Steps to Using SAS:

A. GETTING STARTED:

1. Visit SAS University Edition Website: http://www.sas.com/en_us/software/university-edition/download-software.html

2. Determine which Operating System you are using: **Windows, OS X, or LINUX**. Choose the respective tab.

Before You Begin

3. Install Oracle VirtualBox virtualization software on your machine

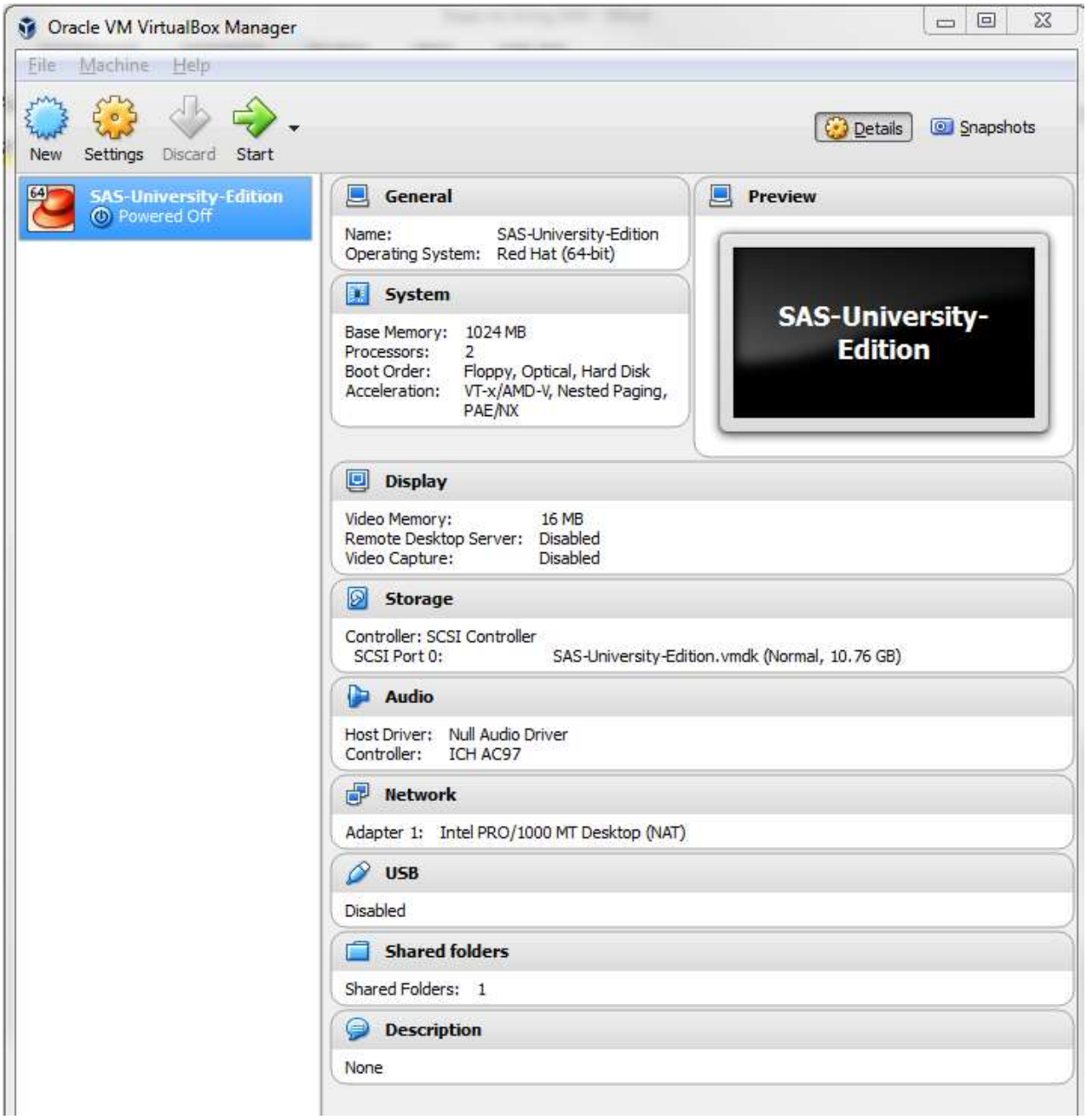
Note: Once installed, be sure to choose "Linux Red Hat 64-bit"as your operating system. Do not choose your actual operating system, as choosing anything other than "Linux Red Hat 64-bit" may cause an execution error.

4. Download the SAS University Edition vApp.

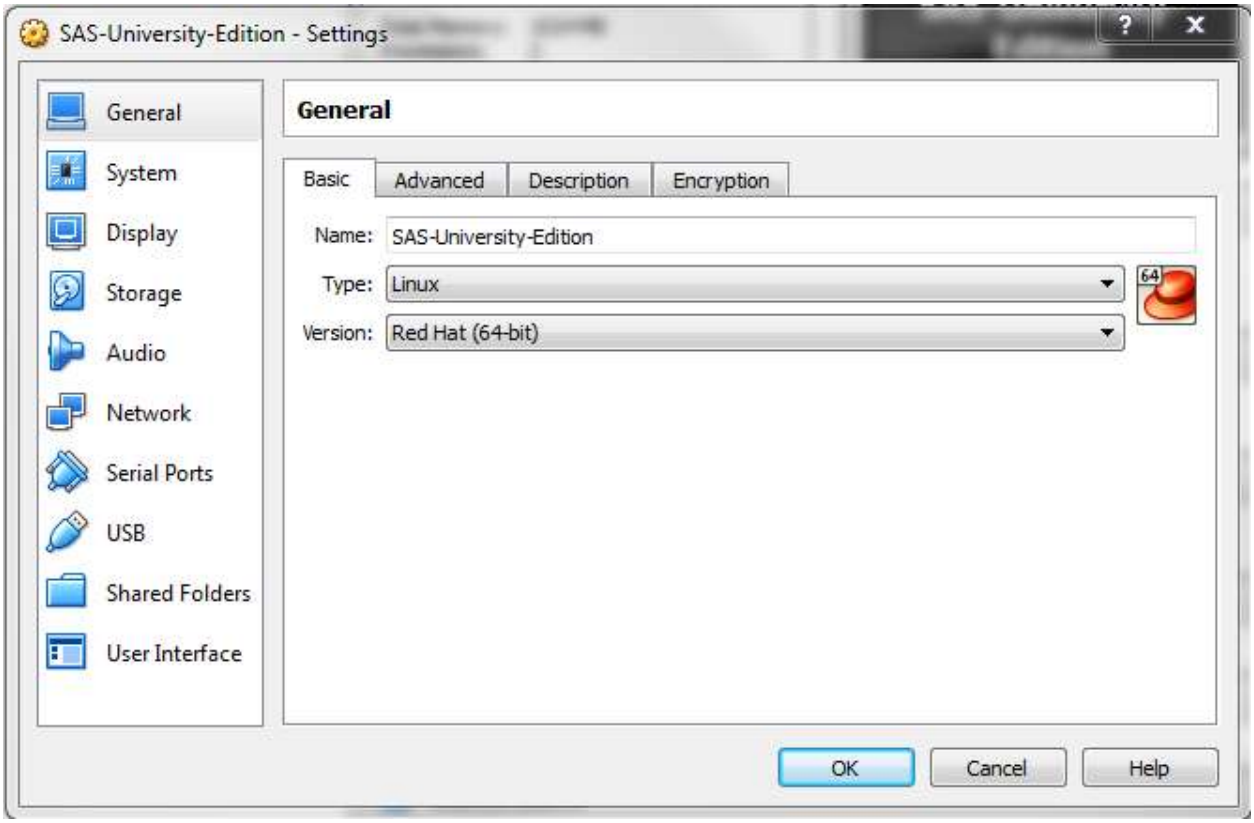
Note: This application can only be opened through your virtual machine. Therefore, after successful installation of your Virtual Machine, e.g., Oracle's or VMWare's, open up the VM software to run SAS University.

5. **If any errors are encountered, be sure to check out SAS videos and pdfs**. Also, copy the error code and paste into Google in search for a solution.

