Problem 5

```sas
* Help to seperate the training set and test set;
data case5;
infile "/home/u63045488/my_stuff/hw5_5_data.txt";
input Xt Yt;
if _n_ <= 500 then yt1=Yt; * training set;
if _n_ > 500 then yt2=Yt; * test set;
run;

proc print data=case5 (firstobs=501 obs=520);
run;

/* Step 2: Preliminary Analysis: Build Individual ARIMA Models */
* Xt;
proc arima data=case5;
identify var=Xt;
identify var=Xt(1);
estimate p=1 method=ml;
estimate q=1 method=ml;
forecast out=resX back=0 lead=20 noprint;
* Reason for "forecast" step: get the output for
the residuals, and check the residual CCF later.;
run;

* Yt;
proc arima data=case5;
identify var=yt1 nlag=50;
identify var=yt1(1) nlag=50;
identify var=yt1(1,12) nlag=50;
estimate p=1 q=(1)(12) noint method=ml;
* estimate p=(1,2)(12,24) q=(12) noint method=ml;
forecast out=resY back=0 lead=20 noprint;
* Reason for "forecast" step: get the forecast for
the last 20 obs., and compare them with RDL model;
run;

/* Step 3: Fit dynamic regression models */
* RDL model;
proc arima data=case5;
identify var=yt1(1) crosscorr=(Xt) nlag=50;
estimate input=((1,2,3,4,5,6,7,8,9,10,11,12,13,14,15) Xt) noint method=ml;
* Primary goal: look at the ACF and PACF of residuals n_t;
* see p213 in ARIMA manual;
estimate p=1 q=(1)(12) input=(2$ / (1) Xt) noint method=ml;
forecast out=resRDL back=0 lead=20;
run;
```

```sas
* Check the CCF of residuals;
* Create the data with all the residuals;
data res0;
set resX;
rX1 = RESIDUAL;
set resRDL;
rRDL = RESIDUAL;
keep rX1 rRDL;
run;

proc arima data=res0;
identify var=rRDL crosscorr=(rX1);
run;


* Look at the forecast results;
data fore;
set resRDL;
FRDL = FORECAST;
FY = FORECAST;
set case5;
TrueY = Yt;
keep FRDL FY TrueY; * Only keep these three variables;

data fore1;
set fore;
if _n_ >=501; * Get a subset from obs. 501-520;
id = _n_; * Create an index for the plot below;
run;

proc print data=fore1;
run;

* Draw the plot to compare the results;
proc sgplot data=fore1;
series x=id y=FRDL;
series x=id y=FY;
series x=id y=TrueY;
run;
```

Obs	Xt	Yt	yt1	yt2
501	148.766	748.034	.	748.034
502	144.668	728.146	.	728.146
503	121.343	655.409	.	655.409
504	105.214	704.410	.	704.410
505	137.205	732.196	.	732.196
506	131.445	690.775	.	690.775
507	170.647	632.386	.	632.386
508	109.615	672.313	.	672.313
509	122.257	675.153	.	675.153
510	118.381	752.470	.	752.470
511	147.604	704.628	.	704.628
512	132.993	663.234	.	663.234
513	189.340	641.722	.	641.722
514	176.044	700.193	.	700.193
515	176.465	711.560	.	711.560
516	105.511	830.581	.	830.581
517	120.183	865.761	.	865.761
518	183.070	887.040	.	887.040
519	129.102	750.578	.	750.578
520	149.215	697.892	.	697.892

**The ARIMA Procedure**

Name of Variable = Xt	
Mean of Working Series	149.818
Standard Deviation	29.41719
Number of Observations	520

Autocorrelation Check for White Noise									
To Lag	Chi-Square	DF	Pr > ChiSq	Autocorrelations					
6	1.77	6	0.9399	-0.016	0.043	-0.023	-0.023	0.003	0.016
12	3.09	12	0.9949	0.018	0.023	-0.010	0.020	0.005	0.033
18	6.93	18	0.9907	-0.008	-0.058	-0.003	-0.025	0.055	0.008
24	8.57	24	0.9984	0.005	0.009	-0.014	0.003	0.031	0.042

Trend and Correlation Analysis for Xt
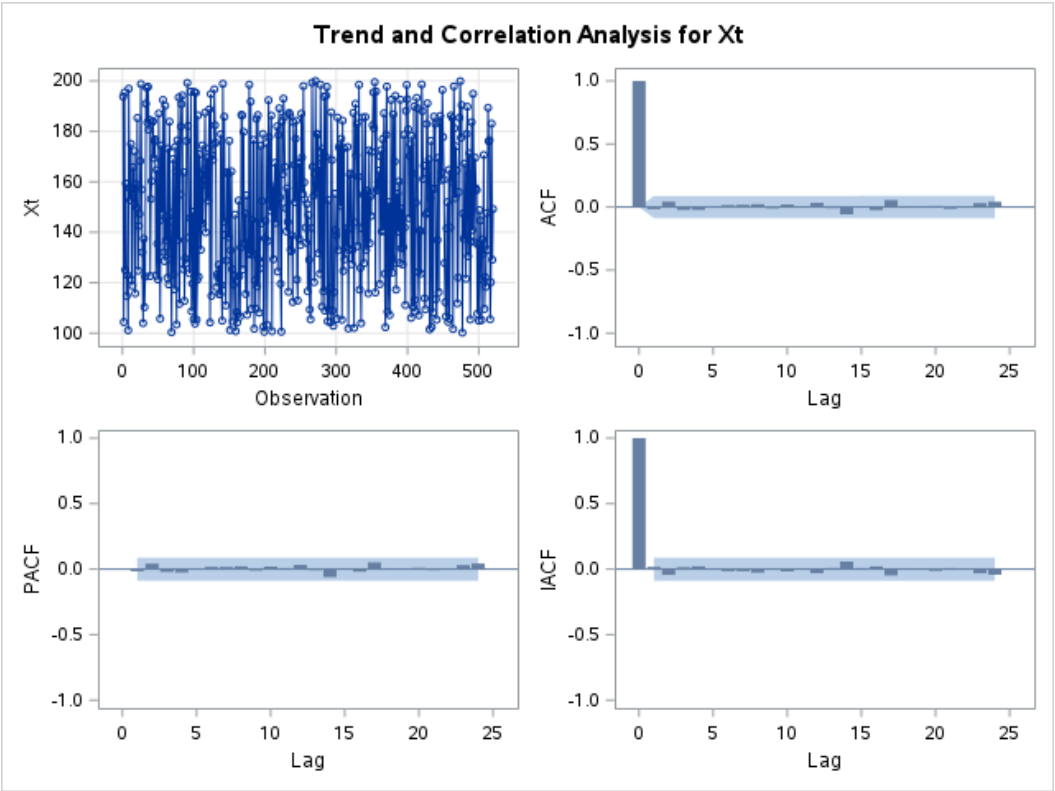
Name of Variable = Xt	
Period(s) of Differencing	1
Mean of Working Series	-0.08586
Standard Deviation	41.92846
Number of Observations	519
Observation(s) eliminated by differencing	1

Autocorrelation Check for White Noise									
To Lag	Chi-Square	DF	Pr > ChiSq	Autocorrelations					
6	146.51	6	<.0001	-0.526	0.057	-0.029	-0.014	0.008	0.005
12	148.33	12	<.0001	-0.000	0.014	-0.029	0.023	-0.022	0.037
18	154.64	18	<.0001	0.004	-0.054	0.038	-0.051	0.065	-0.024
24	155.65	24	<.0001	-0.003	0.012	-0.017	-0.006	0.008	0.036
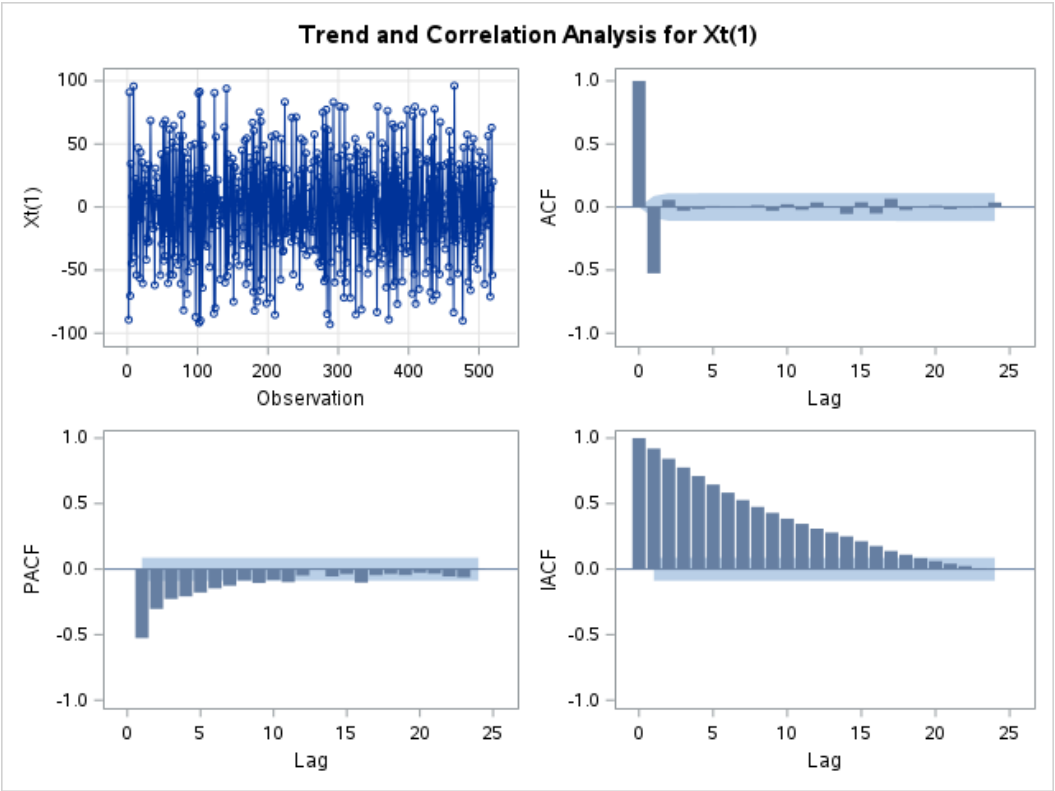
Trend and Correlation Analysis for Xt(1)

