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| DA6213  Exercise #6 (yes I know,slightly out of order but this is more important than the missing data one)  Name Eri Osta  Aussies tend to drink a lot of beer. You have been commission by XXXX Beer Company in Brisbane, Australia (yes it is real and pronounced four-ex and it’s not bad). You need to forecast beer consumption for the next 48 time periods. They have 476 data points for you to use in your Unobserved Components Model (UCM) time series model. The data appears at the end of this exercise. Here are your questions:   1. What is the adjusted R square for your model? Does that look like a pretty decent fit? Paste the table form the output as well.   Adjusted R2: 0.84  An adjusted R-squared of 0.84 suggests that the model is a good fit for the data and that it can explain 84% of the variation in the response variable, after taking into account the number of predictor variables in the model. Generally, 0.84 is considered a reasonable and good fit. However, it is important to keep in mind that the appropriateness of the model should be evaluated based on other metrics as well, such as residual plots, statistical tests of significance, and other diagnostic measures.  time fitted actual  1 0.000000 93.2  2 0.000000 96.0  3 50.516137 95.2  4 105.068357 77.1  5 98.871316 70.9  6 90.846578 64.8  7 82.477619 70.1  8 80.210089 77.3  9 81.958036 79.5  10 83.818153 100.6  11 92.969964 100.7  12 99.260681 107.1  13 105.703310 95.9  14 106.977233 82.8  15 104.142103 83.3  16 101.944808 80.0  17 99.302835 80.4  18 97.201315 67.5  19 92.615137 75.7  20 90.506133 71.1  21 87.816076 89.3  22 88.963155 101.1  23 92.031748 105.2  24 95.326097 114.1  25 99.593751 96.3  26 100.424762 84.4  27 99.303073 91.2  28 99.300114 81.9  29 97.956949 80.5  30 96.562949 70.4  31 93.975104 74.8  32 92.227130 75.9  33 90.794377 86.3  34 90.757399 98.7  35 92.168373 100.9  36 93.682498 113.8  37 96.470069 89.8  38 96.404050 84.4  39 95.769260 87.2  40 95.469185 85.6  41 95.028563 72.0  42 93.296402 69.2  43 91.436051 77.5  44 90.491164 78.1  45 89.671535 94.3  46 90.347930 97.7  47 91.265000 100.2  48 92.323256 116.4  49 111.661166 97.1  50 99.911881 93.0  51 95.654009 96.0  52 77.669790 80.5  53 72.181213 76.1  54 66.876476 69.9  55 72.695463 73.6  56 80.035791 92.6  57 83.899944 94.2  58 106.256769 93.5  59 104.990383 108.5  60 111.770843 109.4  61 100.364661 105.1  62 87.728644 92.5  63 88.689543 97.1  64 86.169859 81.4  65 86.219670 79.1  66 72.764193 72.1  67 80.933506 78.7  68 76.171658 87.1  69 95.287342 91.4  70 106.814300 109.9  71 111.201409 116.3  72 120.560804 113.0  73 102.201054 100.0  74 90.154335 84.8  75 96.540011 94.3  76 87.064436 87.1  77 85.666780 90.3  78 75.945681 72.4  79 80.068488 84.9  80 81.564457 92.7  81 92.888078 92.2  82 105.279855 114.9  83 108.308225 112.5  84 121.620665 118.3  85 97.436632 106.0  86 92.801735 91.2  87 95.565783 96.6  88 94.135594 96.3  89 80.797715 88.2  90 78.683478 70.2  91 86.409706 86.5  92 87.096905 88.2  93 103.460975 102.8  94 106.885257 119.1  95 110.433305 119.2  96 127.436559 125.1  97 108.298679 106.1  98 107.557946 102.1  99 108.218547 105.2  100 91.240358 101.0  101 87.034744 84.3  102 80.770922 87.5  103 86.043772 92.7  104 99.915887 94.4  105 101.492477 113.0  106 112.880847 113.9  107 120.713729 122.9  108 124.749692 132.7  109 117.894976 106.9  110 104.308218 96.6  111 106.368547 127.3  112 98.839939 98.2  113 98.057179 100.2  114 88.510802 89.4  115 96.209193 95.3  116 98.251790 104.2  117 110.231922 106.4  118 125.281769 116.2  119 129.959877 135.9  120 133.454862 134.0  121 118.301060 104.6  122 103.761384 107.1  123 112.345507 123.5  124 105.216088 98.8  125 105.751584 98.6  126 