6. Open up your Virtual Machine. *(This example is for Oracle VM VirtualBox)*

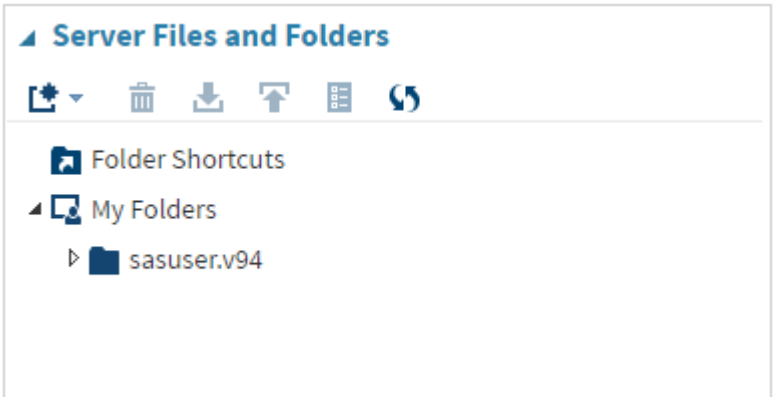


7. Go to Settings and select “Linux Red Hat 64-bit” under the “General” tab.

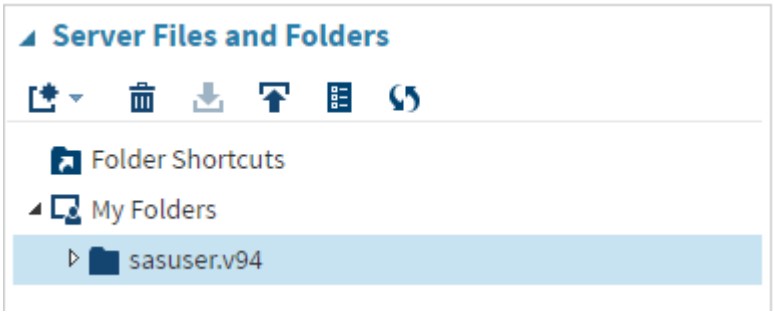


B. USING SAS STUDIO

1. Choose “Server Files and Folders”

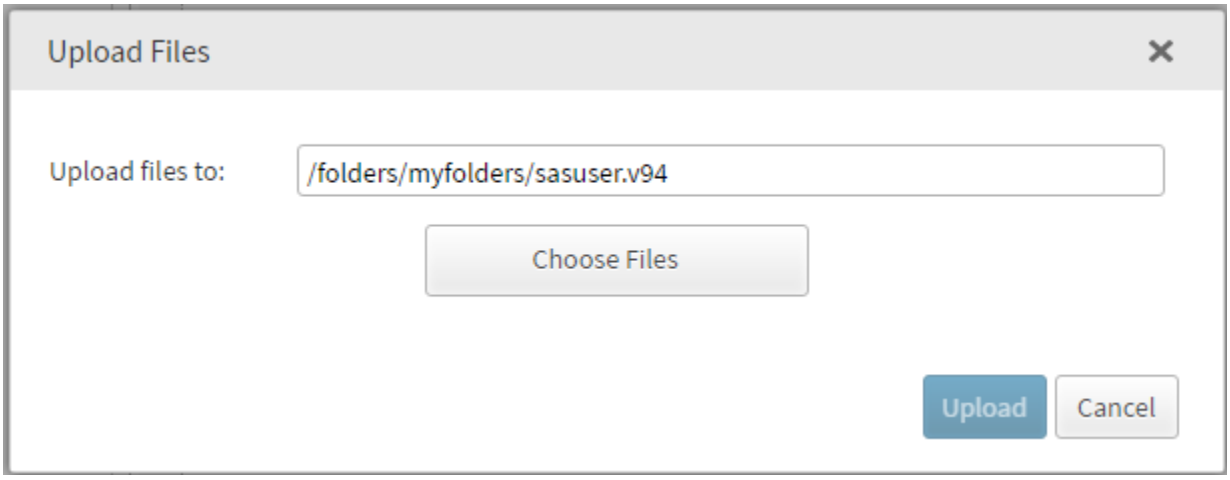


2. Select the sasuser.v94 folder

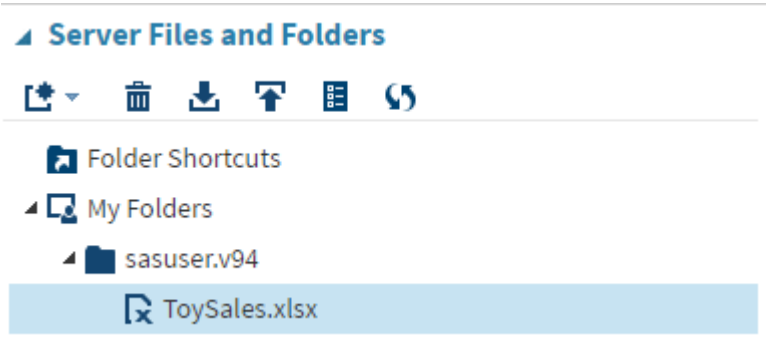


3. Click on the upload  button:

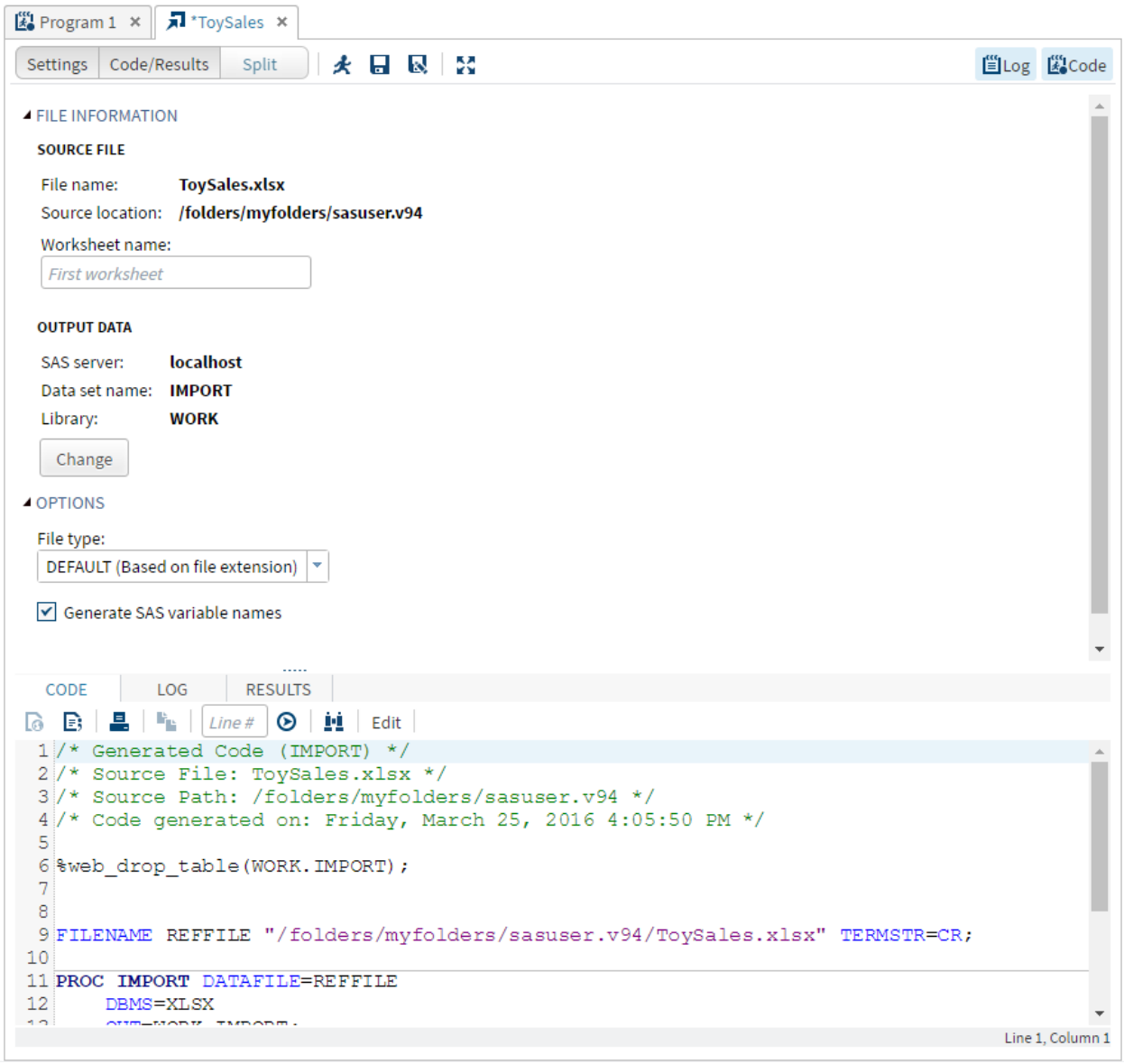
4. Choose the file you want:



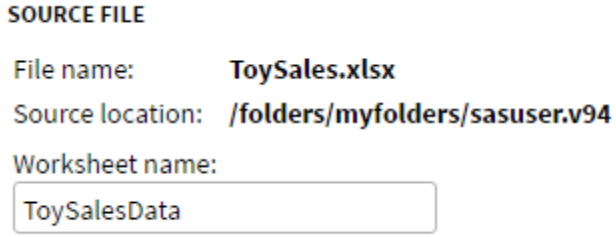
5. Double click the ToySales.xlsx file



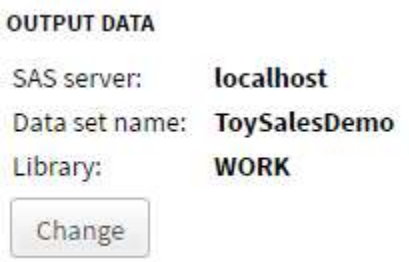
6. The ToySales Tab window opens on the right side.

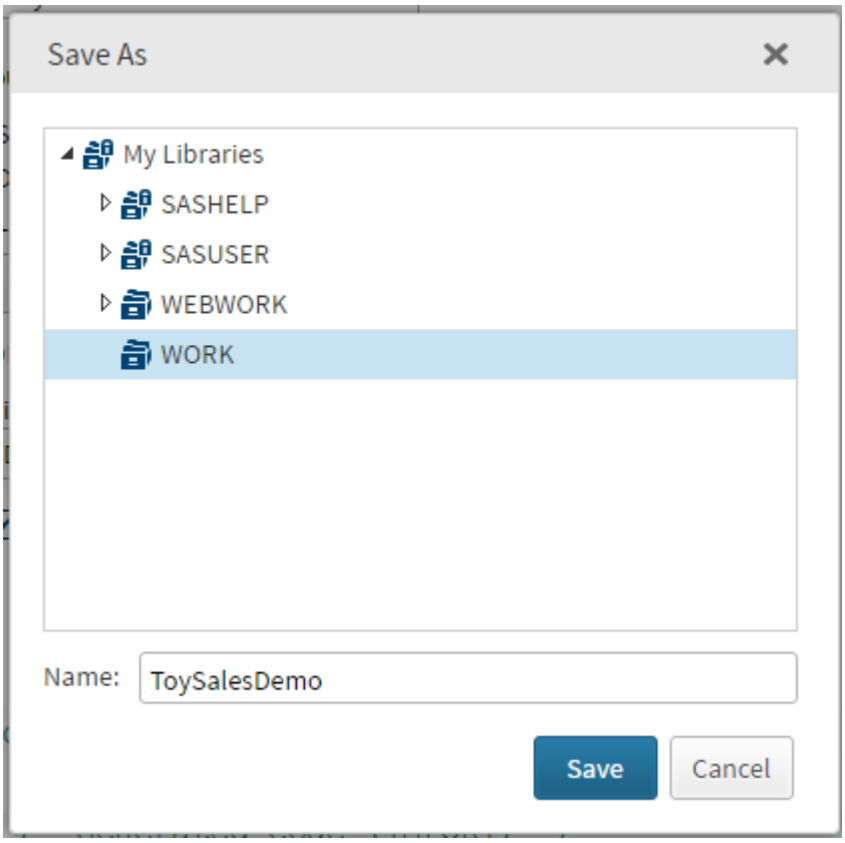


7. List the name of the Worksheet you wish to import in the "Worksheet name:" field. *(In this case, the ToySales.xlsx file has only one worksheet, so inserting the worksheet name is not necessary. But had there been multiple sheets, then the desired worksheet for which to import would need to be specified.)*

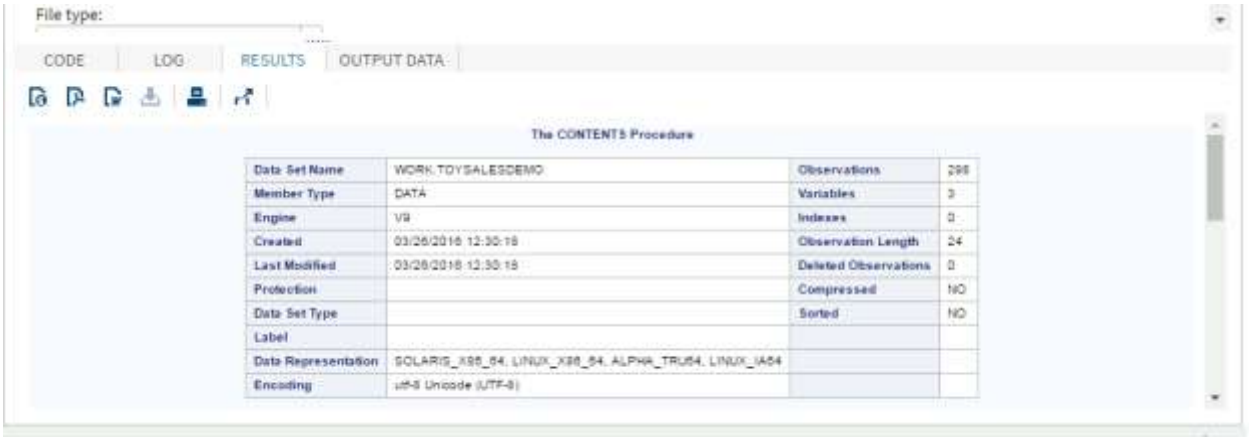


8. Click on the "Change" button within the "OUTPUT DATA" area and "Save as" your file in your desired location with your desired name. *(In this demonstration, I saved the file as ToySalesDemo and saved it within the "Work" section.)*

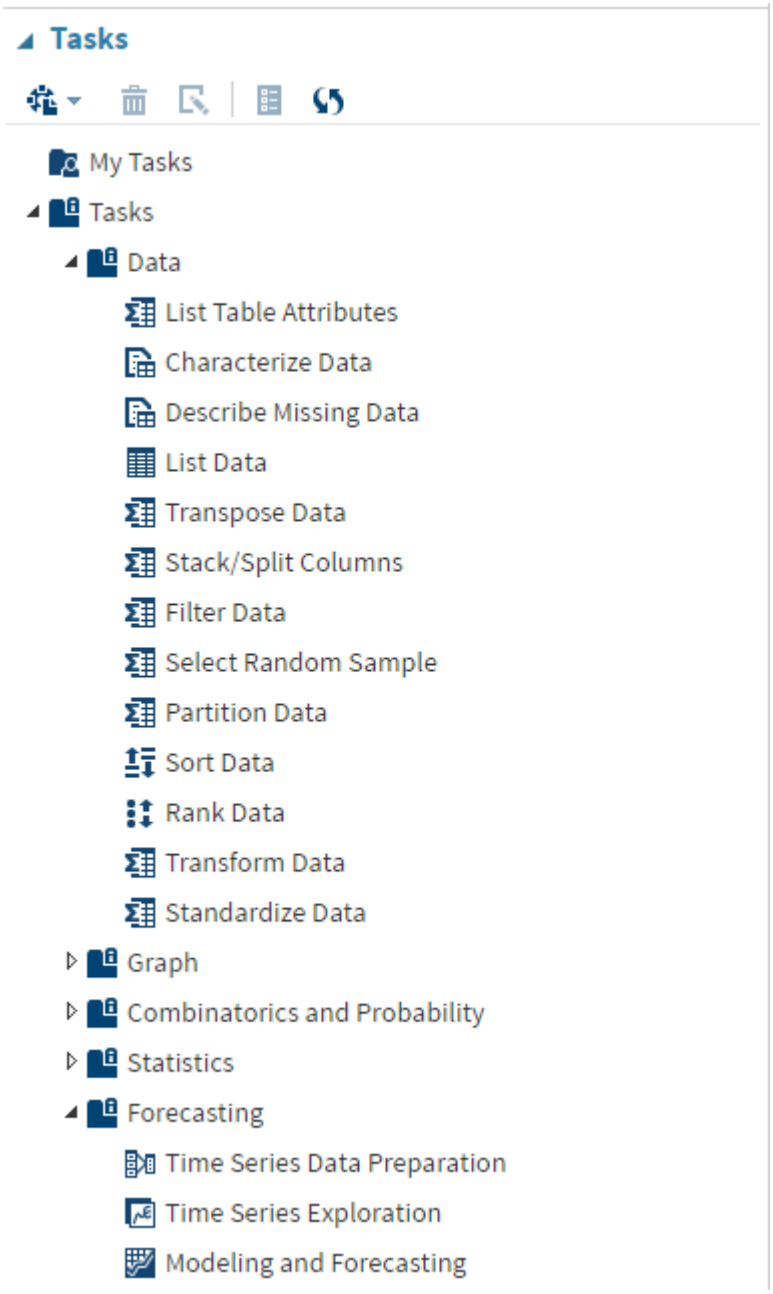




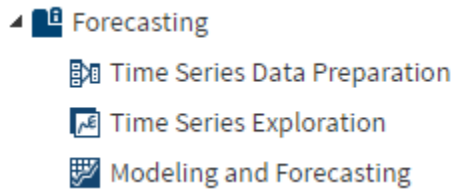
9. Click on the “Run” button: Your file data should output into the Results tab at the bottom of your screen, if you are in “Split” mode, which will indicate a successful import.