Maximum Likelihood Estimation

Parameter	Estimate	Standard Error	t Value	Approx Pr > |t|	Lag
MU	-0.03972	1.02419	-0.04	0.9691	0
AR1,1	-0.52948	0.03728	-14.20	<.0001	1

Constant Estimate	-0.06075
Variance Estimate	1272.667
Std Error Estimate	35.67446
AIC	5185.447
SBC	5193.951
Number of Residuals	519

Correlations of Parameter Estimates

Parameter	MU	AR1,1
MU	1.000	0.001
AR1,1	0.001	1.000

Autocorrelation Check of Residuals

To Lag	Chi-Square	DF	Pr > ChiSq	Autocorrelations					
6	63.11	5	<.0001	-0.156	-0.306	-0.021	-0.041	0.009	0.014
12	65.02	11	<.0001	0.015	0.003	-0.026	0.002	0.003	0.052
18	69.52	17	<.0001	-0.003	-0.065	-0.009	-0.016	0.062	0.004
24	71.19	23	<.0001	-0.014	0.005	-0.026	-0.017	0.037	0.022
30	76.20	29	<.0001	-0.050	0.043	0.005	-0.038	0.027	0.051
36	79.04	35	<.0001	-0.046	-0.044	0.002	0.002	0.018	-0.026
42	82.02	41	0.0001	-0.002	0.037	0.049	-0.036	0.002	0.014
48	99.37	47	<.0001	-0.055	-0.063	-0.003	0.068	0.120	-0.065

Residual Correlation Diagnostics for Xt(1)

Residual Normality Diagnostics for Xt(1)

bell shaped curve.

white noise proess
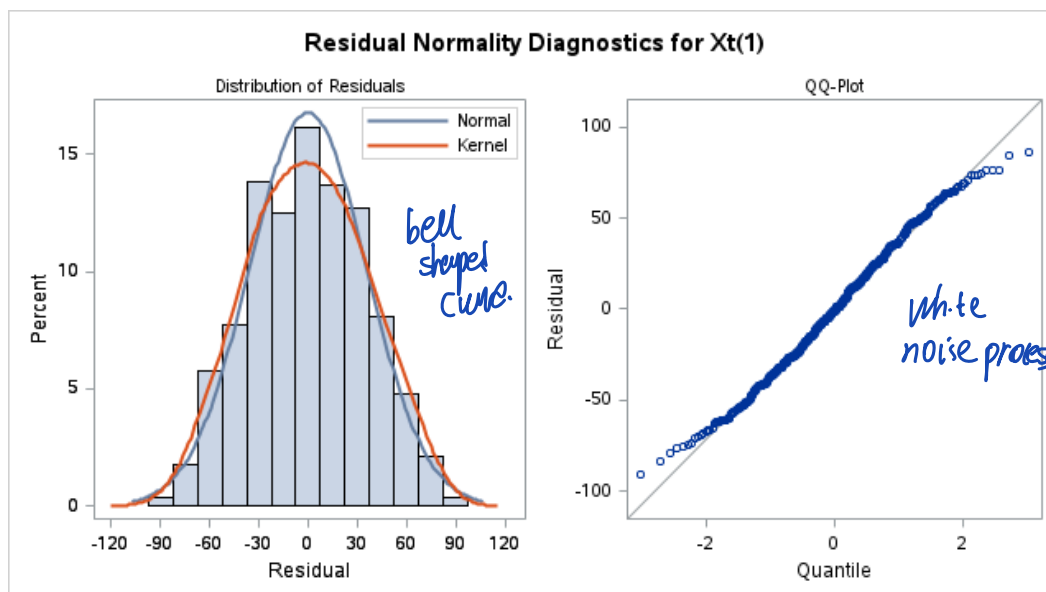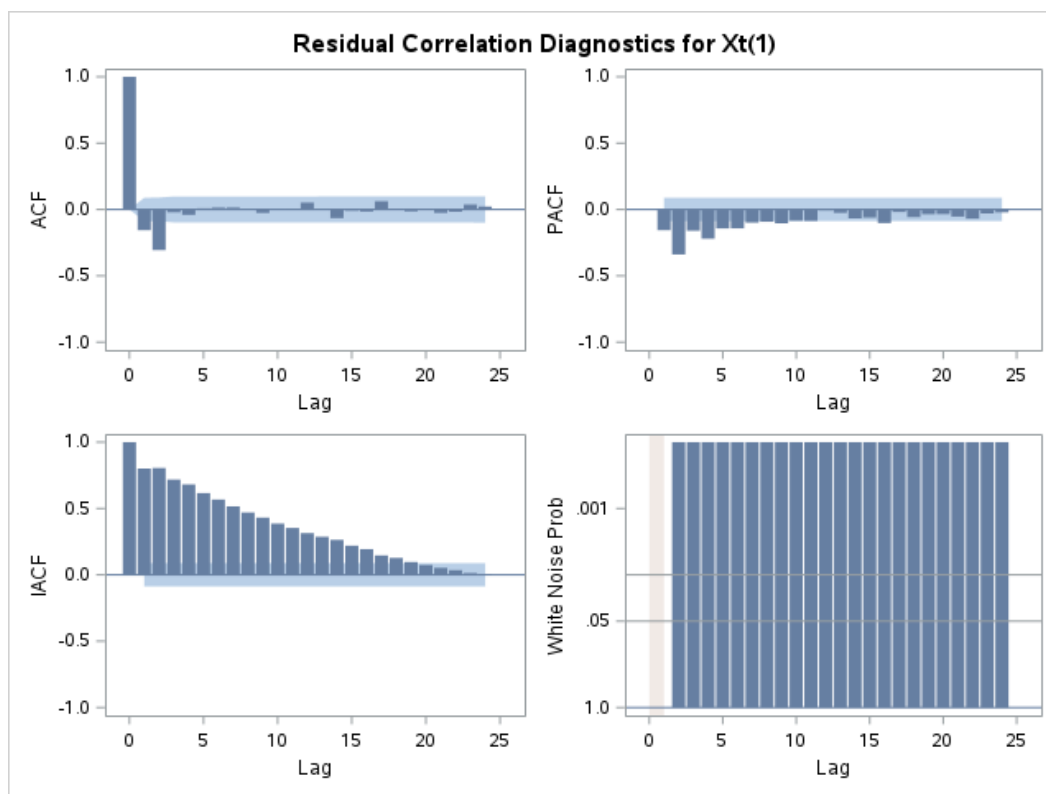
Model for variable Xt	
Estimated Mean	-0.03972
Period(s) of Differencing	1

Autoregressive Factors	
Factor 1:	1 + 0.52948 B**(1)