91.298719 90.6  127 99.824833 89.1  128 103.480079 105.2  129 108.669854 114.0  130 126.773940 122.1  131 126.382661 138.0  132 136.825150 142.2  133 119.269027 116.4  134 109.069216 112.6  135 113.605792 123.8  136 113.673843 103.6  137 102.134802 113.9  138 92.881029 98.6  139 105.844951 95.0  140 106.256112 116.0  141 122.639415 113.9  142 131.920301 127.5  143 132.987733 131.4  144 144.028626 145.9  145 125.832964 131.5  146 124.823046 131.0  147 127.398634 130.5  148 115.317651 118.9  149 106.784971 114.3  150 104.689981 85.7  151 107.938389 104.6  152 117.126793 105.1  153 123.685255 117.3  154 130.345504 142.5  155 139.573843 140.0  156 145.462740 159.8  157 133.120136 131.2  158 121.151066 125.4  159 133.651293 126.5  160 117.190817 119.4  161 117.595175 113.5  162 107.182239 98.7  163 113.497435 114.5  164 117.950025 113.8  165 125.949329 133.1  166 140.062142 143.4  167 150.562970 137.3  168 150.775444 165.2  169 132.081692 126.9  170 123.574903 124.0  171 134.641099 135.7  172 121.130172 130.0  173 122.576386 109.4  174 109.575445 117.8  175 115.543967 120.3  176 124.434639 121.0  177 130.518670 132.3  178 145.213803 142.9  179 150.386125 147.4  180 157.888473 175.9  181 138.893508 132.6  182 130.522760 123.7  183 136.546167 153.3  184 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161.4  230 158.008085 169.4  231 171.613560 168.8  232 161.392209 158.1  233 155.014012 158.5  234 145.799442 135.3  235 151.072401 149.3  236 160.080306 143.4  237 165.724504 142.2  238 175.967536 188.4  239 183.548935 166.2  240 195.395394 199.2  241 170.795460 182.7  242 173.025267 145.2  243 174.479577 182.1  244 158.906448 158.7  245 156.772149 141.6  246 143.140739 132.6  247 149.939558 139.6  248 156.018645 147.0  249 165.299643 166.6  250 177.502215 157.0  251 181.675523 180.4  252 192.069208 210.2  253 173.790100 159.8  254 163.040189 157.8  255 171.884770 168.2  256 156.309164 158.4  257 158.078950 152.0  258 137.760093 142.2  259 154.744405 137.2  260 156.624078 152.6  261 160.413808 166.8  262 179.805516 165.6  263 187.745857 198.6  264 194.189443 201.5  265 168.995913 170.7  266 159.224605 164.4  267 171.431715 179.7  268 162.917274 157.0  269 159.075800 168.0  270 146.408006 139.3  271 150.629322 138.6  272 158.579149 153.4  273 167.798929 138.9  274 177.822392 172.1  275 181.521294 198.4  276 195.432707 217.8  277 169.523826 173.7  278 164.742971 153.8  279 173.276749 175.6  280 162.862062 147.1  281 156.168556 160.3  282 143.744013 135.2  283 150.214453 148.8  284 155.713200 151.0  285 160.229675 148.2  286 177.769577 182.2  287 178.444073 189.2  288 196.244382 183.1  289 170.815954 170.0  290 164.954210 158.4  291 173.388220 176.1  292 155.743090 156.2  293 150.732577 153.2  294 138.825268 117.9  295 144.168110 149.8  296 151.343864 156.6  297 163.139780 166.7  298 171.618015 156.8  299 178.889412 158.6  300 190.474355 210.8  301 166.952001 203.6  302 161.689004 175.2  303 172.253045 168.7  304 157.506009 155.9  305 157.521129 147.3  306 138.382433 137.0  307 151.120968 141.1  308 155.521122 167.4  309 162.300445 160.2  310 177.525674 191.9  311 191.919297 174.4  312 195.378276 208.2  313 169.769168 159.4  314 159.441227 161.1  315 171.812404 172.1  316 160.216122 158.4  317 158.980082 114.6  318 138.813518 159.6  319 144.294929 159.7  320 155.453564 159.4  321 161.334483 160.7  322 177.232379 165.5  323 184.056079 205.0  324 199.476807 205.2  325 169.368214 141.6  326 159.182008 148.1  327 169.564779 184.9  328 157.163500 132.5  329 152.600815 137.3  330 136.190048 135.5  331 144.175785 121.7  332 146.970820 166.1  333 152.045037 146.8  334 172.538234 162.8  335 172.855347 186.8  336 186.878721 185.5  337 164.155675 151.5  338 156.166730 158.1  339 166.390670 143.0  