10. Click on the Tasks dropdown menu to expand options:



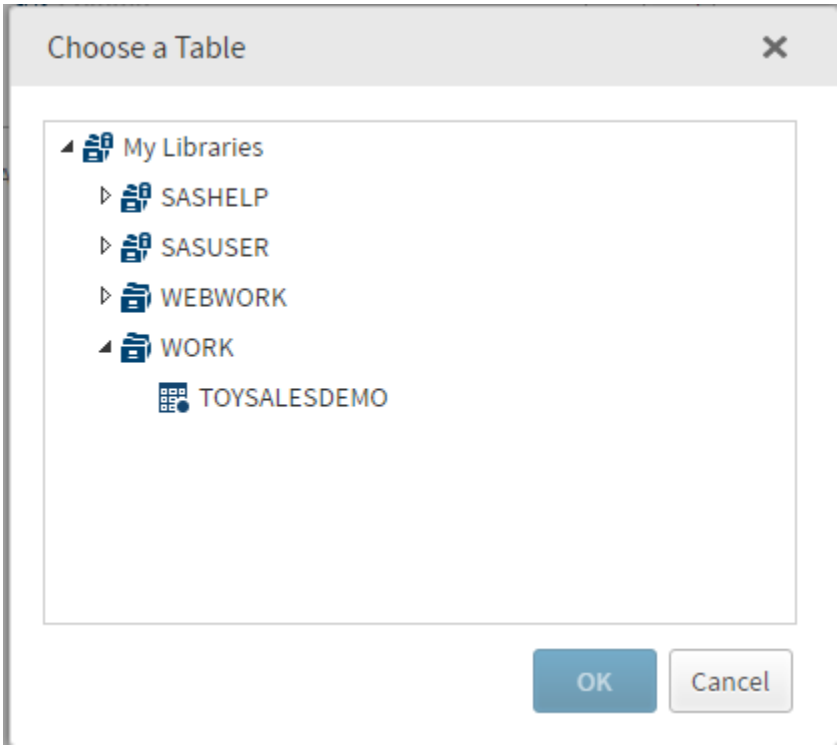
11. Click on the Forecasting dropdown menu.



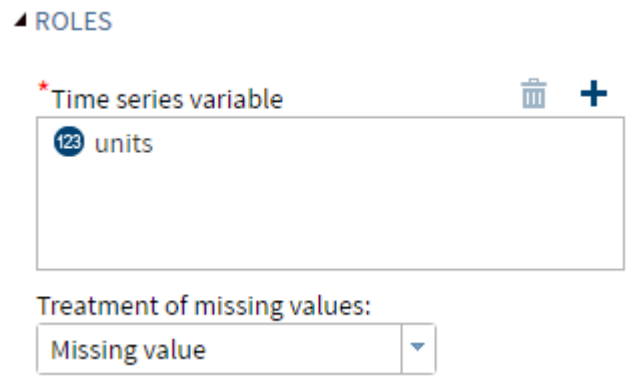
12. Click on Time Series Data Preparation

    a. Click on the table  button under the DATA section and select your file:

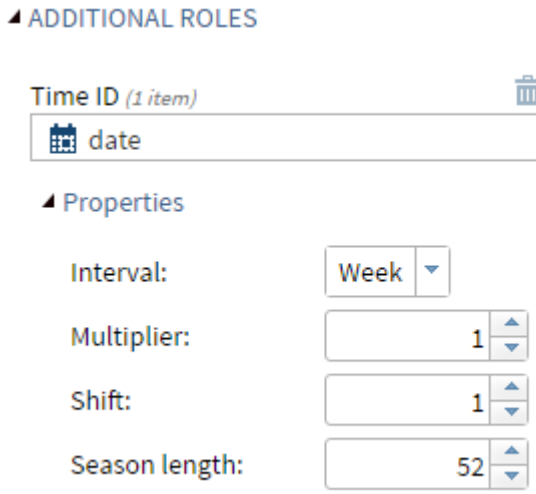
    b. Choose your table. *(I saved my file as TOYSALESDEMO under the "WORK" category).*



c. Under ROLES, click on the + button and select your dependent variable, “units”

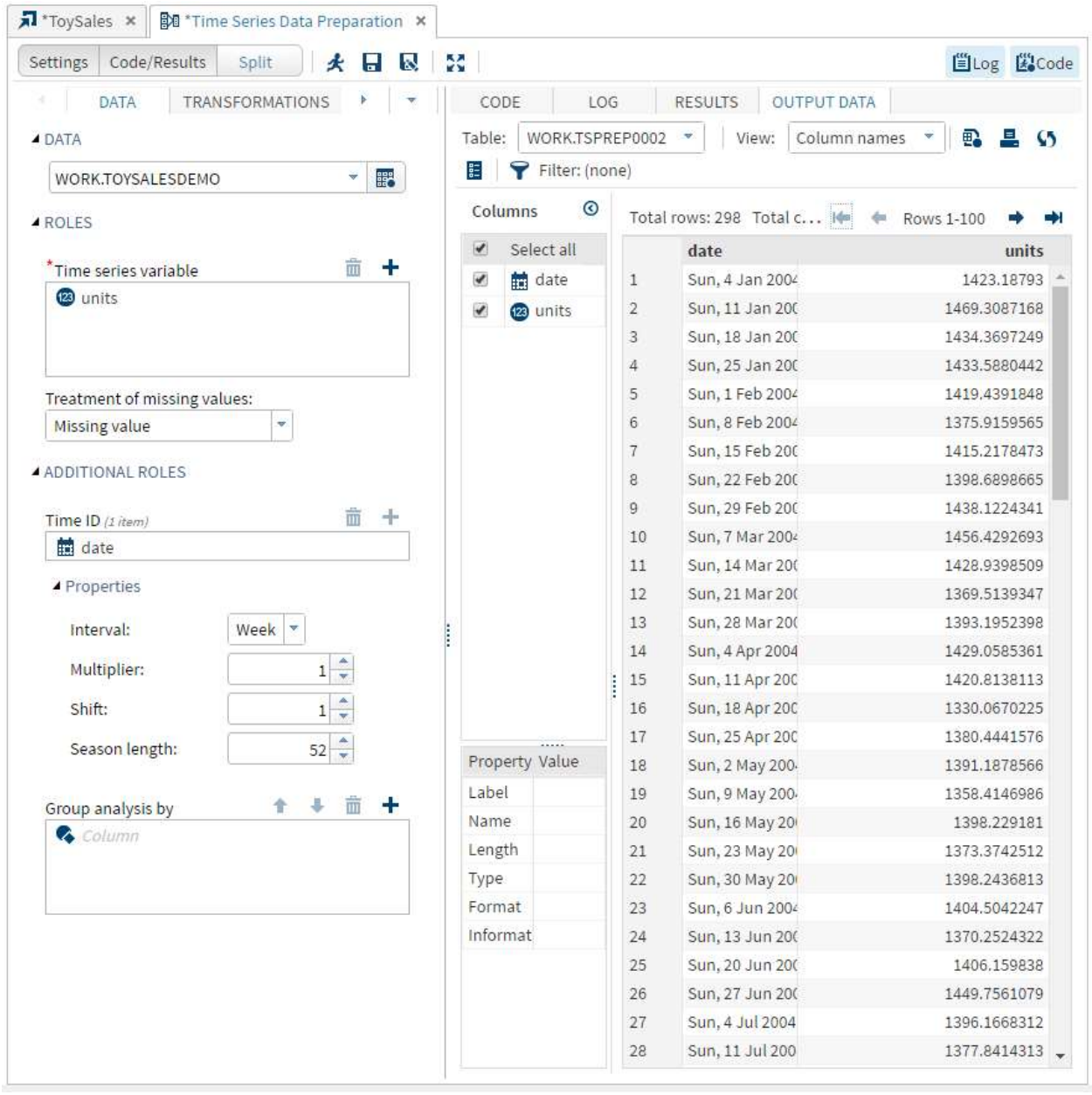


d. Click the arrow adjacent ADDITIONAL ROLES to expand menu. Click on the + button for Time ID and choose the variable, “date.” *(The software recognizes the intervals and season lengths in the data and pre-populates the fields)*

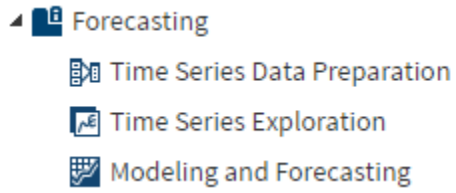


e. After variables have been declared and data prepped, click on the button along the top, beneath the “Time Series Data Preparation” tab.

f. You can view the data in the OUTPUT DATA section in either the Code/Results tab or Split tab, beneath the main tab, “Time Series Data Preparation.”

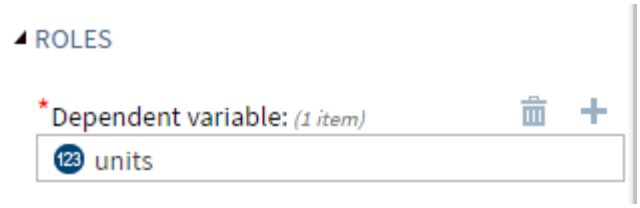


13. Click on Time Series Exploration task.

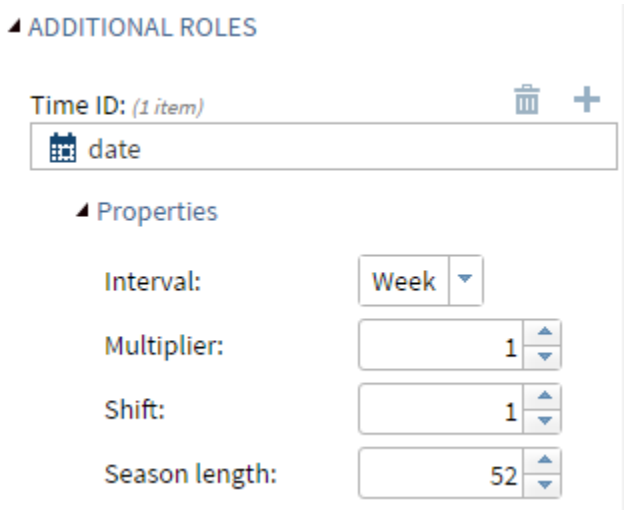


a. *The file you prepped in "Time Series Data Preparation" should already be preloaded in your DATA field. This will remain true as you go through all "Forecasting" tools.*

b. Choose "units" under the Dependent variable in the ROLES section.

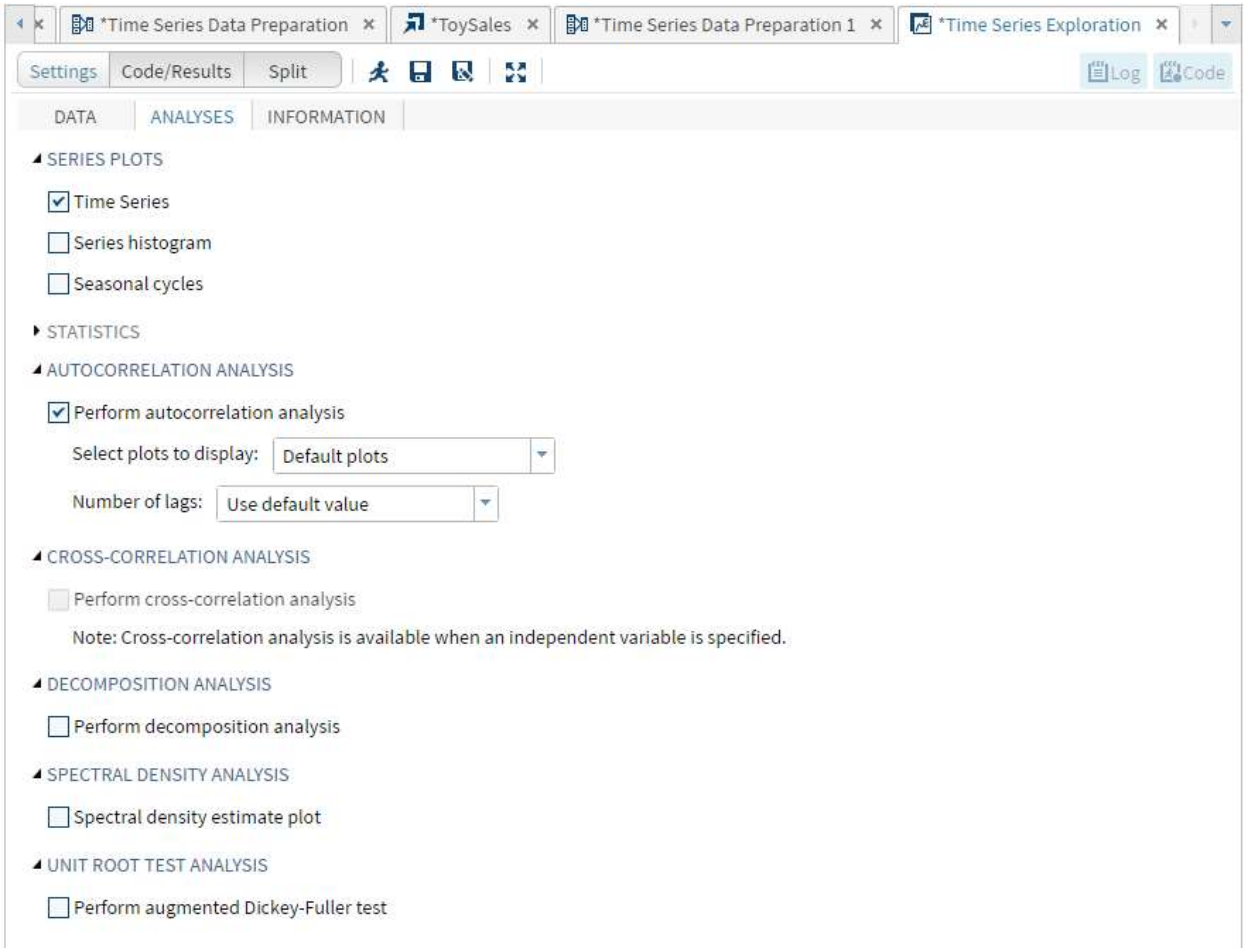


c. Expand the ADDITIONAL ROLES menu and select "date" in the Time ID field.



