	$1.42	-$0.06	0.0630	0.0040	4.6324
51	$1.38	$1.40	-$0.02	0.0210	0.0004	1.5251
52	$1.40	$1.39	$0.01	0.0150	0.0002	1.0714
1	$1.41	$1.38	$0.03	0.0285	0.0008	2.0198
2	$1.47	$1.39	$0.08	0.0820	0.0067	5.5820
3	$1.54	$1.41	$0.12	0.1208	0.0146	7.8664
4	$1.59	$1.45	$0.13	0.1323	0.0175	8.3386
5	$1.59	$1.50	$0.08	0.0848	0.0072	5.3470
6	$1.66	$1.54	$0.12	0.1153	0.0133	6.9470
7	$1.66	$1.59	$0.07	0.0718	0.0051	4.3145
8	$1.64	$1.62	$0.01	0.0137	0.0002	0.8400
9	$1.66	$1.64	$0.02	0.0200	0.0004	1.2077
10	$1.63	$1.65	-$0.02	0.0237	0.0006	1.4571
11	$1.58	$1.65	-$0.07	0.0665	0.0044	4.2089
12	$1.53	$1.63	-$0.10	0.0998	0.0100	6.5367
13	$1.45	$1.60	-$0.14	0.1440	0.0207	9.9037
14	$1.38	$1.55	-$0.16	0.1635	0.0267	11.8136
15	$1.35	$1.49	-$0.14	0.1360	0.0185	10.0741
16	$1.33	$1.43	-$0.10	0.0985	0.0097	7.4060
17	$1.32	$1.38	-$0.06	0.0615	0.0038	4.6662
18	$1.32	$1.35	-$0.03	0.0265	0.0007	2.0091
19	$1.32	$1.33	-$0.01	0.0103	0.0001	0.7771
20	$1.35	$1.32	$0.03	0.0255	0.0007	1.8931
21	$1.40	$1.33	$0.07	0.0733	0.0054	5.2359
22	$1.48	$1.35	$0.13	0.1340	0.0180	9.0541
23	$1.54	$1.39	$0.15	0.1518	0.0230	9.8667
24	$1.51	$1.44	$0.07	0.0700	0.0049	4.6327
25	$1.52	$1.48	$0.03	0.0340	0.0012	2.2427
26	$1.46	$1.51	-$0.05	0.0513	0.0026	3.5103
27	$1.38	$1.51	-$0.13	0.1253	0.0157	9.0695
28	$1.31	$1.47	-$0.16	0.1570	0.0246	11.9847
29	$1.26	$1.42	-$0.15	0.1528	0.0233	12.0847
30	$1.24	$1.35	-$0.11	0.1138	0.0129	9.1734
31	$1.21	$1.30	-$0.09	0.0888	0.0079	7.3347
32	$1.23	$1.26	-$0.03	0.0260	0.0007	2.1138
33	$1.25	$1.24	$0.01	0.0140	0.0002	1.1200
34	$1.26	$1.23	$0.03	0.0275	0.0008	2.1825

				MAD	MSE	MAPE
35	$1.31	$1.24	$0.07	0.0725	0.0053	5.5344
36	$1.34	$1.26	$0.08	0.0775	0.0060	5.7836
37	$1.32	$1.29	$0.03	0.0300	0.0009	2.2727
38	$1.37	$1.31	$0.06	0.0625	0.0039	4.5620
39	$1.39	$1.34	$0.05	0.0550	0.0030	3.9568
40		$1.36		0.0562	0.0047	3.9180
				MAD	**MSE**	**MAPE**