340 145.836845 151.2  341 141.265059 147.6  342 126.117533 130.7  343 137.047565 137.5  344 143.589074 146.1  345 154.764062 133.6  346 158.202467 167.9  347 166.432432 181.9  348 186.598182 202.0  349 165.148134 166.5  350 153.764832 151.3  351 160.411023 146.2  352 144.664662 148.3  353 143.601788 144.7  354 126.337522 123.6  355 137.457305 151.6  356 146.803625 133.9  357 149.330230 137.4  358 165.737765 181.6  359 175.614706 182.0  360 185.078106 190.0  361 155.420385 161.2  362 147.931855 155.5  363 160.514864 141.9  364 146.773931 164.6  365 141.019452 136.2  366 133.046250 126.8  367 135.581614 152.5  368 145.357808 126.6  369 148.497778 150.1  370 162.845164 186.3  371 177.230379 147.5  372 186.127108 200.4  373 151.882065 177.2  374 148.369427 127.4  375 161.503497 177.1  376 143.595710 154.4  377 143.256398 135.2  378 129.501803 126.4  379 134.280187 147.3  380 146.069651 140.6  381 145.929318 152.3  382 166.929623 151.2  383 170.159970 172.2  384 181.272732 215.3  385 160.443079 154.1  386 154.997124 159.3  387 162.590973 160.4  388 147.625087 151.9  389 143.509587 148.4  390 128.454167 139.6  391 139.891242 148.2  392 147.810446 153.5  393 156.771305 145.1  394 165.127238 183.7  395 175.466112 210.5  396 198.094602 203.3  397 174.722151 153.3  398 161.348773 144.3  399 165.626612 169.6  400 154.006617 143.7  401 151.859922 160.1  402 135.190802 135.6  403 149.113333 141.8  404 153.731716 159.9  405 158.339222 145.7  406 178.452854 183.5  407 186.768618 198.2  408 196.974522 186.8  409 166.515097 172.0  410 159.644478 150.6  411 167.880569 163.3  412 160.050534 153.7  413 149.802753 152.9  414 142.567021 135.5  415 148.127477 148.5  416 152.401295 148.4  417 159.426912 133.6  418 174.281202 194.1  419 182.112412 208.6  420 201.443273 197.3  421 167.421016 164.4  422 156.121512 148.1  423 174.952819 152.0  424 153.339636 144.1  425 149.023988 155.0  426 137.085333 124.5  427 143.038733 153.0  428 152.412200 146.0  429 153.618634 138.0  430 169.934292 190.0  431 178.394476 192.0  432 194.644812 192.0  433 166.074479 147.0  434 160.541276 133.0  435 164.430693 163.0  436 150.032322 150.0  437 145.435534 129.0  438 128.950432 131.0  439 139.057932 145.0  440 146.231427 137.0  441 151.624624 138.0  442 162.656778 168.0  443 173.408050 176.0  444 189.673235 188.0  445 162.214458 139.0  446 148.365148 143.0  447 155.280757 150.0  448 140.717012 154.0  449 142.099407 137.0  450 122.930358 129.0  451 135.975149 128.0  452 141.436735 140.0  453 142.799238 143.0  454 165.373152 151.0  455 172.169870 177.0  456 178.912791 184.0  457 150.888711 151.0  458 141.429995 134.0  459 149.659634 164.0  460 142.765007 126.0  461 132.069494 131.0  462 122.833713 125.0  463 129.457314 127.0  464 132.489459 143.0  465 137.866466 143.0  466 159.905033 160.0  467 166.537182 190.0  468 182.053744 182.0  469 148.079380 138.0  470 135.154207 136.0  471 152.633424 152.0  472 133.959450 127.0  473 131.137824 151.0  474 118.165994 130.0  475 128.483602 119.0  476 134.209303 153.0   1. Tell me which of the modeling components – irregular, level, slope and period are statistically significant – that is, you have found those components in the data. Paste the output table that shows this here as well.   Based on the results, the irregular component is the only statistically significant component in the model. The trend and seasonal components are not significant, which might imply that the model is not adequately capturing the underlying patterns in the data.  Moreover, the diagnostic tests indicate potential issues with autocorrelation and heteroskedasticity in the residuals, as well as non-normality of the residual distribution. These issues might affect the model's reliability and the accuracy of the forecasts. Further model refinement and validation may be necessary to improve the model's performance.  