d. Then click on the Analyses tab to choose settings for your model. ***(Please observe, different types of charts/graphs may be chosen here within the "Analyses" tab.***
    a. ***Time Series***
    b. ***Series Histogram***
    c. ***Seasonal Cycles***

    Please select the analysis needed for your intended objective. The default settings, as chosen by the software, are shown below and this demonstration uses such.)

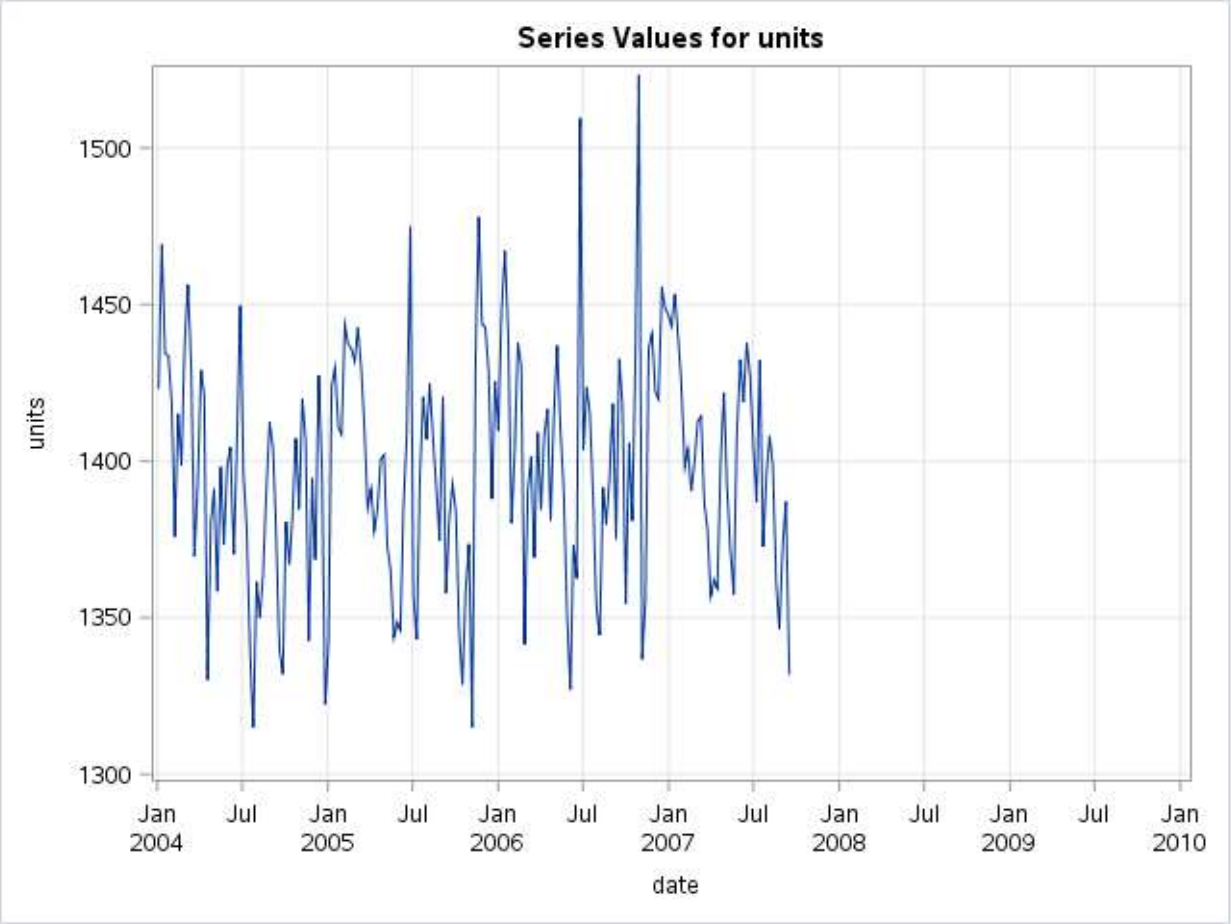


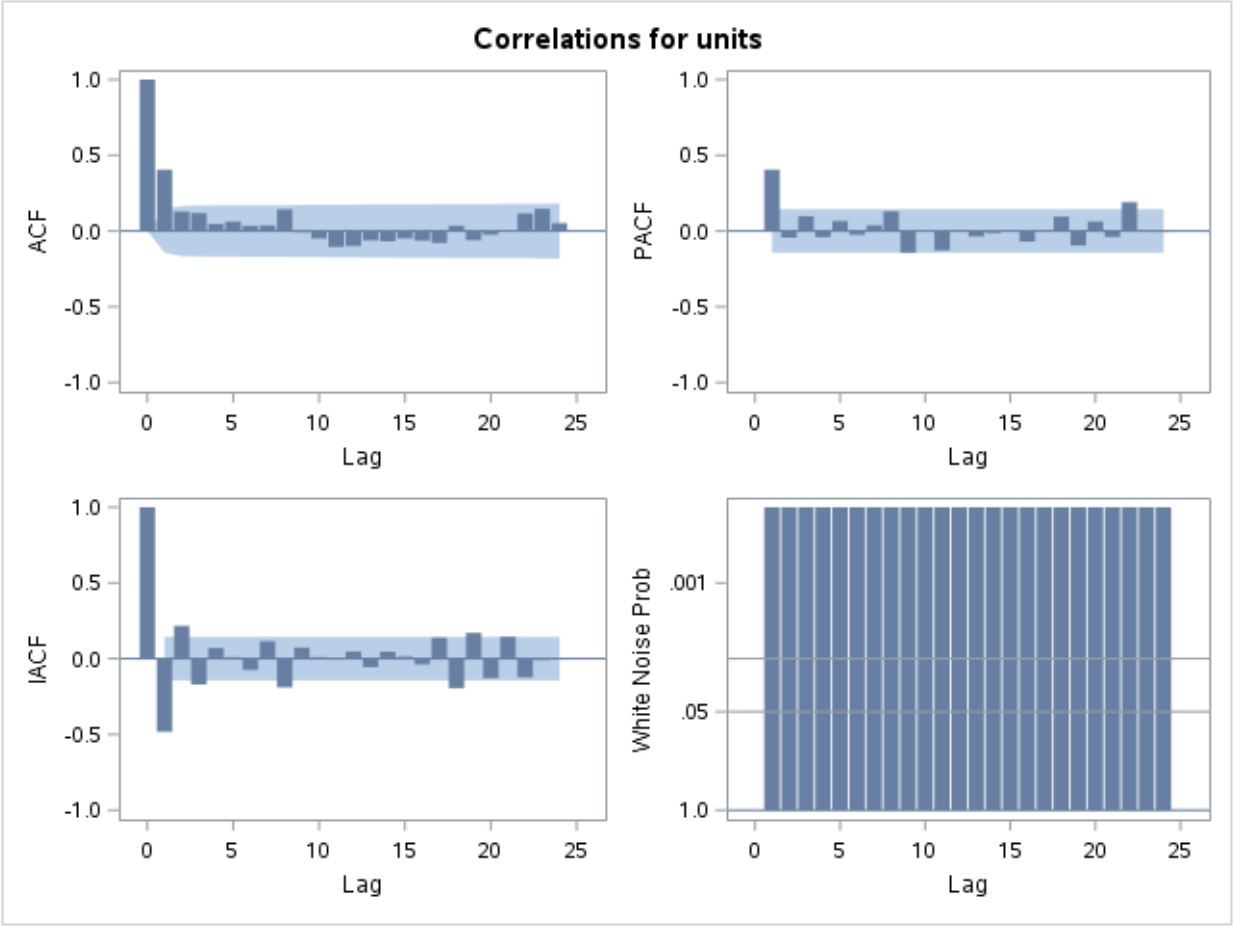
e. After variables have been declared and settings made, click on the run button along the top, beneath the "Time Series Exploration" tab.

f. To view the results and charts, click on the “Code/Results” tab, then click on “Results”

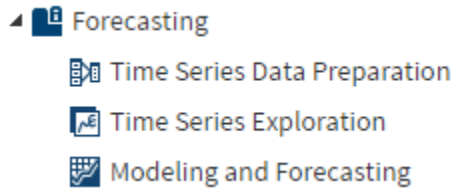
Input Data Set	
Name	WORK.TEMPSORTED
Label	
Time ID Variable	date
Time Interval	WEEK
Length of Seasonal Cycle	52

Variable Information	
Name	units
Label	units
First	Sun, 4 Jan 2004
Last	Sun, 16 Sep 2007
Number of Observations Read	298

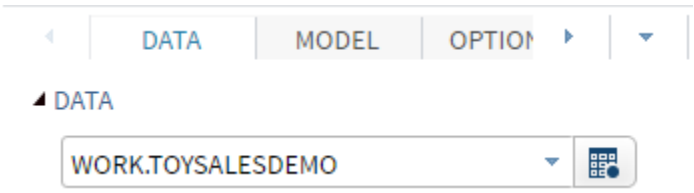



Correlations for units
ACF
PACF
IACF
White Noise Prob
1.0
0.5
0.0
-0.5
-1.0
.001
.05
1.0
0
5
10
15
20
25
Lag

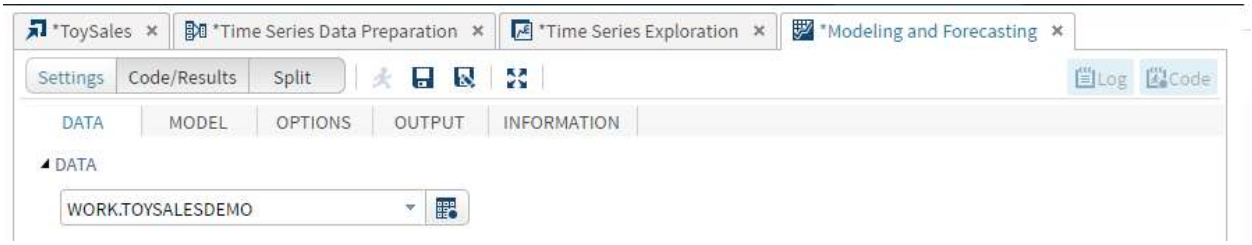
14. Click on Modeling and Forecasting task



a. Your prepped file should be preloaded in your DATA field.



b. Select the "Settings" tab option to display all options available. (Be sure the DATA tab is selected so you may declare your variables.)