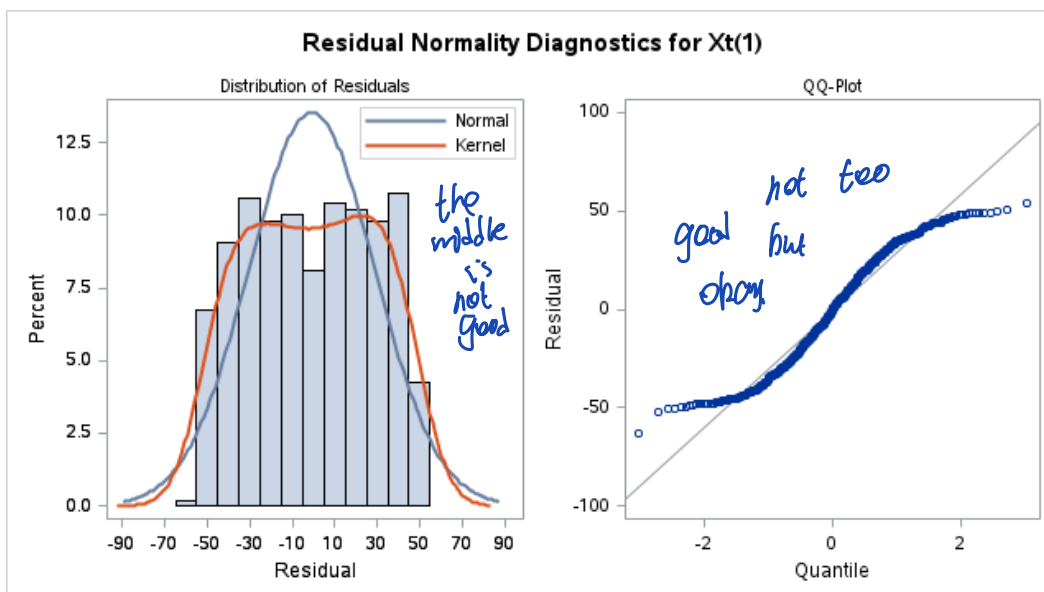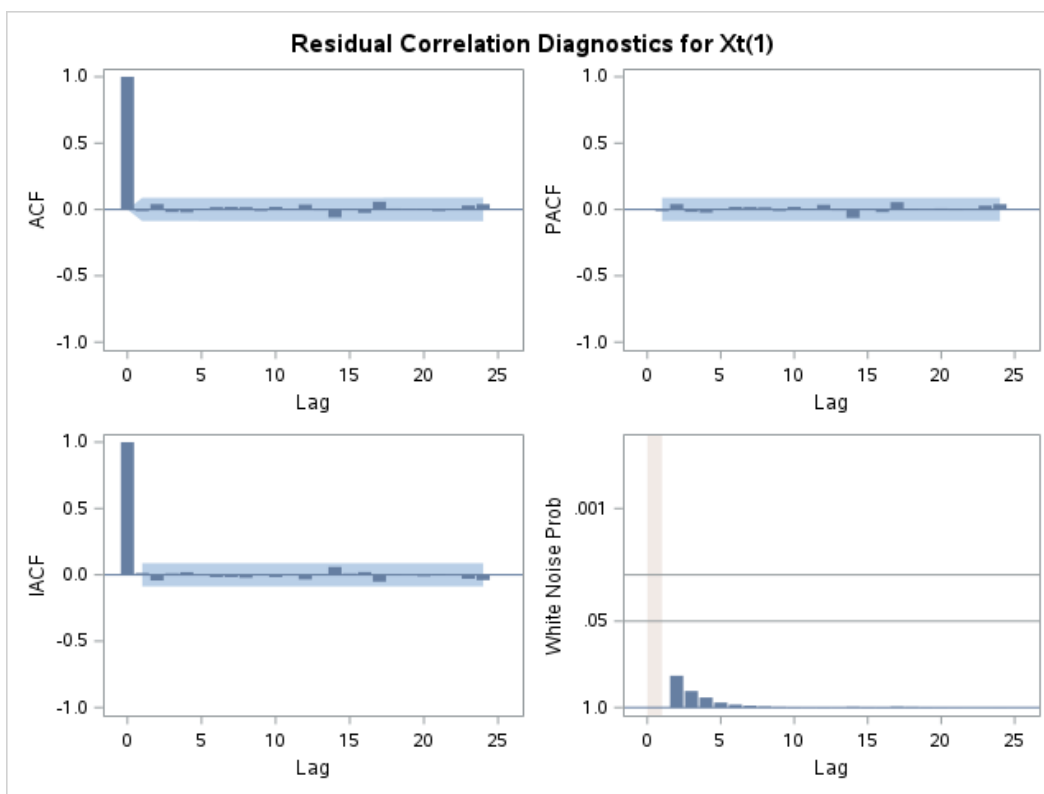| ARIMA Estimation Optimization Summary	
Estimation Method	Maximum Likelihood

Parameters Estimated	2
Termination Criteria	Maximum Relative Change in Estimates
Iteration Stopping Value	0.001
Criteria Value	2.776274
Maximum Absolute Value of Gradient	40764.73
R-Square Change from Last Iteration	0.047661
Objective Function	Log Gaussian Likelihood
Objective Function Value	-2495.17
Marquardt's Lambda Coefficient	1E-6
Numerical Derivative Perturbation Delta	0.001
Iterations	10
Warning Message	Estimates may not have converged.

Maximum Likelihood Estimation					
Parameter	Estimate	Standard Error	t Value	Approx Pr > |t|	Lag
MU	0.0033934	0.0085708	0.40	0.6922	0
MA1,1	0.99998	2.73860	0.37	0.7150	1

Constant Estimate	0.003393
Variance Estimate	870.6783
Std Error Estimate	29.50726
AIC	4994.35
SBC	5002.854
Number of Residuals	519

Correlations of Parameter Estimates		
Parameter	MU	MA1,1
MU	1.000	0.024
MA1,1	0.024	1.000

Autocorrelation Check of Residuals									
To Lag	Chi-Square	DF	Pr > ChiSq	Autocorrelations					
6	1.59	5	0.9021	-0.012	0.041	-0.019	-0.021	0.007	0.019
12	3.02	11	0.9904	0.020	0.018	-0.010	0.020	0.005	0.038
18	7.16	17	0.9813	-0.006	-0.059	-0.004	-0.025	0.058	0.008
24	8.67	23	0.9970	0.005	0.007	-0.012	0.003	0.030	0.040
30	10.79	29	0.9992	-0.024	0.050	0.008	-0.008	0.013	0.022
36	15.82	35	0.9978	-0.054	-0.059	-0.031	-0.032	0.004	-0.027
42	18.80	41	0.9988	0.017	0.028	0.049	-0.029	-0.012	-0.028
48	35.66	47	0.8868	-0.064	-0.059	0.020	0.063	0.132	-0.013

Residual Correlation Diagnostics for Xt(1)

Residual Normality Diagnostics for Xt(1)

the middle is not good

not too good but okay

Model for variable Xt	
Estimated Mean	0.003393
Period(s) of Differencing	1

Moving Average Factors	
Factor 1:	1 - 0.99998 B**(1)

The ARIMA Procedure

Name of Variable = yt1	
Mean of Working Series	797.1971
Standard Deviation	77.14118
Number of Observations	500

Autocorrelation Check for White Noise									
To Lag	Chi-Square	DF	Pr > ChiSq	Autocorrelations					
6	293.34	6	<.0001	0.617	0.371	0.204	0.108	0.082	0.060
12	297.41	12	<.0001	0.054	0.050	0.024	0.019	0.027	0.029
18	301.52	18	<.0001	0.009	-0.028	-0.027	0.002	0.056	0.056
24	314.65	24	<.0001	0.049	0.039	0.028	0.056	0.085	0.100
30	322.64	30	<.0001	0.084	0.077	0.039	0.014	0.009	-0.019
36	333.49	36	<.0001	-0.074	-0.078	-0.072	-0.044	0.015	0.033
42	340.19	42	<.0001	0.050	0.048	0.034	-0.003	-0.042	-0.068
48	357.51	48	<.0001	-0.061	-0.031	0.035	0.096	0.119	0.045

Trend and Correlation Analysis for yt1

Name of Variable = yt1	
Period(s) of Differencing	1
Mean of Working Series	-0.26669
Standard Deviation	67.09645
Number of Observations	499
Observation(s) eliminated by differencing	1

Autocorrelation Check for White Noise									
To Lag	Chi-Square	DF	Pr > ChiSq	Autocorrelations					
6	28.95	6	<.0001	-0.172	-0.104	-0.097	-0.087	-0.012	-0.013
12	30.52	12	0.0023	-0.006	0.036	-0.026	-0.014	-0.004	0.029
18	35.46	18	0.0083	0.020	-0.052	-0.029	-0.032	0.068	0.008
24	38.43	24	0.0313	0.002	0.007	-0.056	-0.004	0.014	0.048
30	41.81	30	0.0743	-0.008	0.043	-0.023	-0.035	0.032	0.041

36	46.33	36	0.1161	-0.061	-0.012	-0.023	-0.043	0.046	-0.007
42	48.21	42	0.2362	0.026	0.011	0.030	0.004	-0.010	-0.041
48	61.98	48	0.0847	-0.031	-0.052	0.003	0.050	0.126	-0.052

Trend and Correlation Analysis for yt1(1)

Name of Variable = yt1	
Period(s) of Differencing	1,12
Mean of Working Series	0.384041
Standard Deviation	93.26579
Number of Observations	487
Observation(s) eliminated by differencing	13

