Lab 2 - Forecasting and Decision Support System

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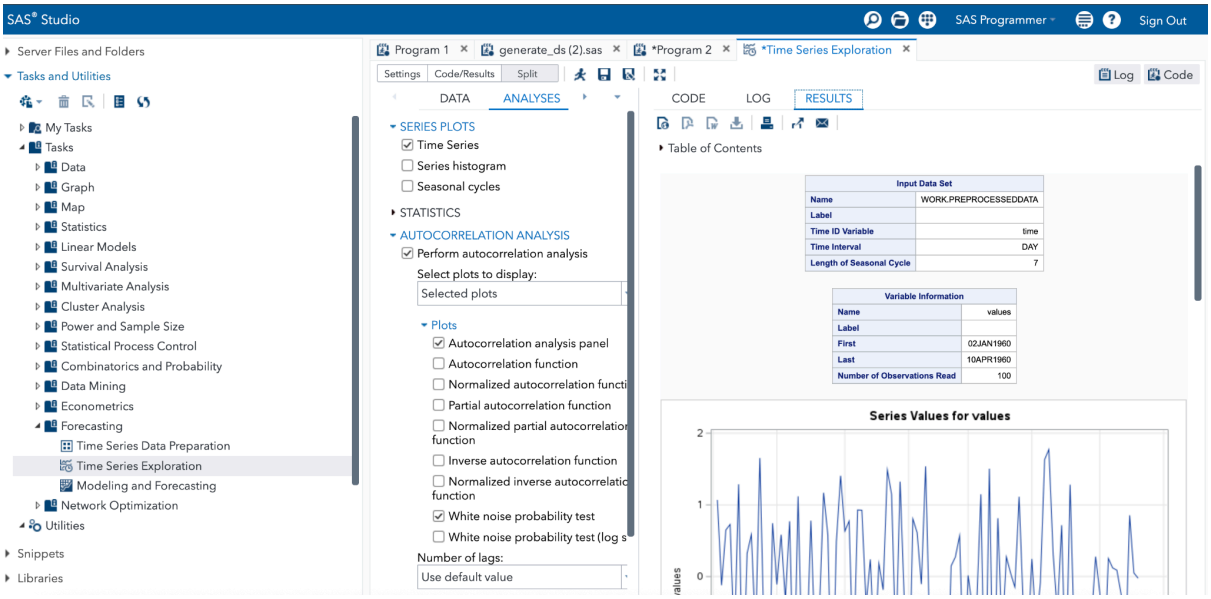
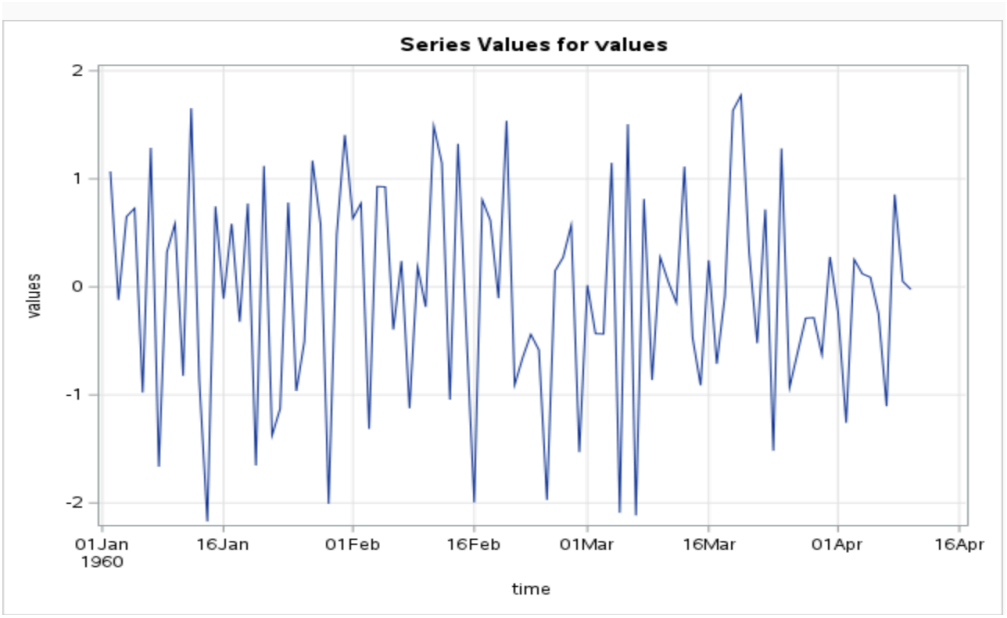