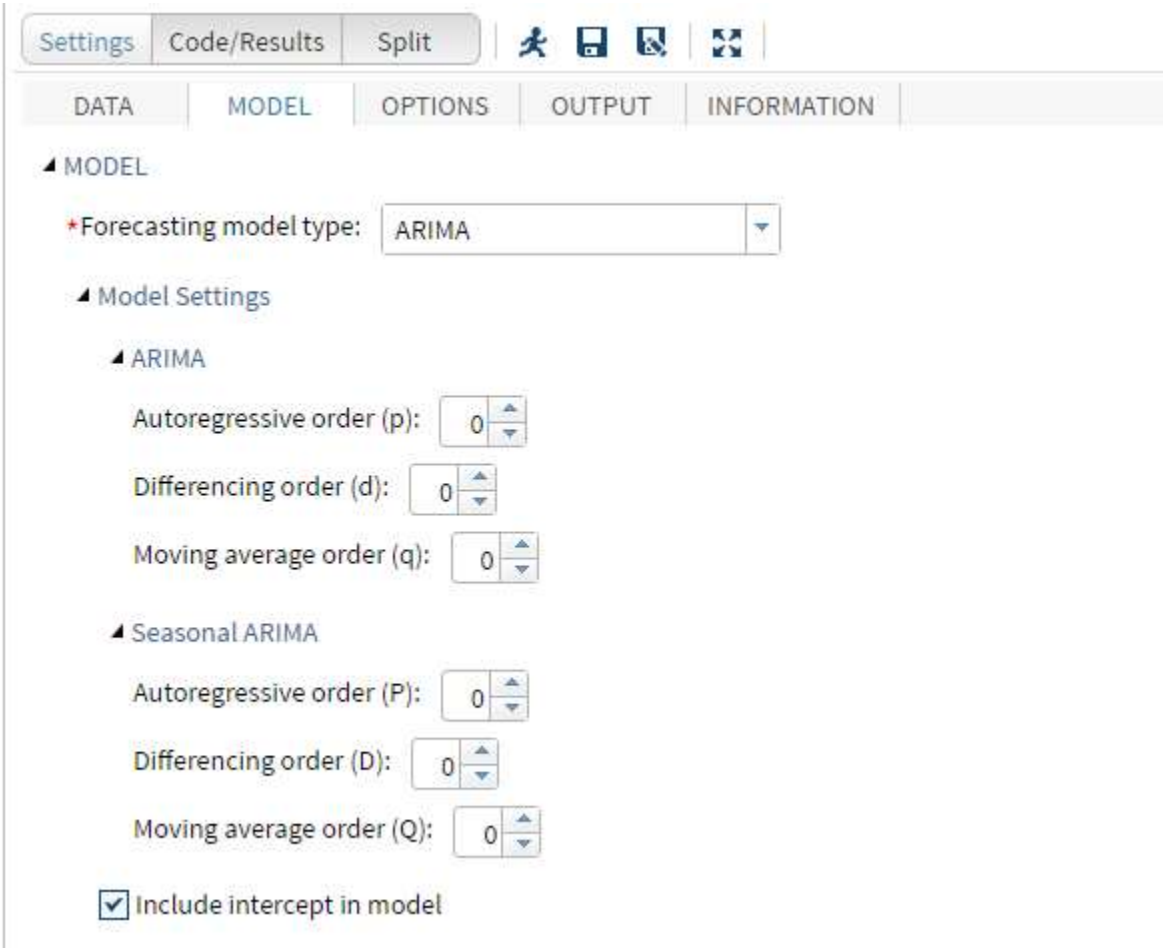


c. Under ROLES, choose "units" as your Dependent variable

d. Expand the ADDITIONAL ROLES menu and choose "date" in the Time ID field.

e. Click on the MODEL tab.

f. Select the dropdown menu for “Forecasting model type:” and select ARIMA

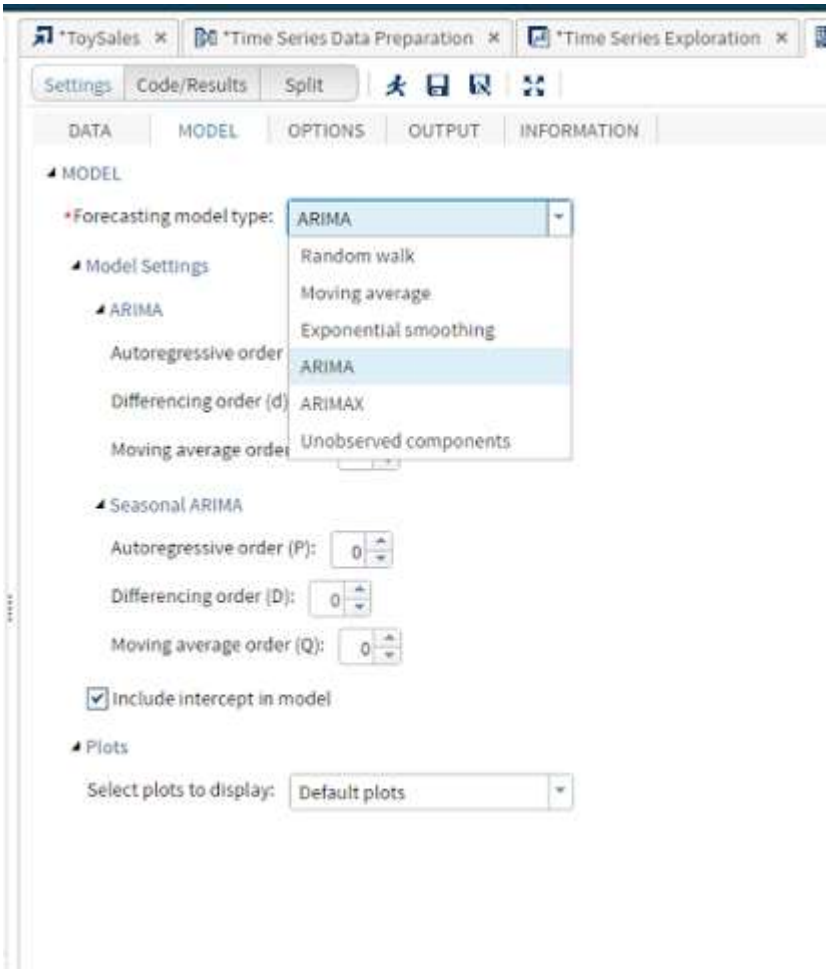


For this example, we will use a 3-1-1 Arima model, so set Autoregressive order to 3, Differencing order to 1, and Moving average order to 1. All else will remain as defaults.

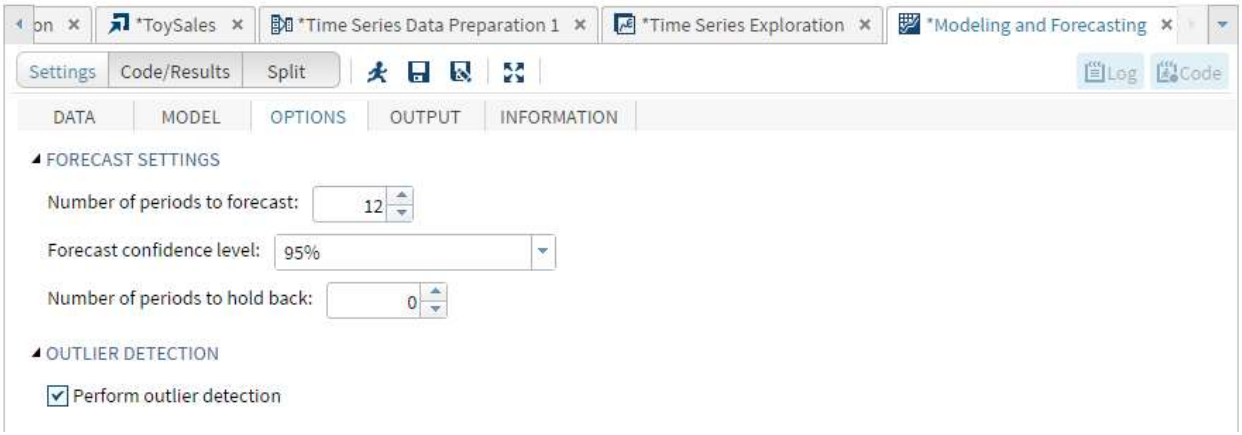
Additionally, please note the plethora of model options to choose from:

1. ***Random Walk***
2. ***Moving Average***
3. ***Exponential Smoothing***
4. ***ARIMA***
5. ***ARIMAX***
6. ***Unobserved Components***

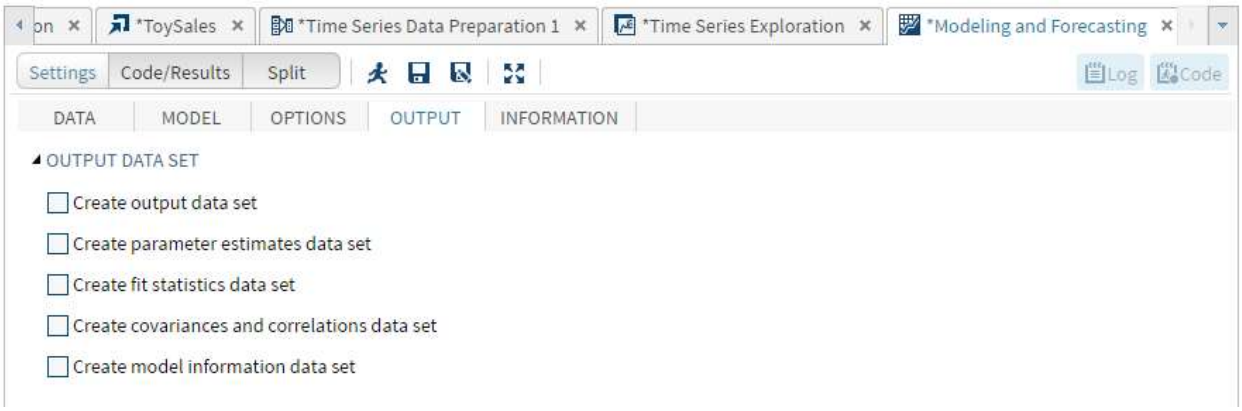
Select the model that best suits your intended objective:



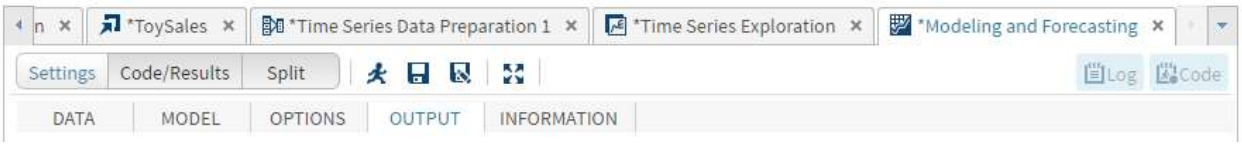
g. Next, choose the OPTIONS tab and adjust settings *(This demonstration keeps everything at default).*



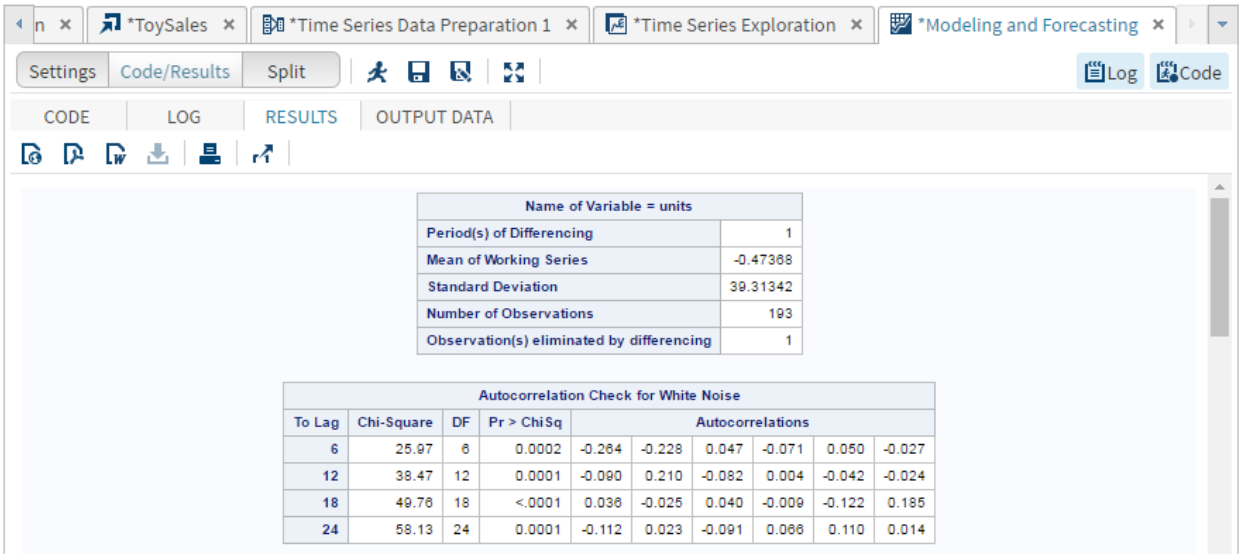
h. Choose the OUTPUT tab and select the desired DATA SETS to be output.



i. After declaring variables, selecting a model, determining options, and figuring out desired outputs, click on the run button below the "Modeling and Forecasting" tab.