Autocorrelation Check for White Noise									
To Lag	Chi-Square	DF	Pr > ChiSq	Autocorrelations					
6	26.62	6	0.0002	-0.181	-0.081	-0.076	-0.083	-0.045	-0.017
12	160.08	12	<.0001	0.002	0.076	0.054	0.050	0.064	-0.501
18	169.94	18	<.0001	0.116	-0.026	0.045	0.017	0.055	0.001
24	172.10	24	<.0001	0.037	0.001	-0.034	0.025	-0.004	0.032
30	179.37	30	<.0001	-0.048	0.077	-0.034	-0.006	-0.002	0.068
36	184.15	36	<.0001	-0.053	0.004	0.005	-0.075	-0.024	0.012
42	190.28	42	<.0001	0.039	-0.012	0.060	-0.015	-0.008	-0.077
48	199.17	48	<.0001	0.023	-0.021	0.011	0.050	0.094	-0.063
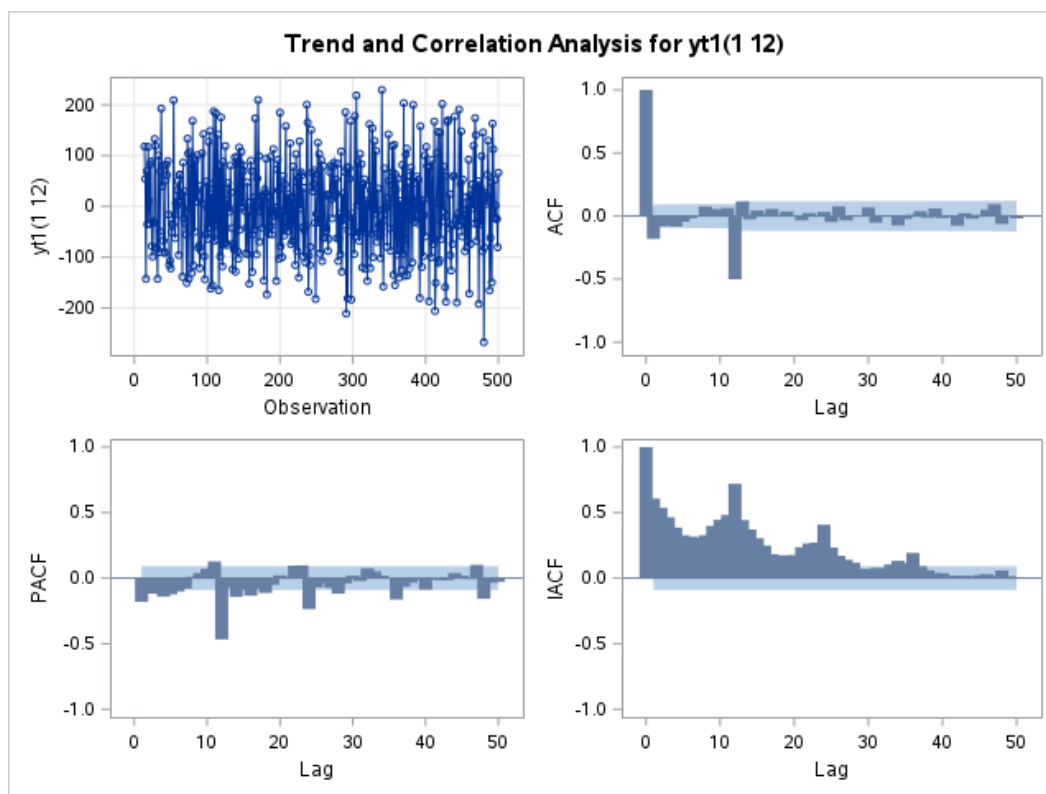
Trend and Correlation Analysis for yt1(1 12)

Maximum Likelihood Estimation					
Parameter	Estimate	Standard Error	t Value	Approx Pr > |t|	Lag
MA1,1	0.98802	0.01306	75.66	<.0001	1
MA2,1	0.93087	0.02833	32.86	<.0001	12
AR1,1	0.61561	0.03710	16.59	<.0001	1

Variance Estimate	3870.273
Std Error Estimate	62.21152
AIC	5437.907
SBC	5450.472
Number of Residuals	487

Correlations of Parameter Estimates			
Parameter	MA1,1	MA2,1	AR1,1
MA1,1	1.000	-0.158	0.334
MA2,1	-0.158	1.000	-0.050
AR1,1	0.334	-0.050	1.000

Autocorrelation Check of Residuals									
To Lag	Chi-Square	DF	Pr > ChiSq	Autocorrelations					
6	1.04	3	0.7910	0.010	0.004	-0.023	-0.033	0.005	0.018
12	2.59	9	0.9783	0.008	0.051	-0.015	-0.001	-0.013	0.008
18	7.20	15	0.9518	0.008	-0.049	-0.027	-0.020	0.062	0.041
24	10.22	21	0.9759	0.015	0.027	-0.047	0.013	0.019	0.046
30	14.30	27	0.9782	-0.005	0.067	-0.011	-0.011	0.022	0.051
36	19.96	33	0.9640	-0.069	-0.020	-0.052	-0.043	0.033	-0.007
42	21.81	39	0.9881	0.020	0.017	0.015	0.001	-0.026	-0.043
48	35.34	45	0.8484	-0.047	-0.044	-0.008	0.058	0.126	-0.039

Residual Correlation Diagnostics for yt1(1 12)

Residual Normality Diagnostics for yt1(1 12)

→looks deees.

White noise process
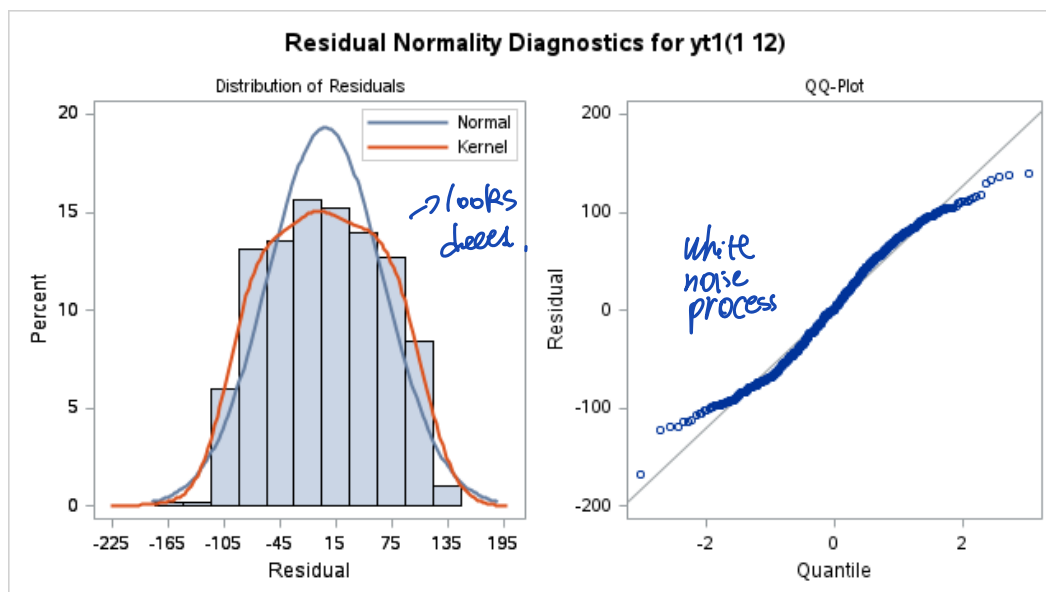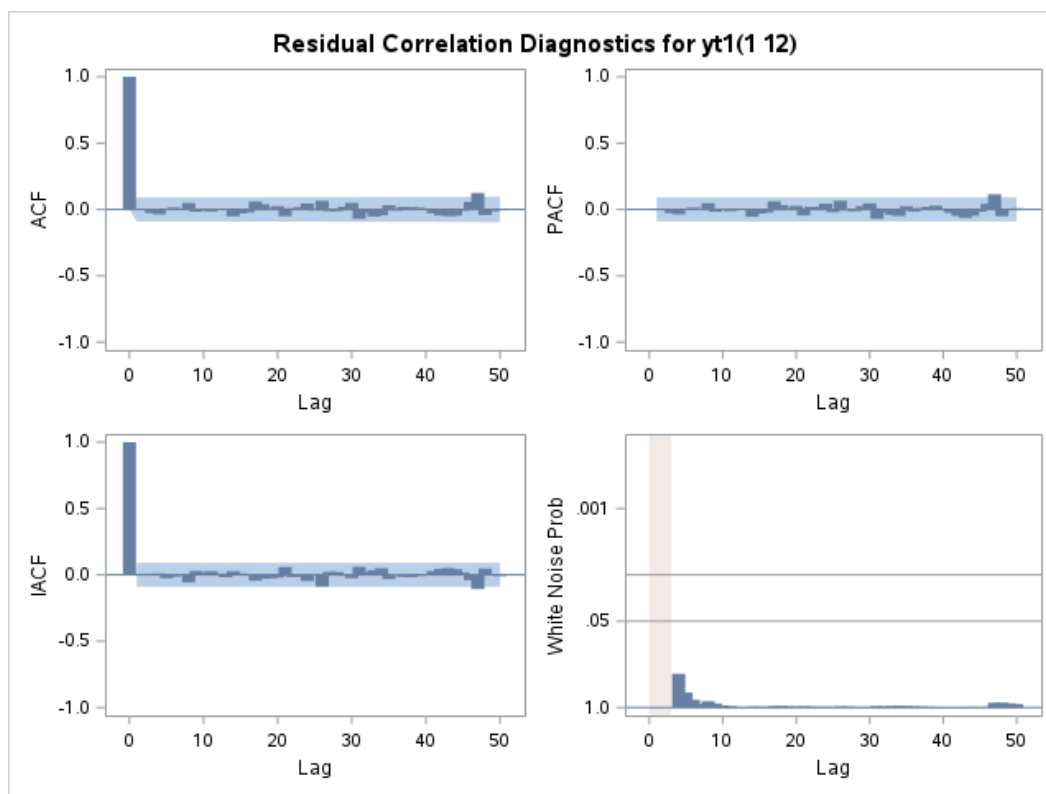
Model for variable yt1	
Period(s) of Differencing	1,12

No mean term in this model.