Component Significance:  Unobserved Components Results  =====================================================================================  Dep. Variable: consumption No. Observations: 476  Model: local linear trend Log Likelihood -1653.693  + stochastic seasonal(48) AIC 3315.387  Date: Wed, 19 Apr 2023 BIC 3331.614  Time: 14:51:51 HQIC 3321.796  Sample: 0  - 476  Covariance Type: opg  ====================================================================================  coef std err z P>|z| [0.025 0.975]  ------------------------------------------------------------------------------------  sigma2.irregular 95.3886 6.037 15.802 0.000 83.557 107.220  sigma2.level 6.047e-11 0.492 1.23e-10 1.000 -0.964 0.964  sigma2.trend 0.0018 0.001 1.511 0.131 -0.001 0.004  sigma2.seasonal 1.016e-10 0.684 1.49e-10 1.000 -1.340 1.340  ===================================================================================  Ljung-Box (L1) (Q): 4.44 Jarque-Bera (JB): 16.27  Prob(Q): 0.04 Prob(JB): 0.00  Heteroskedasticity (H): 3.88 Skew: -0.15  Prob(H) (two-sided): 0.00 Kurtosis: 3.91  ===================================================================================  Warnings:  [1] Covariance matrix calculated using the outer product of gradients (complex-step).   1. Forecast the next 48 time periods of the data and put the forecasted data table below.   Forecasted data:  477 136.407229  478 157.827570  479 163.870634  480 177.069516  481 146.782442  482 141.817586  483 150.502950  484 136.348814  485 130.104906  486 116.821370  487 127.197912  488 132.404808  489 138.142003  490 152.249423  491 162.387184  492 178.095197  493 148.693945  494 138.622813  495 146.151817  496 134.061313  497 132.711010  498 115.231166  499 126.541351  500 133.461883  501 135.282768  502 156.563771  503 166.645186  504 173.246938  505 144.519332  506 134.491852  507 145.704473  508 134.737611  509 127.161020  510 118.564744  511 124.778630  512 129.532835  513 133.737350  514 155.042006  515 164.177082  516 175.582441  517 140.698546  518 129.784727  519 147.170942  520 128.037809  521 128.594794  522 113.332233  523 120.619762  524 129.987575   1. Plot out the data and forecast data and paste that plot below. Does it look like it did a good job of forecasting?   I believe so! The peaks may be a bit more consistent than the heterogeneity of the fluctuations seen before.    Here is your data…time period is the first number and beer consumption the second number.  1 93.2  2 96  3 95.2  4 77.1  5 70.9  6 64.8  7 70.1  8 77.3  9 79.5  10 100.6  11 100.7  12 107.1  13 95.9  14 82.8  15 83.3  16 80  17 80.4  18 67.5  19 75.7  20 71.1  21 89.3  22 101.1  23 105.2  24 114.1  25 96.3  26 84.4  27 91.2  28 81.9  29 80.5  30 70.4  31 74.8  32 75.9  33 86.3  34 98.7  35 100.9  36 113.8  37 89.8  38 84.4  39 87.2  40 85.6  41 72  42 69.2  43 77.5  44 78.1  45 94.3  46 97.7  47 100.2  48 116.4  49 97.1  50 93  51 96  52 80.5  53 76.1  54 69.9  55 73.6  56 92.6  57 94.2  58 93.5  59 108.5  60 109.4  61 105.1  62 92.5  63 97.1  64 81.4  65 79.1  66 72.1  67 78.7  68 87.1  69 91.4  70 109.9  71 116.3  72 113  73 100  74 84.8  75 94.3  76 87.1  77 90.3  78 72.4  79 84.9  80 92.7  81 92.2  82 114.9  83 112.5  84 118.3  85 106  86 91.2  87 96.6  88 96.3  89 88.2  90 70.2  91 86.5  92 88.2  93 102.8  94 119.1  95 119.2  96 125.1  97 106.1  98 102.1  99 105.2  100 101  101 84.3  102 87.5  103 92.7  104 94.4  105 113  106 113.9  107 122.9  108 132.7  109 106.9  110 96.6  111 127.3  112 98.2  113 100.2  114 89.4  115 95.3  116 104.2  117 106.4  118 116.2  119 135.9  120 134  121 104.6  122 107.1  123 123.5  124 98.8  125 98.6  126 