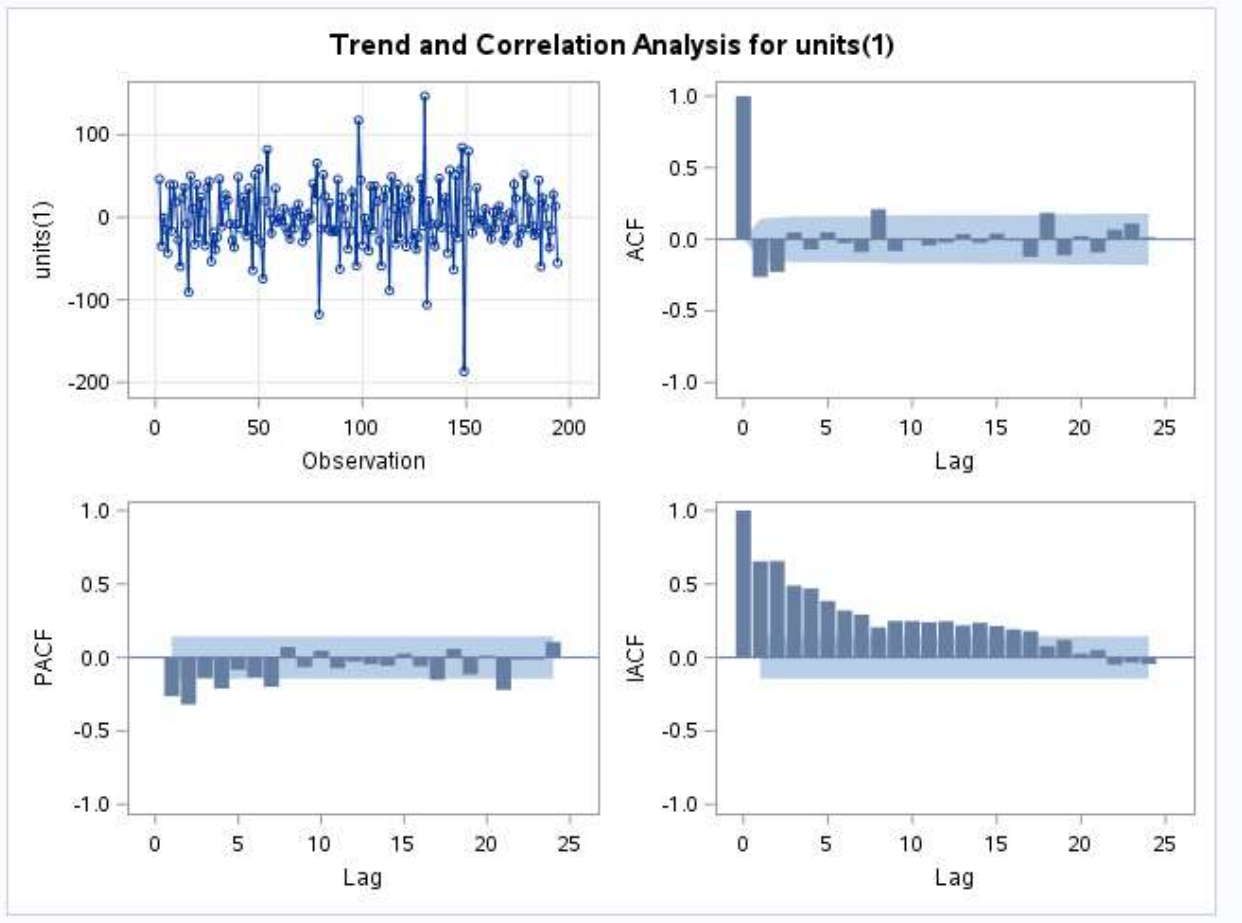


j. Click on “Code/Results,” then click on “RESULTS” to see charts and graphs



Name of Variable = units	
Period(s) of Differencing	1
Mean of Working Series	-0.47368
Standard Deviation	39.31342
Number of Observations	193
Observation(s) eliminated by differencing	1

Autocorrelation Check for White Noise									
To Lag	Chi-Square	DF	Pr > ChiSq	Autocorrelations					
6	25.97	6	0.0002	-0.264	-0.228	0.047	-0.071	0.050	-0.027
12	38.47	12	0.0001	-0.090	0.210	-0.082	0.004	-0.042	-0.024
18	49.76	18	<.0001	0.036	-0.025	0.040	-0.009	-0.122	0.185
24	58.13	24	0.0001	-0.112	0.023	-0.091	0.066	0.110	0.014



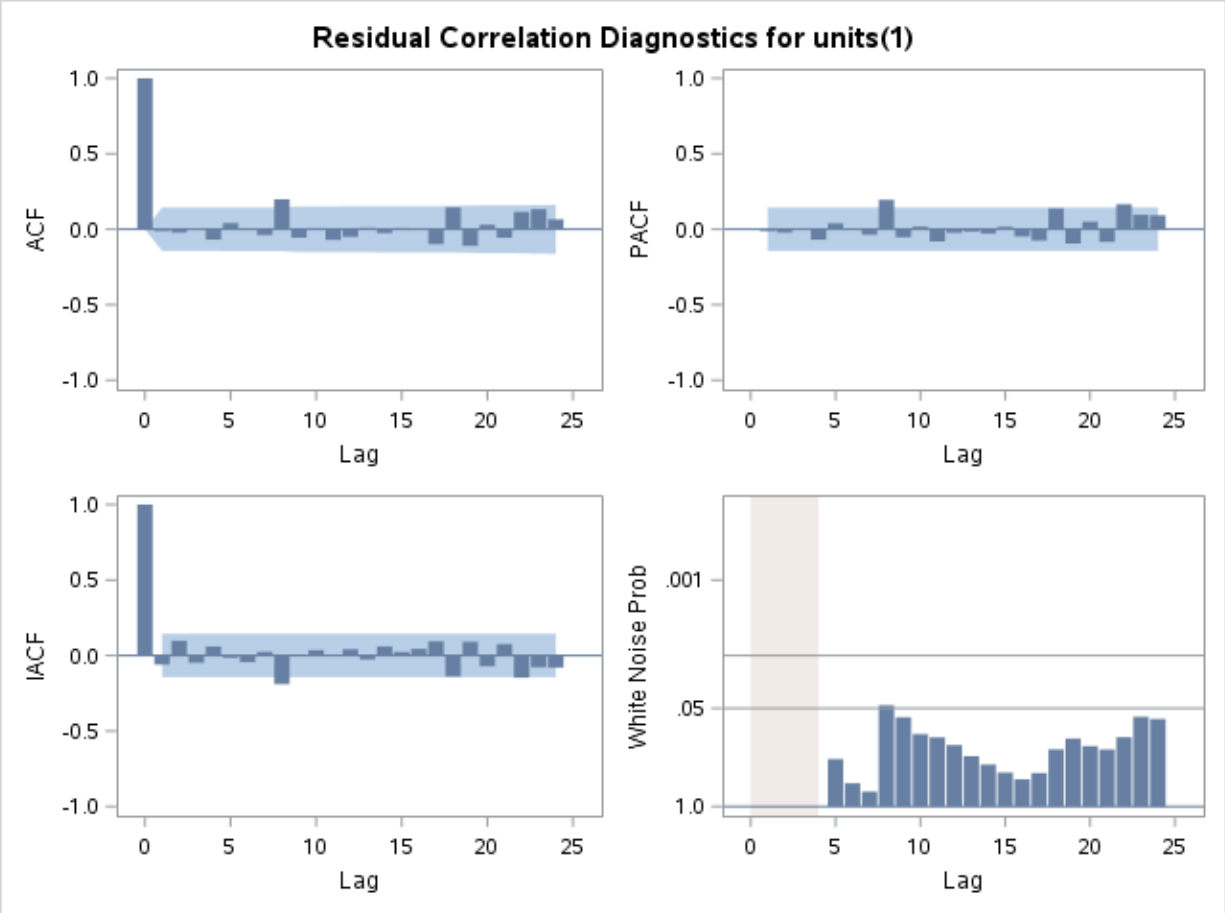
ARIMA Estimation Optimization Summary	
Estimation Method	Maximum Likelihood
Parameters Estimated	5
Termination Criteria	Maximum Relative Change in Estimates
Iteration Stopping Value	0.001
Criteria Value	10.2586
Maximum Absolute Value of Gradient	4471.754
R-Square Change from Last Iteration	0.105576
Objective Function	Log Gaussian Likelihood
Objective Function Value	-950.6
Marquardt's Lambda Coefficient	0.00001
Numerical Derivative Perturbation Delta	0.001
Iterations	8
Warning Message	Estimates may not have converged.

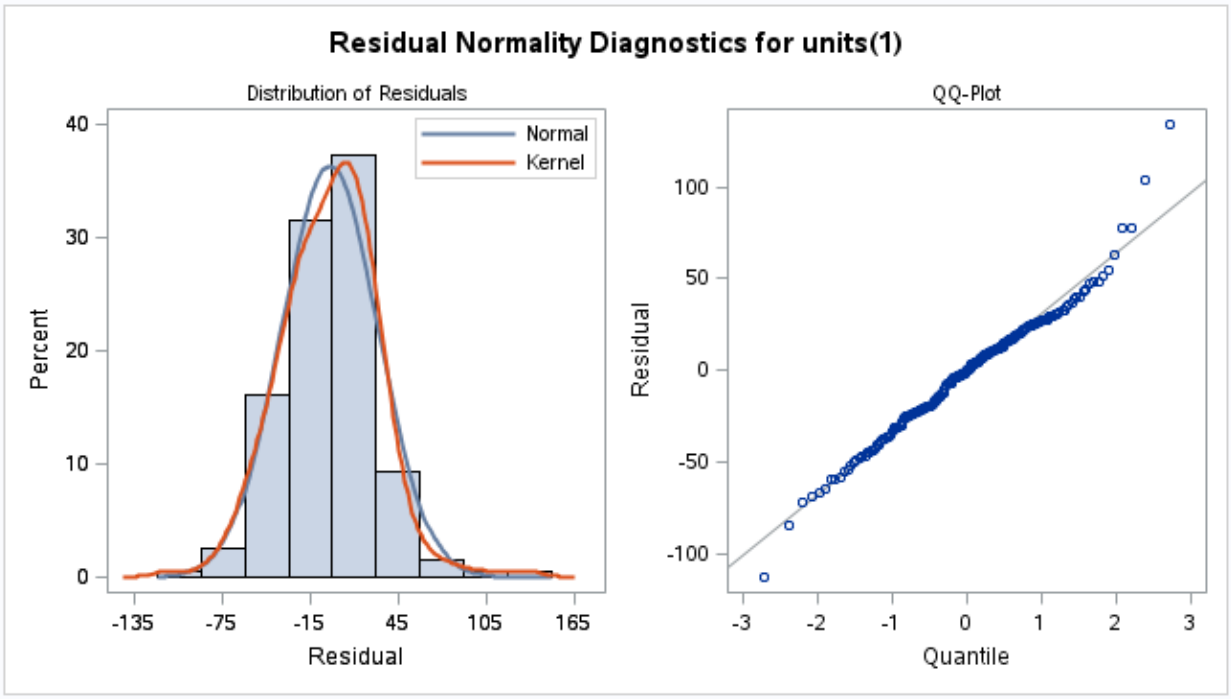
Maximum Likelihood Estimation					
Parameter	Estimate	Standard Error	t Value	Approx Pr > |t|	Lag
MU	0.03052	0.09910	0.31	0.7581	0
MA1,1	0.99994	7.24843	0.14	0.8903	1
AR1,1	0.44908	0.07505	5.98	<.0001	1
AR1,2	-0.07855	0.07941	-0.99	0.3226	2
AR1,3	0.12221	0.07470	1.64	0.1018	3