Autoregressive Factors	
Factor 1:	1 - 0.61561 B**(1)

Moving Average Factors	
Factor 1:	1 - 0.98802 B**(1)
Factor 2:	1 - 0.93087 B**(12)

The ARIMA Procedure

Name of Variable = yt1	
Period(s) of Differencing	1
Mean of Working Series	-0.26669
Standard Deviation	67.09645
Number of Observations	499
Observation(s) eliminated by differencing	1

Autocorrelation Check for White Noise									
To Lag	Chi-Square	DF	Pr > ChiSq	Autocorrelations					
6	28.95	6	<.0001	-0.172	-0.104	-0.097	-0.087	-0.012	-0.013
12	30.52	12	0.0023	-0.006	0.036	-0.026	-0.014	-0.004	0.029
18	35.46	18	0.0083	0.020	-0.052	-0.029	-0.032	0.068	0.008
24	38.43	24	0.0313	0.002	0.007	-0.056	-0.004	0.014	0.048
30	41.81	30	0.0743	-0.008	0.043	-0.023	-0.035	0.032	0.041
36	46.33	36	0.1161	-0.061	-0.012	-0.023	-0.043	0.046	-0.007
42	48.21	42	0.2362	0.026	0.011	0.030	0.004	-0.010	-0.041
48	61.98	48	0.0847	-0.031	-0.052	0.003	0.050	0.126	-0.052

Correlation of yt1 and Xt	
Variance of input =	865.3709
Number of Observations	499
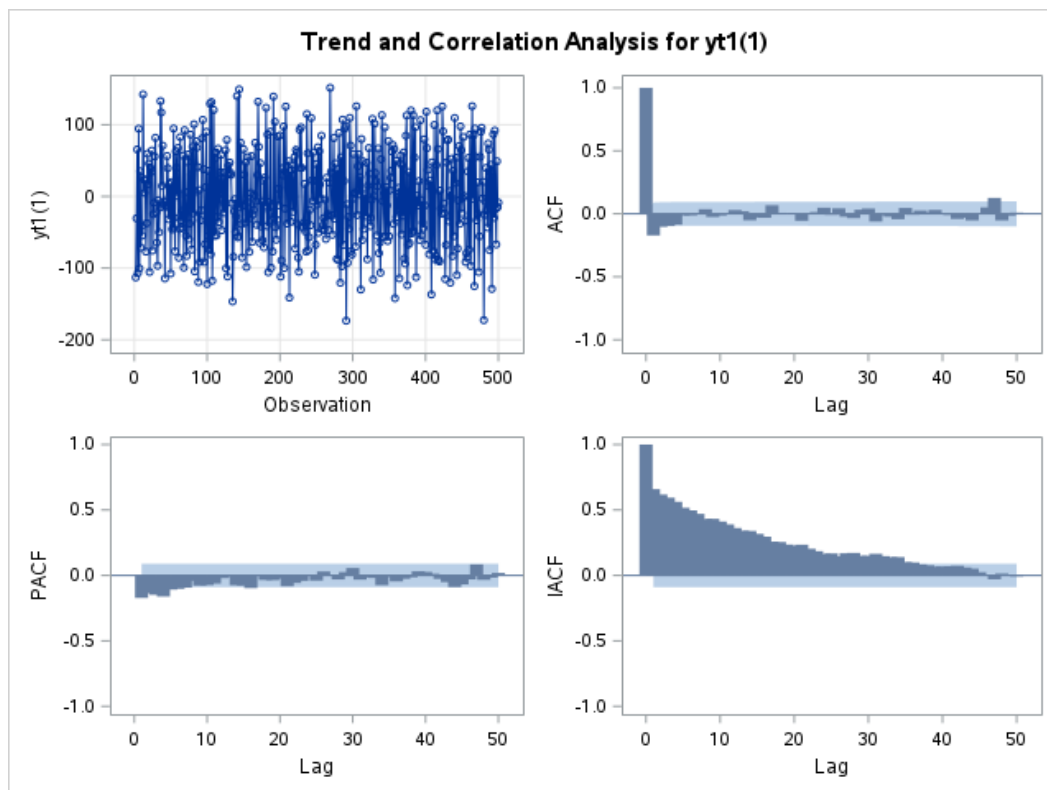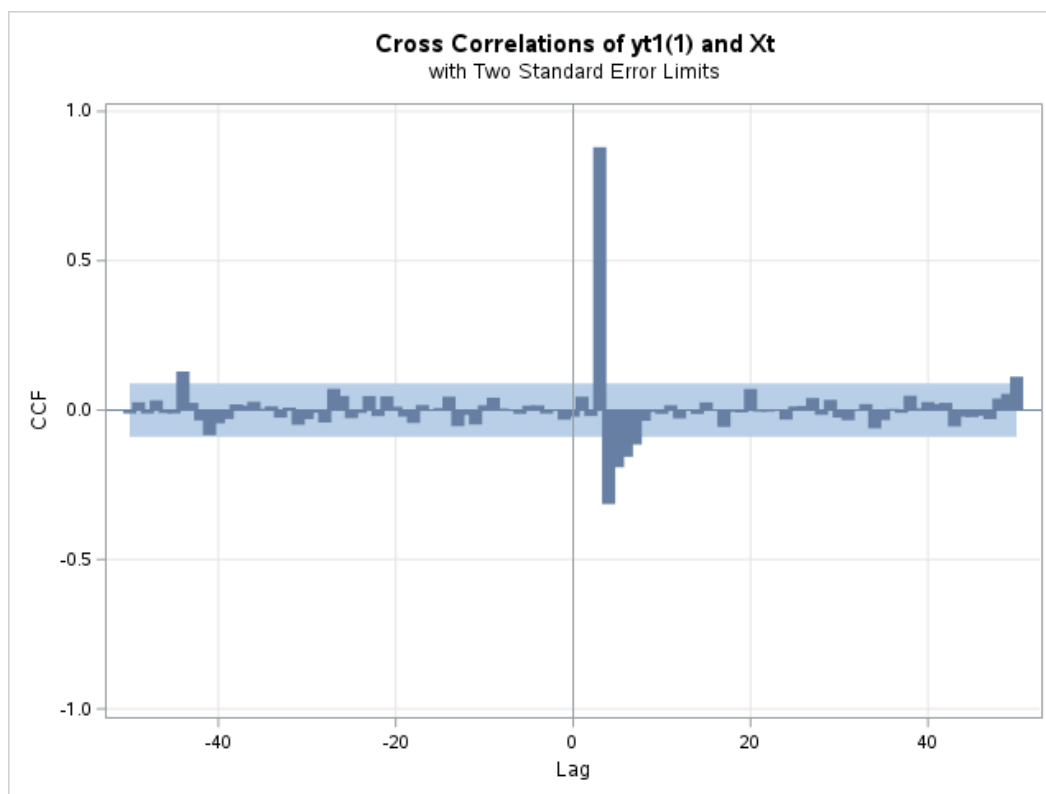
Trend and Correlation Analysis for yt1(1)

Cross Correlations of yt1(1) and Xt
with Two Standard Error Limits

Maximum Likelihood Estimation							
Parameter	Estimate	Standard Error	t Value	Approx Pr > |t|	Lag	Variable	Shift
NUM1	-0.02947	0.02006	-1.47	0.1419	0	Xt	0
NUM1,1	-0.0000631	0.02008	-0.00	0.9975	1	Xt	0
NUM1,2	-0.01302	0.02017	-0.65	0.5186	2	Xt	0
NUM1,3	-2.01952	0.02018	-100.07	<.0001	3	Xt	0
NUM1,4	0.68705	0.02008	34.22	<.0001	4	Xt	0
NUM1,5	0.52862	0.02008	26.33	<.0001	5	Xt	0
NUM1,6	0.31026	0.02006	15.47	<.0001	6	Xt	0
NUM1,7	0.19806	0.02005	9.88	<.0001	7	Xt	0
NUM1,8	0.11207	0.01998	5.61	<.0001	8	Xt	0
NUM1,9	0.05758	0.01997	2.88	0.0039	9	Xt	0
NUM1,10	0.07217	0.01997	3.61	0.0003	10	Xt	0
NUM1,11	-0.01339	0.02002	-0.67	0.5038	11	Xt	0
NUM1,12	0.01713	0.02010	0.85	0.3940	12	Xt	0
NUM1,13	0.02933	0.02011	1.46	0.1448	13	Xt	0
NUM1,14	0.01388	0.01997	0.70	0.4869	14	Xt	0
NUM1,15	-0.0097466	0.01995	-0.49	0.6251	15	Xt	0

h=15

Variance Estimate	178.5247
Std Error Estimate	13.36131
AIC	3906.693
SBC	3973.639
Number of Residuals	485

Correlations of Parameter Estimates															
Variable Parameter	Xt NUM1	Xt NUM1,1	Xt NUM1,2	Xt NUM1,3	Xt NUM1,4	Xt NUM1,5	Xt NUM1,6	Xt NUM1,7	Xt NUM1,8	Xt NUM1,9	Xt NUM1,10	Xt NUM1,11	Xt NUM1,12	Xt NUM1,13	Xt NUM1,14	Xt NUM1,15
Xt NUM1	1.000	0.058	0.100	0.047	0.033	0.071	0.065	0.091	0.081	0.059	0.090	0.073	0.097	0.061	0.006	0.065

