**MG-GY 9753: Business Analytics**

**Fall-2017**

**Short Case 2 Report**

**Submitted by**

**Rushi Thakar**

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1. **Predicting Advertisement Rate:**
2. **Scatter Chart with trendline (with Equation and R-square):**
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4. **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 |
| 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** |

1. **K = 3**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  |  | K=3 |  |  |  |  |
|  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |
| **Week** | **Rate** | **Forecast** | **Error** | **Asolute 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 |
| 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** |

1. **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 |
| 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** |

1. **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.

1. **Forecast for next week:**

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

1. Procurement of Batteries:
2. Scatter chart with trendline (with equation and R-square)
3. 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 | |
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1. Forecast Model:

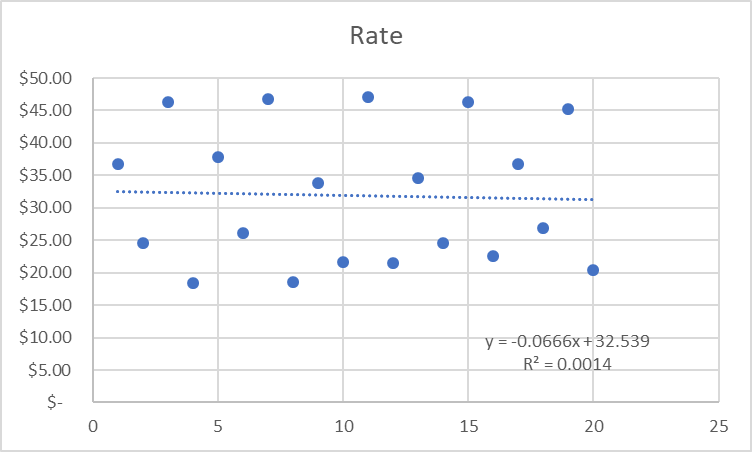
Best possible value for Alpha 0.8744 and beta: 0.0907 when optimized in XLMiner.

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1. **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 |  |

1. **High-Amp Motor upgrades:**
2. **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.

1. **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 |  |  |  |
|  |  |  |  |  |  |  |

1. **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 | |
|  | |  | | | | | | | | | | | | |  | |  | |  |  |  |  |
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1. **Forecasting model based on Regression Analysis:**

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

1. **Forecasting of next-4 seasons regression:**

**Fall(1): $35.958**

**Winter(2): $24.768**

**Spring: $46.35**

**Summer: $20.286**

1. **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 |
|  |  |  |  |  |

1. **Predicting demand:**
2. Summary Output of Regression Analysis:



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)

1. Forecasting model:

Demand = 1223.5 + 2.1342 \* Advertisement Budget

1. Forecast:

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