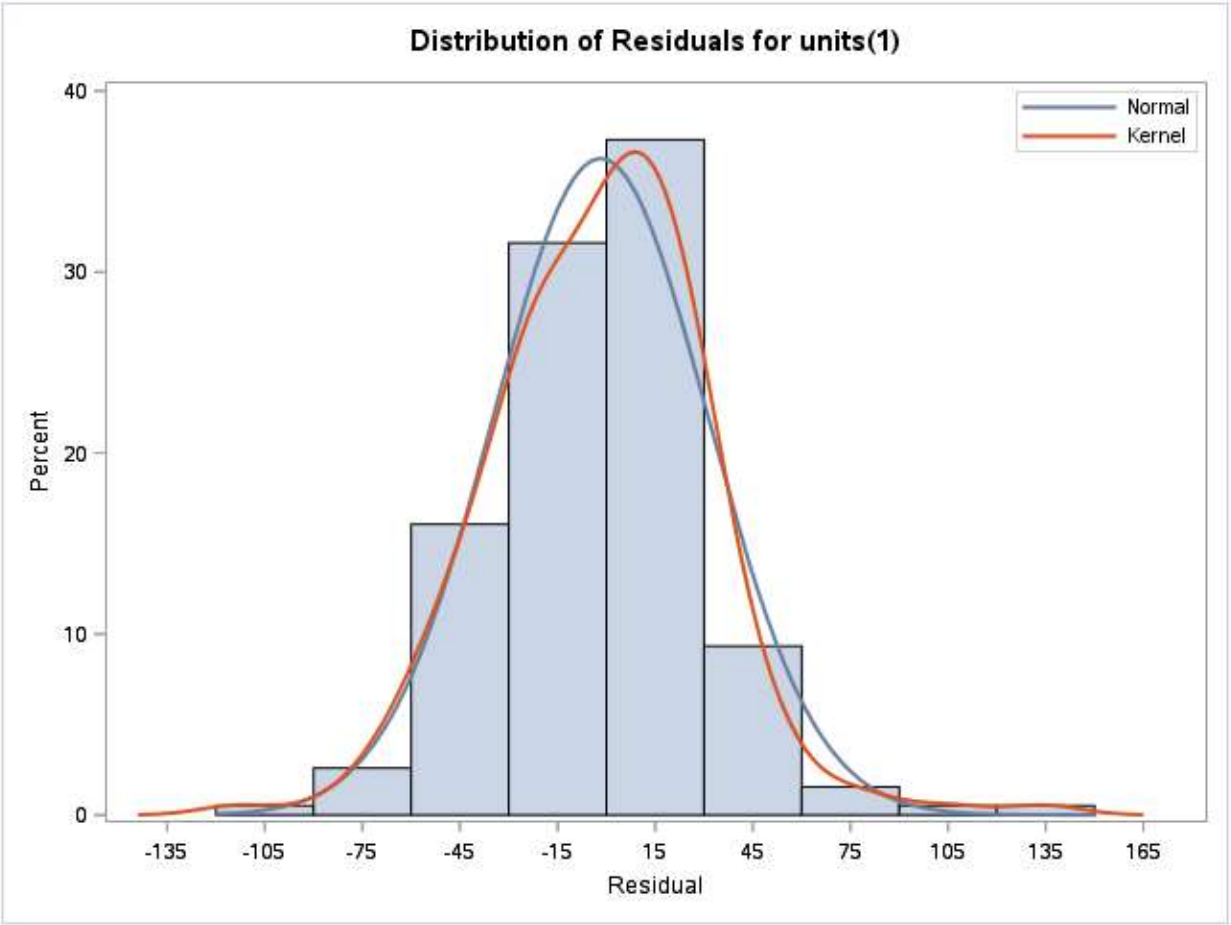
Constant Estimate	0.01548
Variance Estimate	1116.04
Std Error Estimate	33.40718
AIC	1911.199
SBC	1927.513
Number of Residuals	193

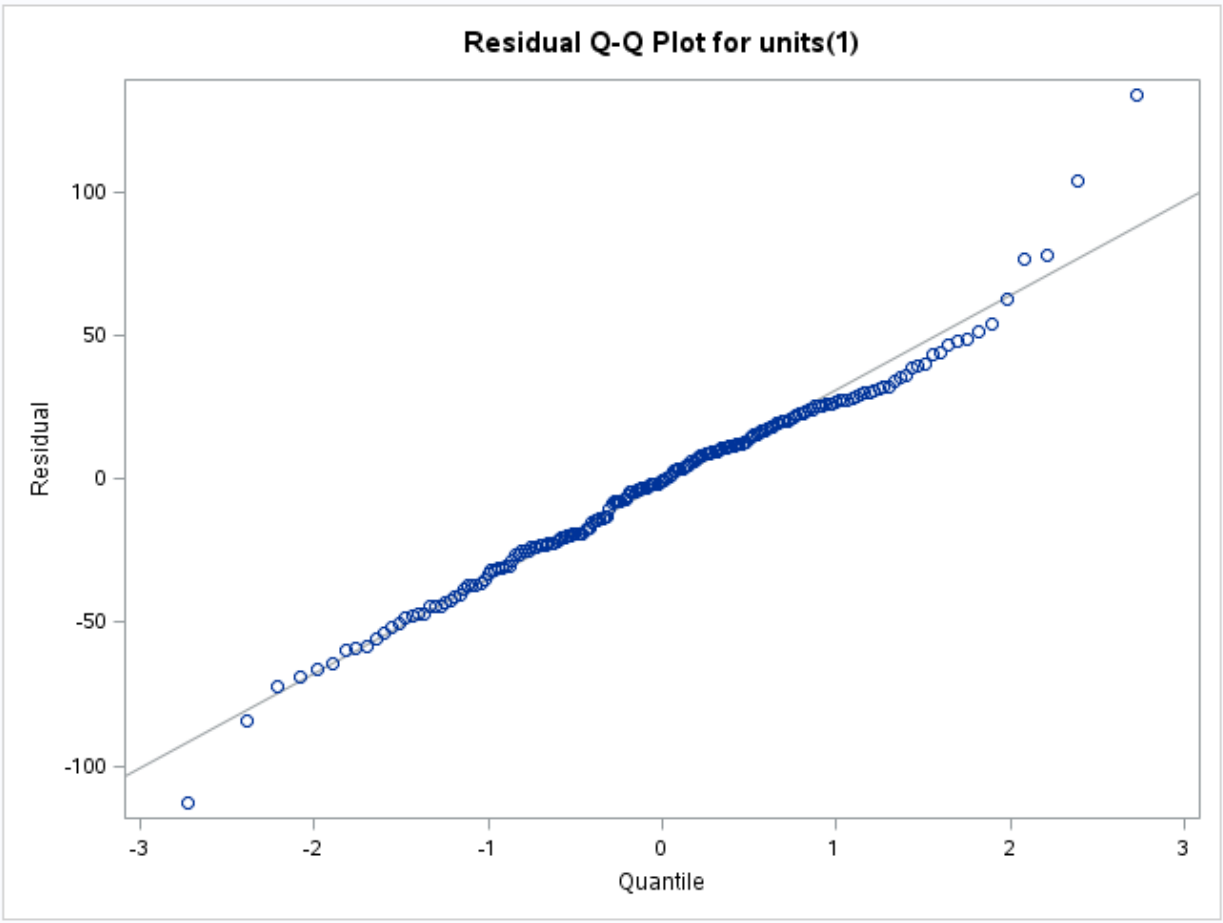
Correlations of Parameter Estimates					
Parameter	MU	MA1,1	AR1,1	AR1,2	AR1,3
MU	1.000	0.560	0.132	0.044	0.072
MA1,1	0.560	1.000	0.252	0.107	0.200
AR1,1	0.132	0.252	1.000	-0.346	0.104
AR1,2	0.044	0.107	-0.346	1.000	-0.349
AR1,3	0.072	0.200	0.104	-0.349	1.000

Autocorrelation Check of Residuals									
To Lag	Chi-Square	DF	Pr > ChiSq	Autocorrelations					
6	1.35	2	0.5099	-0.009	-0.020	0.003	-0.066	0.042	0.009
12	11.85	8	0.1583	-0.036	0.200	-0.054	0.010	-0.070	-0.049
18	18.59	14	0.1812	0.011	-0.024	0.010	-0.001	-0.097	0.146
24	29.84	20	0.0724	-0.109	0.030	-0.055	0.116	0.133	0.066
30	36.94	26	0.0756	-0.066	0.028	-0.103	0.049	-0.106	-0.041
36	39.92	32	0.1586	-0.017	-0.030	0.016	0.008	-0.095	0.044




Residual Normality Diagnostics for units(1)
Distribution of Residuals
Normal
Kernel
Percent
Residual
QQ-Plot
Residual
Quantile


Distribution of Residuals for units(1)
Normal
Kernel
Percent
Residual

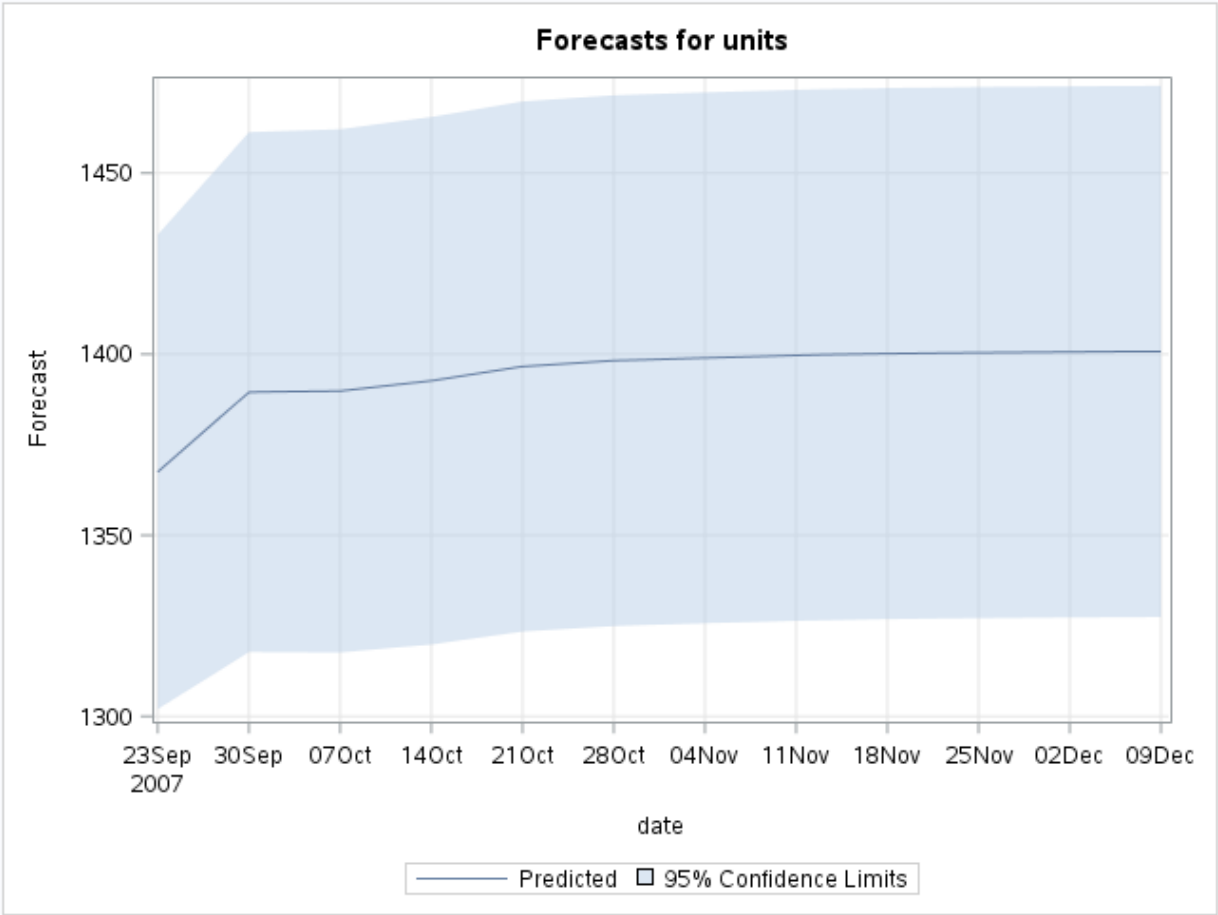

Residual Q-Q Plot for units(1)
Residual
100
50
0
-50
-100
-3
-2
-1
0
1
2
3
Quantile

Model for variable units	
Estimated Mean	0.030517
Period(s) of Differencing	1

Autoregressive Factors	
Factor 1:	1 - 0.44908 B**(1) + 0.07855 B**(2) - 0.12221 B**(3)

Moving Average Factors	
Factor 1:	1 - 0.99994 B**(1)