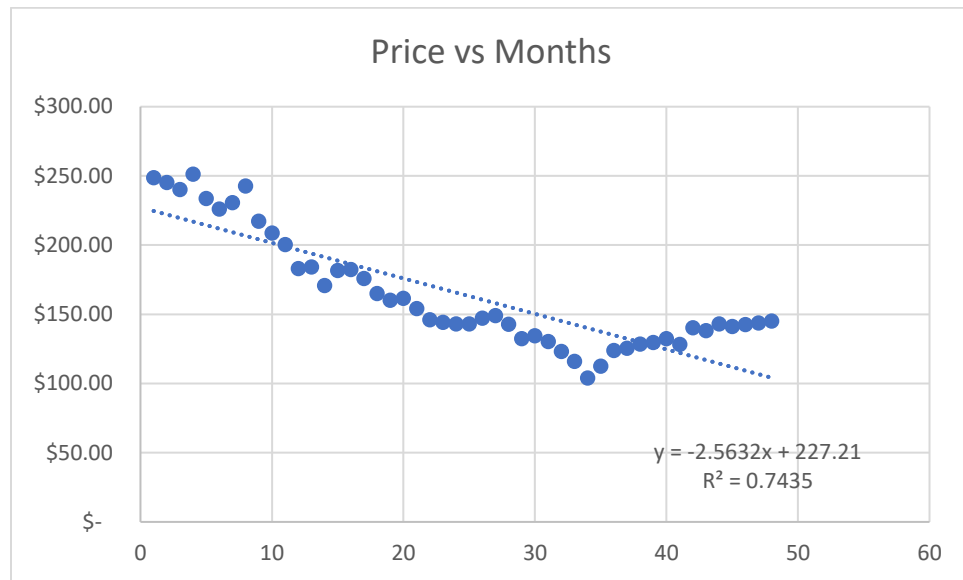## 3) Reasoning for selecting one of the three models:

In the above tables, results show that two-period (k=2) moving average model provides the best forecast among these alternatives because the error metrics are all smaller than for the other models.

4) Forecast for next week:

So, advertising forecast price for next week (week= 40, 2017) is $1.38.

2) Procurement of Batteries:

1) Scatter chart with trendline (with equation and R-square)

Price vs Months

```
$300.00

$250.00   ● ● ●
          ●   ● ●
$200.00           ● ●
                    ● ●
$150.00               ● ● ● ● ●
                            ● ● ●       ● ● ● ● ●
$100.00                         ● ●
                                    ●

$50.00                                  y = -2.5632x + 227.21
                                        R² = 0.7435
$-
        0      10     20     30     40     50     60
```

y = -2.5632x + 227.21

$R^2 = 0.7435$

2) XLminer output with double exponential smoothing:

Inputs

Data	
Workbook	Book2.xlsx
Worksheet	Sheet1
Range	$B$4:$C$52
Selected Variable	Price
# Records in Input Data	48

Parameters/Options	
Optimization Selected	Yes
Alpha (Level)	0.874446852
Beta (Trend)	0.090792566
Forecast	Yes
#Forecasts	6

Training Error Measures

Mean Absolute Percentage Error (MAPE)	3.879706
Mean Absolute Deviation (MAD)	6.353527
Mean Square Error (MSE)	65.57806
Tracking Signal Error (TSE)	10.07151
Cumulative Forecast Error (CFE)	63.9896
Mean Forecast Error (MFE)	1.333117

Fitted Model

Time	Actual	Forecast	Residuals
1	248.6	254.282	-5.682
2	245.3	254.282	-8.982
3	240.1	240.6162	-0.51617
4	251.3	234.3123	16.98772
5	233.7	244.6633	-10.9633
6	226	229.7023	-3.70225
7	230.65	220.7967	9.853334
8	242.6	224.527	18.07299
9	217.1	236.8799	-19.7799
10	208.7	214.562	-5.86204
11	200.25	203.9492	-3.6992
12	183.05	194.934	-11.884
13	184.15	177.8181	6.331926
14	170.85	177.1337	-6.28372
15	181.6	164.9188	16.68123
16	182.25	174.1098	8.140171
17	175.75	176.4785	-0.72846
18	164.95	171.0341	-6.08411
19	160.05	160.4235	-0.37349
20	161.5	154.7769	6.723147
21	154.05	155.8696	-1.81962
22	146	149.3477	-3.34773
23	144.1	141.2238	2.876203
24	143	138.7707	4.229285
25	142.95	137.8366	5.113392
26	147.25	138.0816	9.168426
27	148.9	142.6004	6.299637
28	142.75	145.1107	-2.3607
29	132.3	139.8606	-7.56061