Xt NUM1,1	0.058	1.000	-0.049	-0.095	-0.054	-0.035	-0.076	-0.065	-0.091	-0.087	-0.056	-0.094	-0.067	-0.094	-0.068	-0.009
Xt NUM1,2	0.100	-0.049	1.000	-0.045	-0.091	-0.047	-0.030	-0.063	-0.061	-0.089	-0.080	-0.050	-0.085	-0.057	-0.098	-0.060
Xt NUM1,3	0.047	-0.095	-0.045	1.000	-0.048	-0.093	-0.051	-0.024	-0.069	-0.070	-0.090	-0.083	-0.047	-0.077	-0.068	-0.097
Xt NUM1,4	0.033	-0.054	-0.091	-0.048	1.000	-0.053	-0.100	-0.058	-0.027	-0.073	-0.073	-0.094	-0.082	-0.053	-0.085	-0.074
Xt NUM1,5	0.071	-0.035	-0.047	-0.093	-0.053	1.000	-0.054	-0.099	-0.058	-0.028	-0.073	-0.071	-0.090	-0.082	-0.060	-0.084
Xt NUM1,6	0.065	-0.076	-0.030	-0.051	-0.100	-0.054	1.000	-0.056	-0.100	-0.059	-0.028	-0.071	-0.068	-0.092	-0.089	-0.060
Xt NUM1,7	0.091	-0.065	-0.063	-0.024	-0.058	-0.099	-0.056	1.000	-0.049	-0.099	-0.052	-0.028	-0.061	-0.069	-0.095	-0.092
Xt NUM1,8	0.081	-0.091	-0.061	-0.069	-0.027	-0.058	-0.100	-0.049	1.000	-0.054	-0.102	-0.049	-0.026	-0.056	-0.083	-0.088
Xt NUM1,9	0.059	-0.087	-0.089	-0.070	-0.073	-0.028	-0.059	-0.099	-0.054	1.000	-0.058	-0.098	-0.049	-0.028	-0.066	-0.078
Xt NUM1,10	0.090	-0.056	-0.080	-0.090	-0.073	-0.073	-0.028	-0.052	-0.102	-0.058	1.000	-0.055	-0.093	-0.043	-0.039	-0.060
Xt NUM1,11	0.073	-0.094	-0.050	-0.083	-0.094	-0.071	-0.071	-0.028	-0.049	-0.098	-0.055	1.000	-0.051	-0.096	-0.045	-0.037
Xt NUM1,12	0.097	-0.067	-0.085	-0.047	-0.082	-0.090	-0.068	-0.061	-0.026	-0.049	-0.093	-0.051	1.000	-0.042	-0.102	-0.039
Xt NUM1,13	0.061	-0.094	-0.057	-0.077	-0.053	-0.082	-0.092	-0.069	-0.056	-0.028	-0.043	-0.096	-0.042	1.000	-0.044	-0.107
Xt NUM1,14	0.006	-0.068	-0.098	-0.068	-0.085	-0.060	-0.089	-0.095	-0.083	-0.066	-0.039	-0.045	-0.102	-0.044	1.000	-0.043
Xt NUM1,15	0.065	-0.009	-0.060	-0.097	-0.074	-0.084	-0.060	-0.092	-0.088	-0.078	-0.060	-0.037	-0.039	-0.107	-0.043	1.000

4.15

Autocorrelation Check of Residuals									
To Lag	Chi-Square	DF	Pr > ChiSq	Autocorrelations					
6	113.87	6	<.0001	-0.233	-0.364	0.175	-0.120	0.014	0.030
12	124.39	12	<.0001	-0.029	0.100	-0.049	-0.040	0.052	-0.061
18	126.28	18	<.0001	0.017	0.026	-0.014	-0.017	0.007	0.047
24	130.06	24	<.0001	-0.022	-0.047	0.041	-0.024	0.048	0.013
30	142.89	30	<.0001	-0.095	-0.044	0.089	0.053	-0.051	-0.025
36	149.33	36	<.0001	0.026	-0.028	0.044	-0.018	-0.046	0.081
42	158.24	42	<.0001	-0.040	0.011	0.050	-0.098	0.038	0.039
48	166.12	48	<.0001	-0.025	-0.040	-0.013	0.096	-0.044	-0.033

Residual Correlation Diagnostics for yt1(1)

Residual Normality Diagnostics for yt1(1)
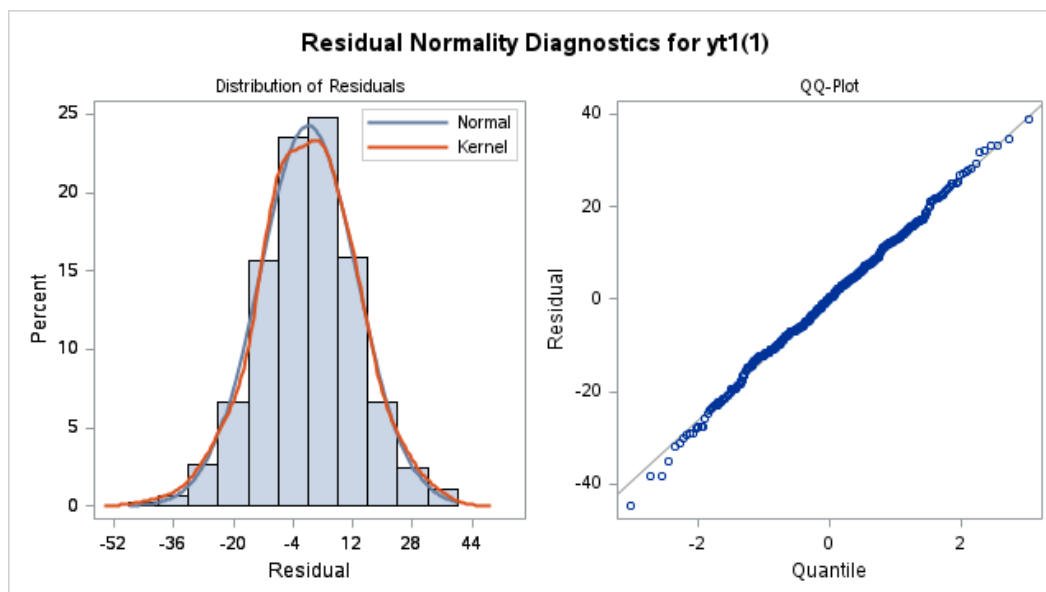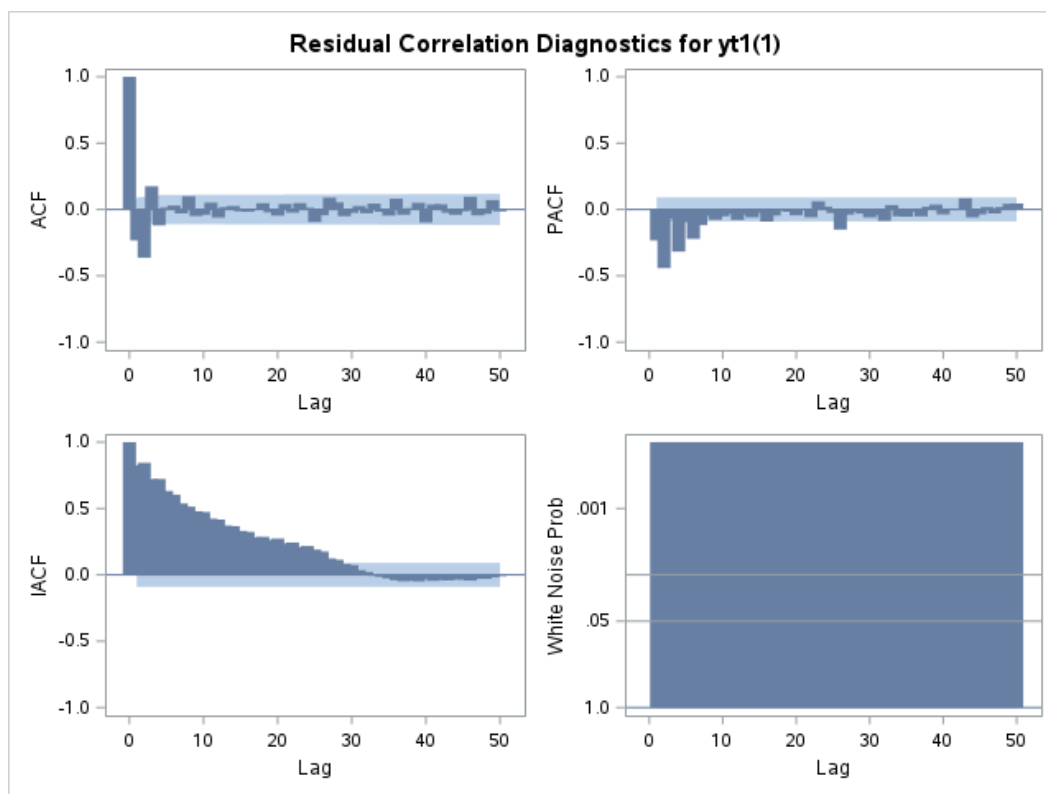
Model for variable yt1	
Period(s) of Differencing	1

No mean term in this model.