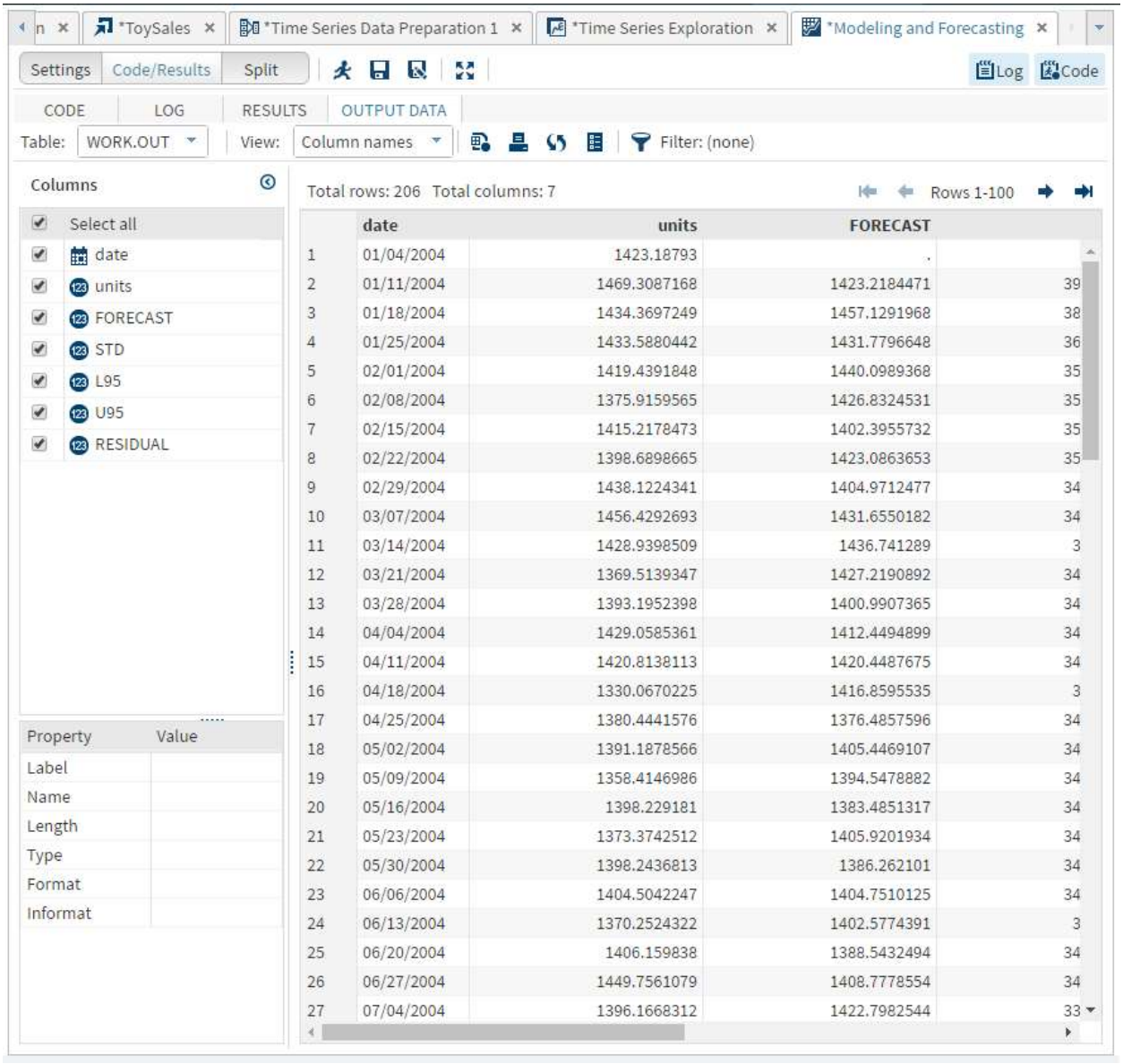
Forecasts for variable units				
Obs	Forecast	Std Error	95% Confidence Limits	
195	1367.4965	33.4072	1302.0197	1432.9734
196	1389.5245	36.6220	1317.7466	1461.3023
197	1389.8657	36.8526	1317.6359	1462.0955
198	1392.6706	37.1580	1319.8422	1465.4990
199	1396.6109	37.3366	1323.4325	1469.7894
200	1398.2173	37.3785	1324.9567	1471.4779
201	1398.9875	37.3944	1325.6957	1472.2792
202	1399.7042	37.4030	1326.3957	1473.0127
203	1400.1773	37.4062	1326.8625	1473.4921
204	1400.4431	37.4074	1327.1261	1473.7602
205	1400.6284	37.4078	1327.3103	1473.9464
206	1400.7640	37.4081	1327.4456	1474.0824



Outlier Detection Summary	
Maximum number searched	4
Number found	4
Significance used	0.05

Outlier Details				
Obs	Type	Estimate	Chi-Square	Approx Prob>ChiSq
130	Additive	128.98820	19.17	<.0001
148	Additive	122.68660	18.29	<.0001
78	Additive	87.63701	9.93	0.0016
97	Additive	-79.99659	8.25	0.0041

k. Click on the OUTPUT DATA tab to see your forecasted quantities, std deviations, confidence intervals, and residuals (differences).



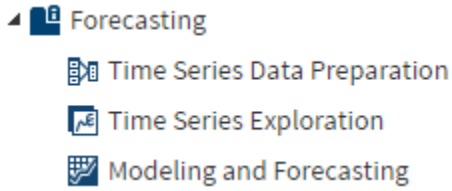
	date	units	FORECAST	
1	01/04/2004	1423.18793	.	
2	01/11/2004	1469.3087168	1423.2184471	39
3	01/18/2004	1434.3697249	1457.1291968	38
4	01/25/2004	1433.5880442	1431.7796648	36
5	02/01/2004	1419.4391848	1440.0989368	35
6	02/08/2004	1375.9159565	1426.8324531	35
7	02/15/2004	1415.2178473	1402.3955732	35
8	02/22/2004	1398.6898665	1423.0863653	35
9	02/29/2004	1438.1224341	1404.9712477	34
10	03/07/2004	1456.4292693	1431.6550182	34
11	03/14/2004	1428.9398509	1436.741289	3
12	03/21/2004	1369.5139347	1427.2190892	34
13	03/28/2004	1393.1952398	1400.9907365	34
14	04/04/2004	1429.0585361	1412.4494899	34
15	04/11/2004	1420.8138113	1420.4487675	34
16	04/18/2004	1330.0670225	1416.8595535	3
17	04/25/2004	1380.4441576	1376.4857596	34
18	05/02/2004	1391.1878566	1405.4469107	34
19	05/09/2004	1358.4146986	1394.5478882	34
20	05/16/2004	1398.229181	1383.4851317	34
21	05/23/2004	1373.3742512	1405.9201934	34
22	05/30/2004	1398.2436813	1386.262101	34
23	06/06/2004	1404.5042247	1404.7510125	34
24	06/13/2004	1370.2524322	1402.5774391	3
25	06/20/2004	1406.159838	1388.5432494	34
26	06/27/2004	1449.7561079	1408.7778554	34
27	07/04/2004	1396.1668312	1422.7982544	33

Appendix

1. To find the Mean Squared Error, Root Mean Squared Error, Mean Absolute Percentage Error, or Maximum Percent Error, please select the following:

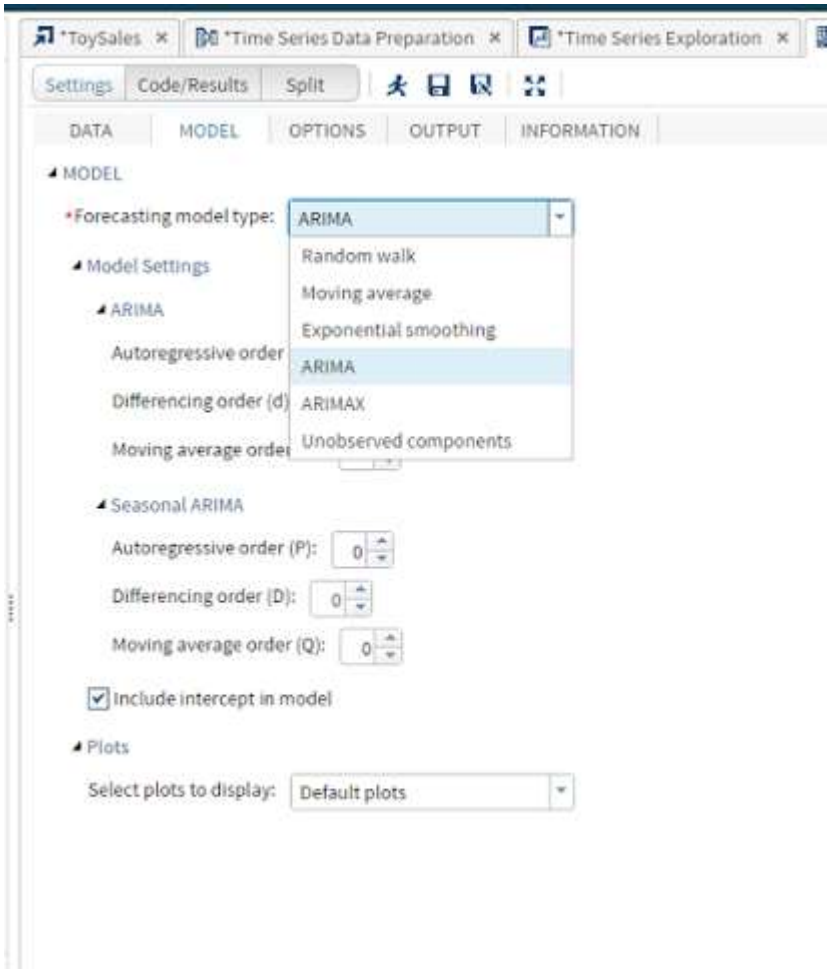
Fit Statistics Based on Residuals	
Mean Squared Error	1257.21999
Root Mean Squared Error	35.45730
Mean Absolute Percentage Error	1.94482
Maximum Percent Error	9.26984
R-Square	0.04581
Adjusted R-Square	0.04081
Random Walk R-Square	0.18655
Amemiya's Adjusted R-Square	0.02583
Number of non-missing residuals used for computing the fit statistics = 193	

   a. Click on Modeling and Forecasting task

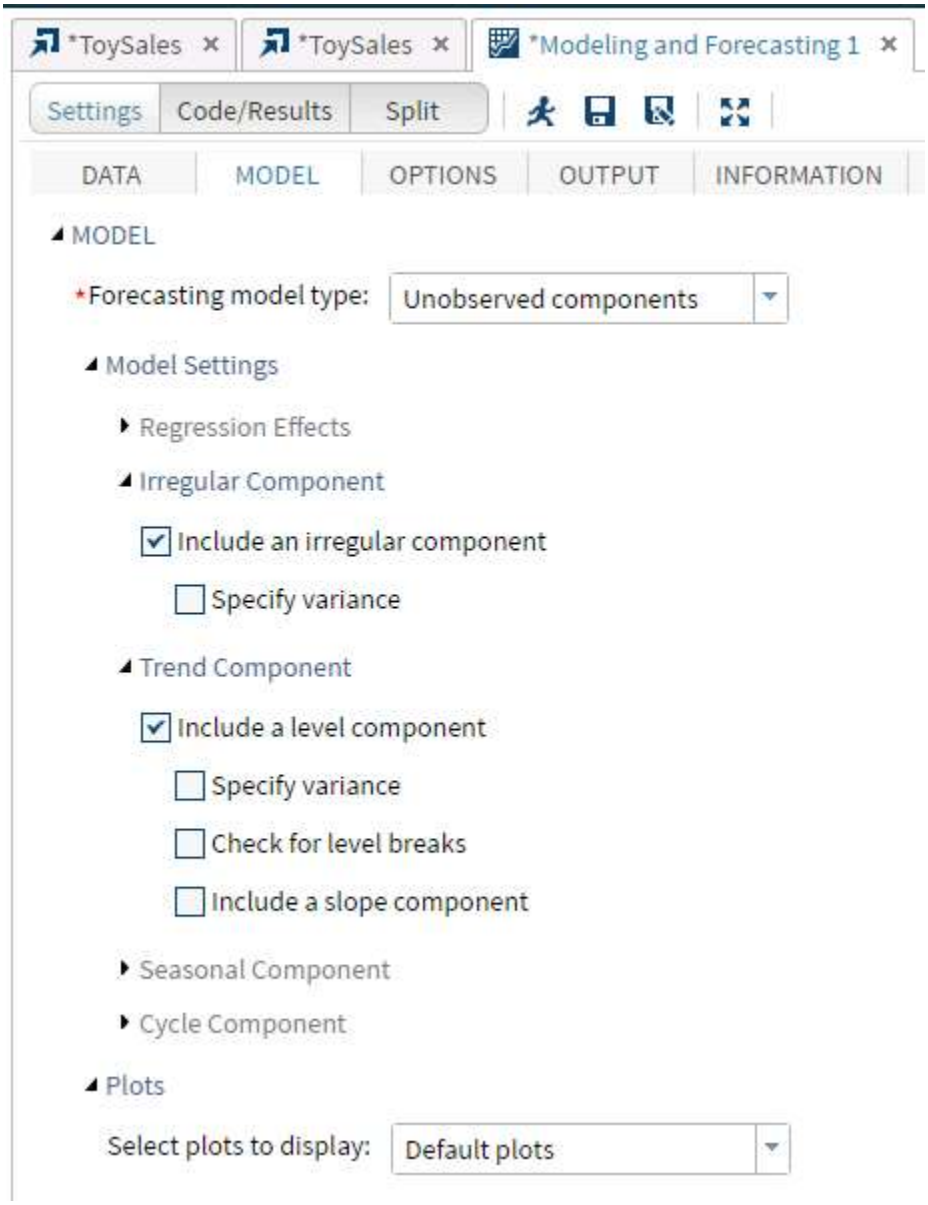


   b. Your data should already be prepped and variables declared. If not, please refer to steps aforementioned above.

c. Under the “MODEL” tab, choose amongst the “Forecasting model type:”



d. Select the “Unobserved components” forecasting model.



e. Adjust settings to your preferences, then click the run button.

f. Click on “Code/Results” and then “Results” to see the model.