90.6  127 89.1  128 105.2  129 114  130 122.1  131 138  132 142.2  133 116.4  134 112.6  135 123.8  136 103.6  137 113.9  138 98.6  139 95  140 116  141 113.9  142 127.5  143 131.4  144 145.9  145 131.5  146 131  147 130.5  148 118.9  149 114.3  150 85.7  151 104.6  152 105.1  153 117.3  154 142.5  155 140  156 159.8  157 131.2  158 125.4  159 126.5  160 119.4  161 113.5  162 98.7  163 114.5  164 113.8  165 133.1  166 143.4  167 137.3  168 165.2  169 126.9  170 124  171 135.7  172 130  173 109.4  174 117.8  175 120.3  176 121  177 132.3  178 142.9  179 147.4  180 175.9  181 132.6  182 123.7  183 153.3  184 134  185 119.6  186 116.2  187 118.6  188 130.7  189 129.3  190 144.4  191 163.2  192 179.4  193 128.1  194 138.4  195 152.7  196 120  197 140.5  198 116.2  199 121.4  200 127.8  201 143.6  202 157.6  203 166.2  204 182.3  205 153.1  206 147.6  207 157.7  208 137.2  209 151.5  210 98.7  211 145.8  212 151.7  213 129.4  214 174.1  215 197  216 193.9  217 164.1  218 142.8  219 157.9  220 159.2  221 162.2  222 123.1  223 130  224 150.1  225 169.4  226 179.7  227 182.1  228 194.3  229 161.4  230 169.4  231 168.8  232 158.1  233 158.5  234 135.3  235 149.3  236 143.4  237 142.2  238 188.4  239 166.2  240 199.2  241 182.7  242 145.2  243 182.1  244 158.7  245 141.6  246 132.6  247 139.6  248 147  249 166.6  250 157  251 180.4  252 210.2  253 159.8  254 157.8  255 168.2  256 158.4  257 152  258 142.2  259 137.2  260 152.6  261 166.8  262 165.6  263 198.6  264 201.5  265 170.7  266 164.4  267 179.7  268 157  269 168  270 139.3  271 138.6  272 153.4  273 138.9  274 172.1  275 198.4  276 217.8  277 173.7  278 153.8  279 175.6  280 147.1  281 160.3  282 135.2  283 148.8  284 151  285 148.2  286 182.2  287 189.2  288 183.1  289 170  290 158.4  291 176.1  292 156.2  293 153.2  294 117.9  295 149.8  296 156.6  297 166.7  298 156.8  299 158.6  300 210.8  301 203.6  302 175.2  303 168.7  304 155.9  305 147.3  306 137  307 141.1  308 167.4  309 160.2  310 191.9  311 174.4  312 208.2  313 159.4  314 161.1  315 172.1  316 158.4  317 114.6  318 159.6  319 159.7  320 159.4  321 160.7  322 165.5  323 205  324 205.2  325 141.6  326 148.1  327 184.9  328 132.5  329 137.3  330 135.5  331 121.7  332 166.1  333 146.8  334 162.8  335 186.8  336 185.5  337 151.5  338 158.1  339 143  340 151.2  341 147.6  342 130.7  343 137.5  344 146.1  345 133.6  346 167.9  347 181.9  348 202  349 166.5  350 151.3  351 146.2  352 148.3  353 144.7  354 123.6  355 151.6  356 133.9  357 137.4  358 181.6  359 182  360 190  361 161.2  362 155.5  363 141.9  364 164.6  365 136.2  366 126.8  367 152.5  368 126.6  369 150.1  370 186.3  371 147.5  372 200.4  373 177.2  374 127.4  375 177.1  376 154.4  377 135.2  378 126.4  379 147.3  380 140.6  381 152.3  382 151.2  383 172.2  384 215.3  385 154.1  386 159.3  387 160.4  388 151.9  389 148.4  390 139.6  391 148.2  392 153.5  393 145.1  394 183.7  395 210.5  396 203.3  397 153.3  398 144.3  399 169.6  400 143.7  401 160.1  402 135.6  403 141.8  404 159.9  405 145.7  406 183.5  407 198.2  408 186.8  409 172  410 150.6  411 163.3  412 153.7  413 152.9  414 135.5  415 148.5  416 148.4  417 133.6  418 194.1  419 208.6  420 197.3  421 164.4  422 148.1  423 152  424 144.1  425 155  426 124.5  427 153  428 146  429 138  430 190  431 192  432 192  433 147  434 133  435 163  436 150  437 129  438 131  439 145  440 137  441 138  442 168  443 176  444 188  445 139  446 143  447 150  448 154  449 137  450 129  451 128  452 140  453 143  454 151  455 177  456 184  457 151  458 134  459 164  460 126  461 131  462 125  463 127  464 143  465 143  466 160  467 190  468 182  469 138  470 136  471 152  472 127  473 151  474 130  475 119  476 153 |
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