Input Number 1	
Input Variable	Xt

$h = 15$ for our model.

| Numerator Factors	
Factor 1:	-0.0295 + 0.00006 B**(1) + 0.01302 B**(2) + 2.01952 B**(3) - 0.68705 B**(4) - 0.52862 B**(5) - 0.31026 B**(6) - 0.19806 B**(7) - 0.11207 B**(8) - 0.05758 B**(9) - 0.07217 B**(10) + 0.01339 B**(11) - 0.01713 B**(12) - 0.02933 B**(13) - 0.01388 B**(14) + 0.00975 B**(15)

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	0.759255
Maximum Absolute Value of Gradient	349733.7
R-Square Change from Last Iteration	0.119559
Objective Function	Log Gaussian Likelihood
Objective Function Value	-2765.62
Marquardt's Lambda Coefficient	0.00001
Numerical Derivative Perturbation Delta	0.001
Iterations	14
Warning Message	Estimates may not have converged.

Maximum Likelihood Estimation							
Parameter	Estimate	Standard Error	t Value	Approx Pr > |t|	Lag	Variable	Shift
MA1,1	-1.00000	0.19751	-5.06	<.0001	1	yt1	0
MA2,1	-0.05996	0.04696	-1.28	0.2017	12	yt1	0
AR1,1	-0.92644	0.03023	-30.65	<.0001	1	yt1	0
NUM1	-0.20373	0.03450	-5.90	<.0001	0	Xt	2
DEN1,1	-0.91217	0.01839	-49.60	<.0001	1	Xt	2

Variance Estimate	4005.861
Std Error Estimate	63.29187
AIC	5541.241
SBC	5562.284
Number of Residuals	497

Correlations of Parameter Estimates					
Variable Parameter	yt1 MA1,1	yt1 MA2,1	yt1 AR1,1	Xt NUM1	Xt DEN1,1
yt1 MA1,1	1.000	-0.016	0.648	-0.084	0.548
yt1 MA2,1	-0.016	1.000	-0.187	0.219	-0.186
yt1 AR1,1	0.648	-0.187	1.000	-0.490	0.670
Xt NUM1	-0.084	0.219	-0.490	1.000	-0.823
Xt DEN1,1	0.548	-0.186	0.670	-0.823	1.000

Autocorrelation Check of Residuals									
To Lag	Chi-Square	DF	Pr > ChiSq	Autocorrelations					
6	7.38	3	0.0607	-0.018	-0.083	-0.053	-0.051	0.030	0.034
12	16.61	9	0.0552	0.050	0.087	0.040	0.051	0.057	0.024
18	29.59	15	0.0135	0.074	0.004	0.017	0.039	0.114	0.071
24	41.33	21	0.0051	0.050	0.057	-0.002	0.052	0.062	0.101
30	55.26	27	0.0011	0.047	0.097	0.029	0.020	0.074	0.089
36	61.90	33	0.0017	-0.010	0.035	0.022	0.015	0.087	0.053
42	72.16	39	0.0010	0.074	0.064	0.076	0.052	0.029	0.002
48	96.47	45	<.0001	0.014	0.001	0.046	0.116	0.169	0.003
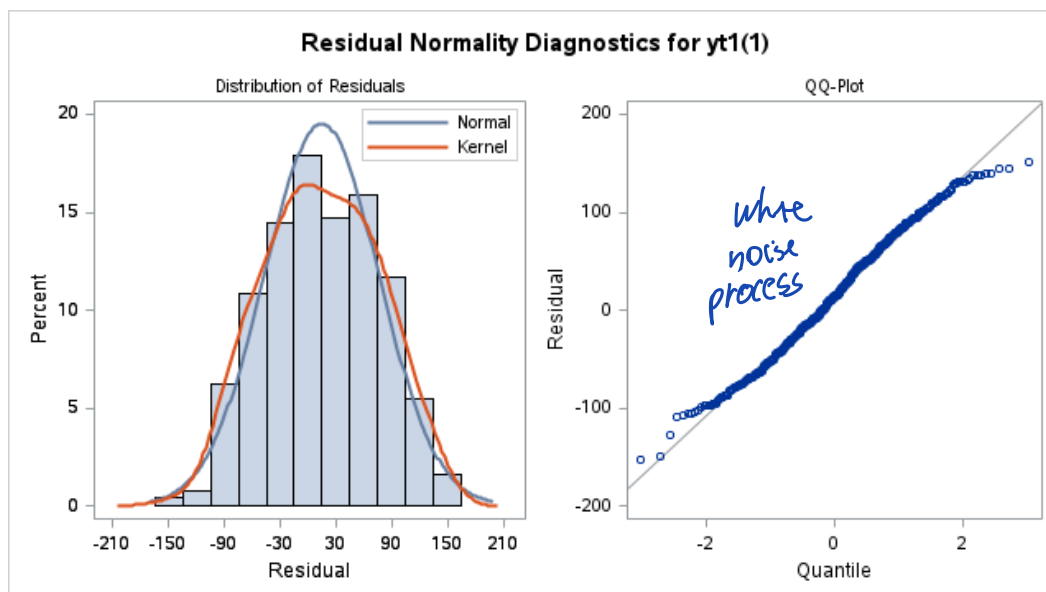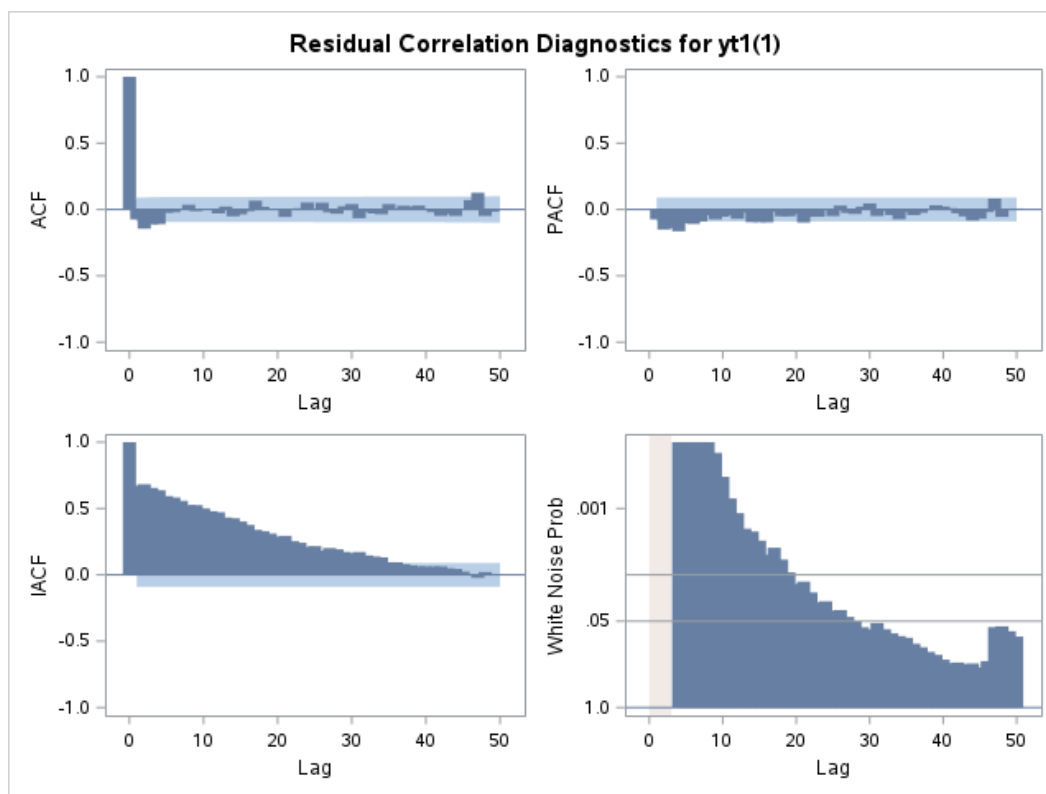
Residual Correlation Diagnostics for yt1(1)

Residual Normality Diagnostics for yt1(1)

Model for variable yt1	
Period(s) of Differencing	1

No mean term in this model.