30	134.5	129.4632	5.03679
31	130.25	130.4815	-0.23145
32	123.15	126.8745	-3.72452
33	116	119.9174	-3.91739
34	104	112.4806	-8.48059
35	112.5	100.3802	12.11979
36	123.8	107.256	16.544
37	125.5	119.314	6.185994
38	128.4	122.8056	5.594387
39	129.6	126.224	3.375952
40	132.3	127.9706	4.329393
41	128.15	130.8946	-2.74462
42	140.25	127.4149	12.83512
43	138.15	138.5778	-0.42782
44	142.9	138.1091	4.790941
45	141.25	142.5842	-1.3342
46	142.65	141.5973	1.052701
47	143.68	142.7812	0.898806
48	145.14	143.9019	1.238125

Time Plot of Actual Vs Forecast (Training Data)
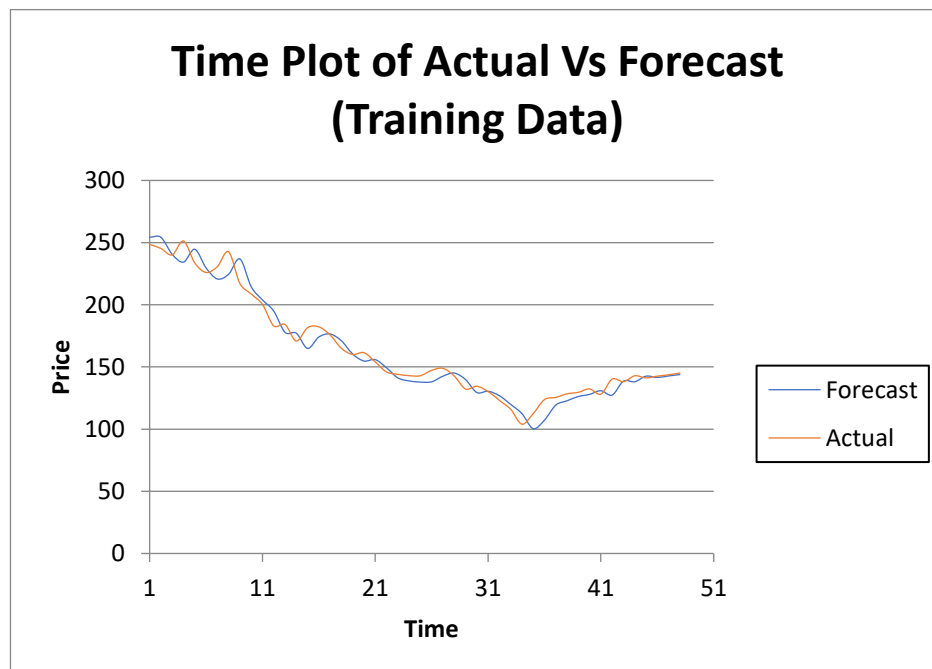
3) Forecast Model:

Best possible value for Alpha 0.8744 and beta: 0.0907 when optimized in XLMiner.

4) **Forecast for next six months:**

Time	Forecast	LCI	UCI
49	145.4176	129.5457	161.2894
50	145.8506	123.9164	167.7848
51	146.2836	118.8966	173.6706
52	146.7166	114.1298	179.3035
53	147.1497	109.4687	184.8306
54	147.5827	104.8384	190.327

3) High-Amp Motor upgrades:

1) Scatter-chart with trendline (with equation and R-squre)
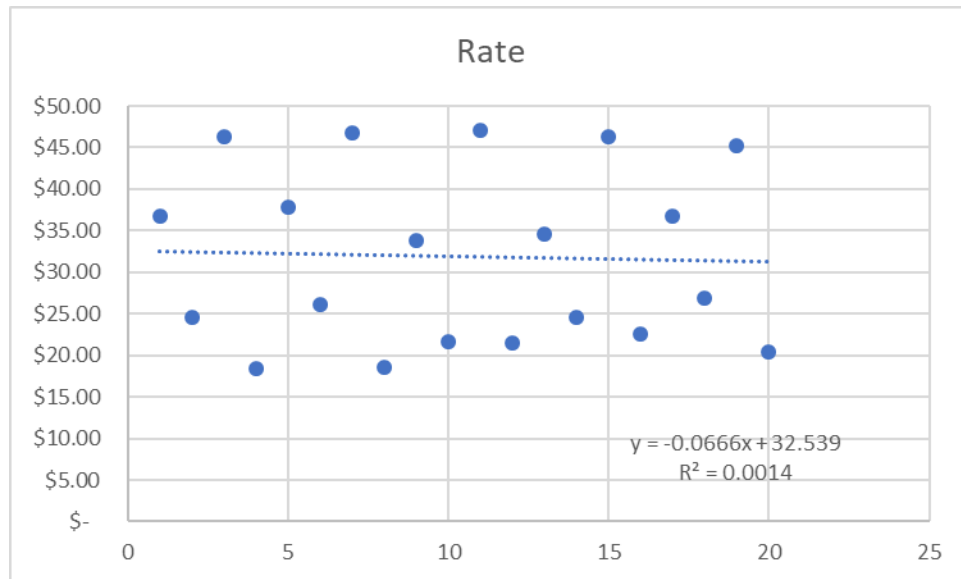
R-sq value is very small and also chart shows there is very little to no relation.