Autoregressive Factors	
Factor 1:	1 + 0.92644 B**(1)

Moving Average Factors	
Factor 1:	1 + 1 B**(1)
Factor 2:	1 + 0.05996 B**(12)

Input Number 1	
Input Variable	Xt
Shift	2
Overall Regression Factor	-0.20373

Denominator Factors	
Factor 1:	1 + 0.91217 B**(1)

$r = 1$

Forecasts for variable yt1				
Obs	**Forecast**	**Std Error**	**95% Confidence Limits**	
501	819.5646	63.2919	695.5148	943.6144
502	817.1546	92.8587	635.1549	999.1544
503	785.2519	112.5703	564.6182	1005.8856
504	779.9426	131.3238	522.5527	1037.3325
505	767.0517	146.0574	480.7844	1053.3189
506	762.7060	160.8411	447.4632	1077.9488
507	744.3123	173.1734	404.8987	1083.7259
508	739.7950	185.7275	375.7759	1103.8141
509	706.3057	196.5749	321.0260	1091.5854
510	715.4283	207.6547	308.4326	1122.4239
511	685.3277	217.4659	259.1024	1111.5531
512	688.6127	227.4801	242.7600	1134.4655
513	655.8722	237.5807	190.2227	1121.5218
514	658.6413	247.8708	172.8235	1144.4591
515	617.5409	257.2138	113.4112	1121.6707
516	619.1647	266.7090	96.4247	1141.9047
517	581.7322	275.4474	41.8653	1121.5992
518	594.3803	284.3033	37.1560	1151.6046
519	558.3582	292.5439	-15.0174	1131.7337
520	553.9185	300.8720	-35.7798	1143.6167

Forecasts for yt1

when 95% CI looks good

Predicted —— □ 95% Confidence Limits
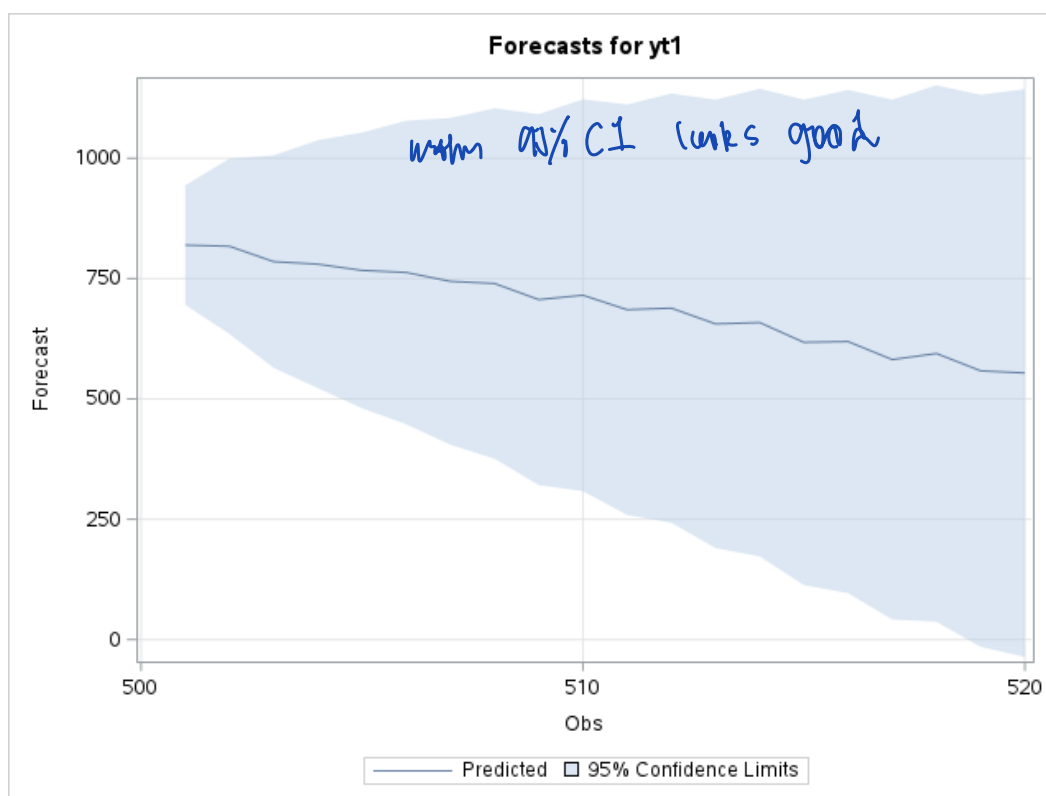
The ARIMA Procedure

Name of Variable = rRDL	
Mean of Working Series	14.61841
Standard Deviation	61.44221
Number of Observations	497

Autocorrelation Check for White Noise									
To Lag	Chi-Square	DF	Pr > ChiSq			Autocorrelations			
6	26.24	6	0.0002	-0.075	-0.144	-0.112	-0.111	-0.025	-0.021
12	27.44	12	0.0067	-0.004	0.036	-0.012	-0.002	0.005	-0.030
18	32.25	18	0.0205	0.021	-0.052	-0.036	-0.013	0.066	0.020
24	35.43	24	0.0623	-0.002	0.006	-0.057	0.000	0.010	0.052

Correlation of rRDL and rX1	
Variance of input =	884.2988
Number of Observations	497

Trend and Correlation Analysis for rRDL

Cross Correlations of rRDL and rX1
with Two Standard Error Limits
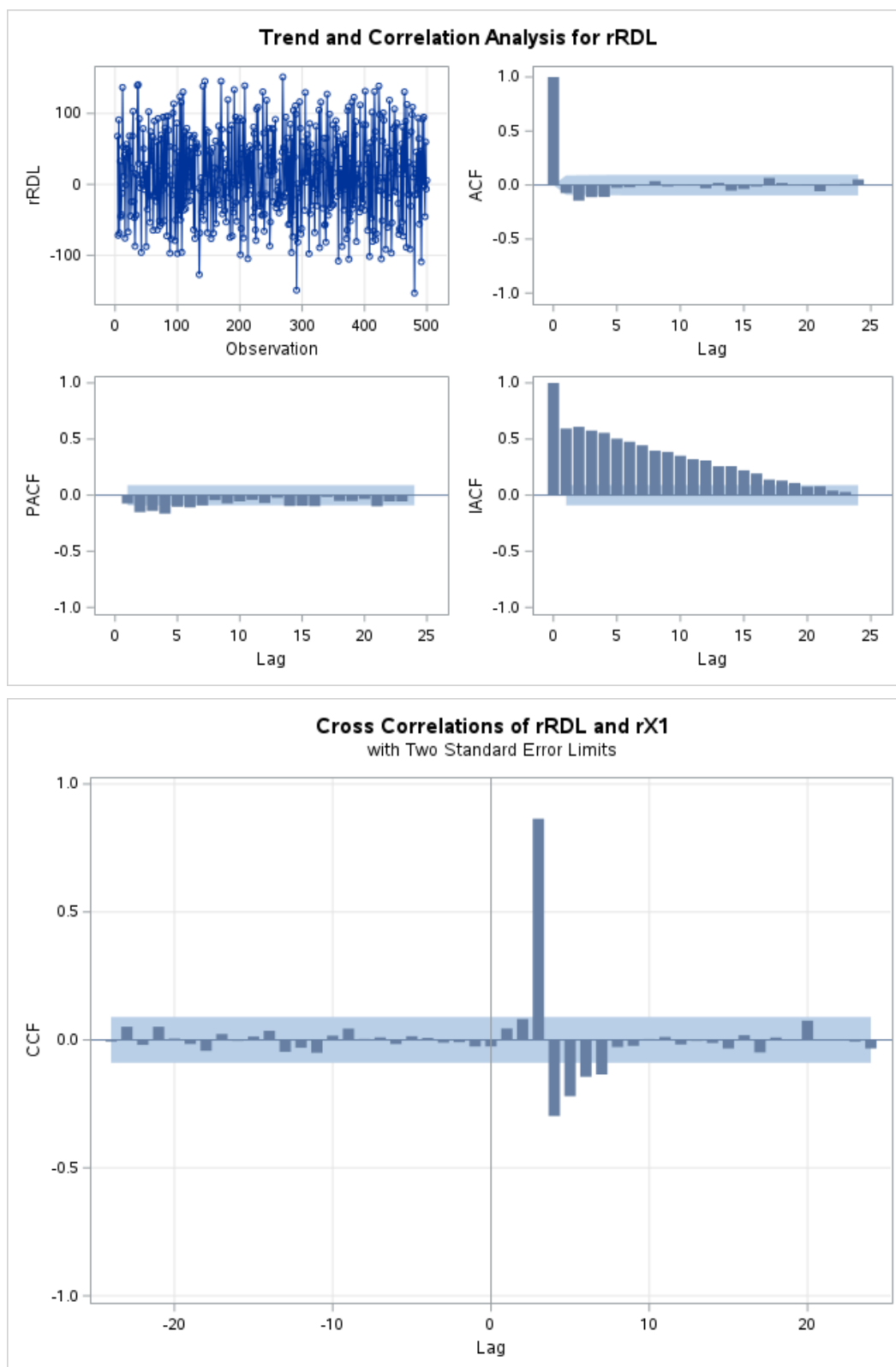
Obs	FRDL	FY	TrueY	id
1	819.565	841.064	748.034	501

2	817.155	848.584	728.146	502
3	785.252	818.394	655.409	503
4	779.943	792.062	704.410	504
5	767.052	806.968	732.196	505
6	762.706	806.706	690.775	506
7	744.312	813.554	632.386	507
8	739.795	805.569	672.313	508
9	706.306	807.012	675.153	509
10	715.428	805.540	752.470	510
11	685.328	808.175	704.628	511
12	688.613	828.029	663.234	512
13	655.872	837.361	641.722	513
14	658.641	846.572	700.193	514
15	617.541	817.423	711.560	515
16	619.165	791.732	830.581	516
17	581.732	807.032	865.761	517
18	594.380	807.013	887.040	518
19	558.358	814.011	750.578	519
20	553.918	806.118	697.892	520

Forecast for last 20 observations