2) Summary output of regression analysis:

SUMMARY
OUTPUT

Regression Statistics	
Multiple R	0.989999236
R Square	0.980098488
Adjusted R Square	0.976366955
Standard Error	1.614943497
Observations	20

ANOVA

	df	SS	MS	F	Significance F
Regression	3	2055.030615	685.010205	262.653007	8.14254E-14
Residual	16	41.72868	2.6080425		

		Total	19	2096.759295			

	Coefficients	Standard Error	t Stat	P-value	Lower 95%	Upper 95%
Intercept	20.286	0.722224688	28.08821179	4.82824E-15	18.75495206	21.81704794
fall	15.672	1.021379949	15.34394719	5.43601E-11	13.50677123	17.83722877
winter	4.482	1.021379949	4.388180916	0.000458355	2.316771234	6.647228766
spring	26.064	1.021379949	25.51841754	2.17142E-14	23.89877123	28.22922877

RESIDUAL OUTPUT

Observation	Predicted Rate	Residuals	Standard Residuals
1	35.958	0.822	0.55466568
2	24.768	-0.168	-0.113362329
3	46.35	-7.10543E-15	-4.79457E-15
4	20.286	-1.866	-1.25913158
5	35.958	1.902	1.283423507
6	24.768	1.392	0.939287867
7	46.35	0.36	0.242919276
8	20.286	-1.656	-1.117428669
9	35.958	-2.178	-1.469661619
10	24.768	-3.108	-2.097203081
11	46.35	0.69	0.465595279
12	20.286	1.254	0.846168811
13	35.958	-1.338	-0.902849975
14	24.768	-0.168	-0.113362329
15	46.35	-7.10543E-15	-4.79457E-15
16	20.286	2.214	1.493953546
17	35.958	0.792	0.534422407
18	24.768	2.052	1.384639872
19	46.35	-1.05	-0.708514555
20	20.286	0.054	0.036437891

3) XLminer output of Holt-Winters model:

If we take a look at the chart there is so little to no trend so we will be using Holt-Winters no trend analysis.

Inputs

Data	
Workbook	Book3
Worksheet	Sheet1
Range	$G$4:$H$24
Selected Variable	Rate
# Records in Input Data	20

| Parameters/Options	
Optimize Weights	Yes
Alpha (Level)	0.004119999
Gamma (Seasonality)	0.000579852
Season length	1
Number of seasons	20
Forecast	Yes
#Forecasts	4

Training Error Measures

Mean Absolute Percentage Error (MAPE)	30.97243
Mean Absolute Deviation (MAD)	9.33905
Mean Square Error (MSE)	107.7182
Tracking Signal Error (TSE)	3.284401
Cumulative Forecast Error (CFE)	30.67319
Mean Forecast Error (MFE)	1.533659

Fitted Model

Season #	Actual	Forecast	Residuals
1	36.78	30.22688	6.553125
2	24.6	30.25767	-5.65767
3	46.35	30.23108	16.11892
4	18.42	30.30684	-11.8868
5	37.86	30.25097	7.609026
6	26.16	30.28673	-4.12673
7	46.71	30.26734	16.44266
8	18.63	30.34462	-11.7146
9	33.78	30.28956	3.490439
10	21.66	30.30597	-8.64597

11	47.04	30.26533	16.77467
12	21.54	30.34417	-8.80417
13	34.62	30.30279	4.317209
14	24.6	30.32308	-5.72308
15	46.35	30.29618	16.05382
16	22.5	30.37163	-7.87163
17	36.75	30.33464	6.415361
18	26.82	30.36479	-3.54479
19	45.3	30.34813	14.95187
20	20.34	30.4184	-10.0784

Time Plot of Actual Vs Forecast (Training Data)
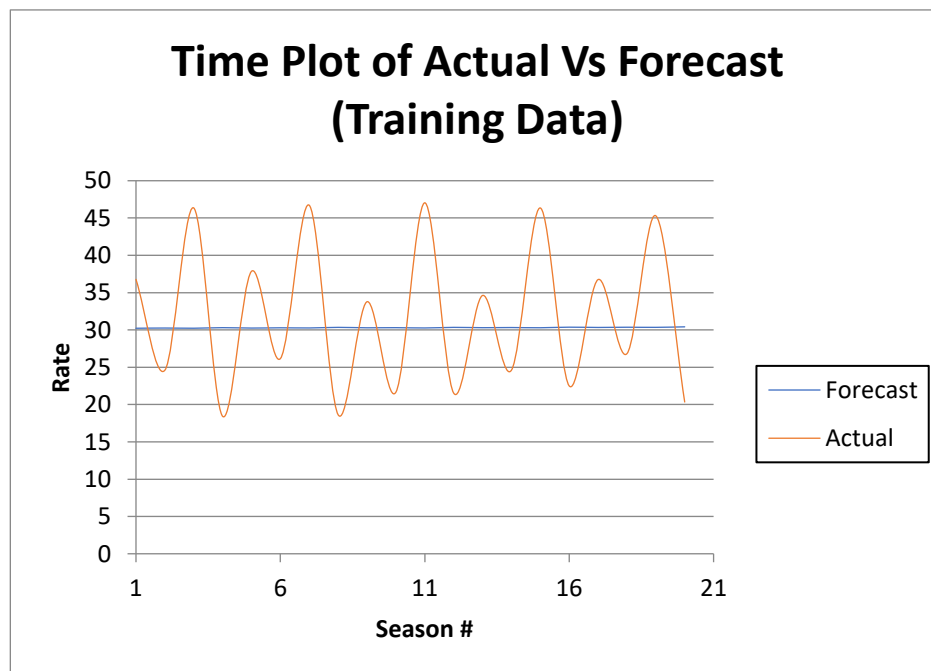
4) Forecasting model based on Regression Analysis:

Rate = 20.286 + 15.672 * fall + 4.482 * winter + 26.064 * spring

5) Forecasting of next-4 seasons regression:

Fall(1): $35.958
Winter(2): $24.768
Spring: $46.35
Summer: $20.286

6) Forecasting of next-4 season Holt-Winters:

Forecast

Season #	Forecast	LCI	UCI
1	30.37103	10.02909	50.71298
2	30.37103	10.02877	50.7133
3	30.37103	10.02841	50.71366
4	30.37103	10.02794	50.71413

4) **Predicting demand:**

1) Summary Output of Regression Analysis:

SUMMARY OUTPUT						
Regression Statistics						
Multiple R	0.902608125					
R Square	0.814701428					
Adjusted R Square	0.80925147					
Standard Error	4651.414557					
Observations	36					
ANOVA						
	df	*SS*	*MS*	*F*	*Significance F*	
Regression	1	3234263636	3234263636	149.4876527	5.3534E-14	
Residual	34	735612351	21635657.38			
Total	35	3969875987				
	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*
Intercept	1223.500098	1909.982381	0.640581876	0.526088524	-2658.051109	5105.051304
Advertisement Budget	2.134238244	0.174558193	12.22651433	5.3534E-14	1.779493316	2.488983173

This is the summary of regression analysis after removing Customer Confidence variable as p-value of that was greater than 0.05. (Which was 0.1049)

2) Forecasting model:
Demand = 1223.5 + 2.1342 * Advertisement Budget

3) Forecast:
If we calculate the demand by the model mention above we get demand as approximately 44,975.