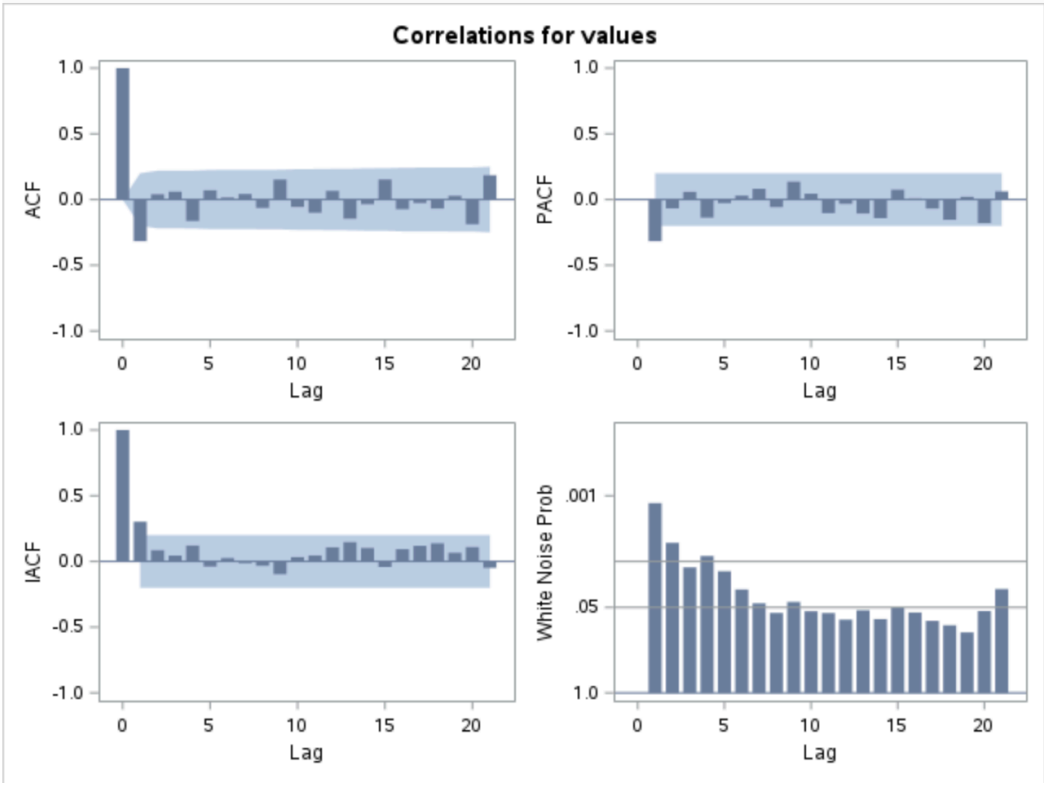
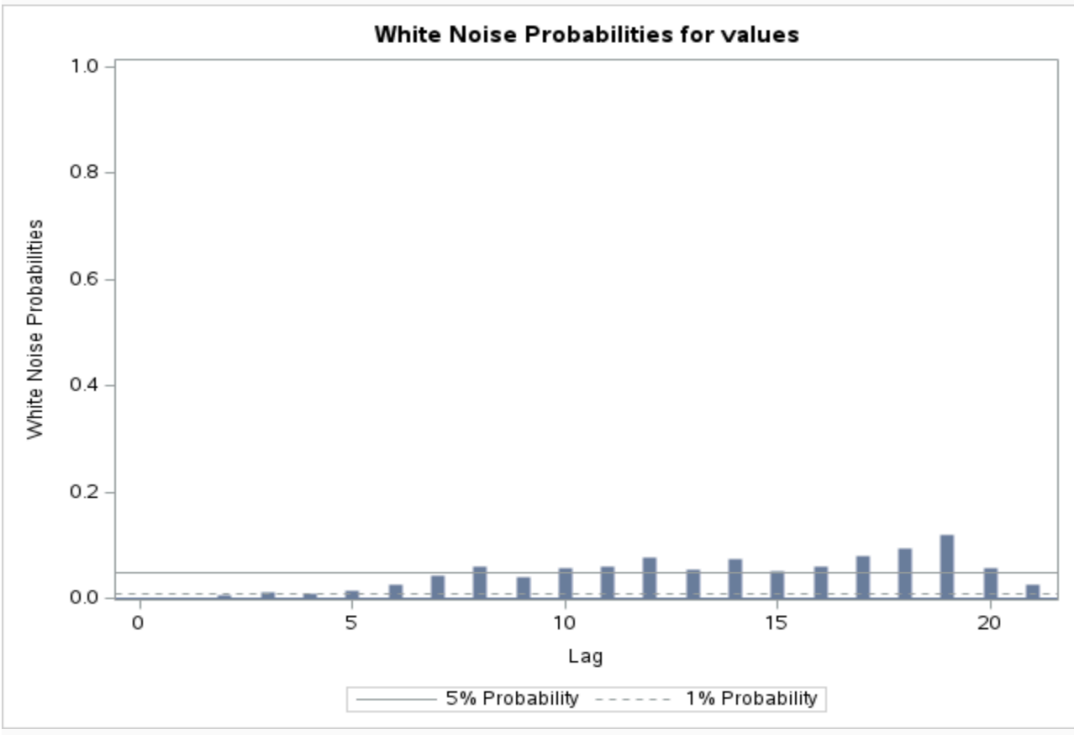
White Noise (The Exercise from Class)






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

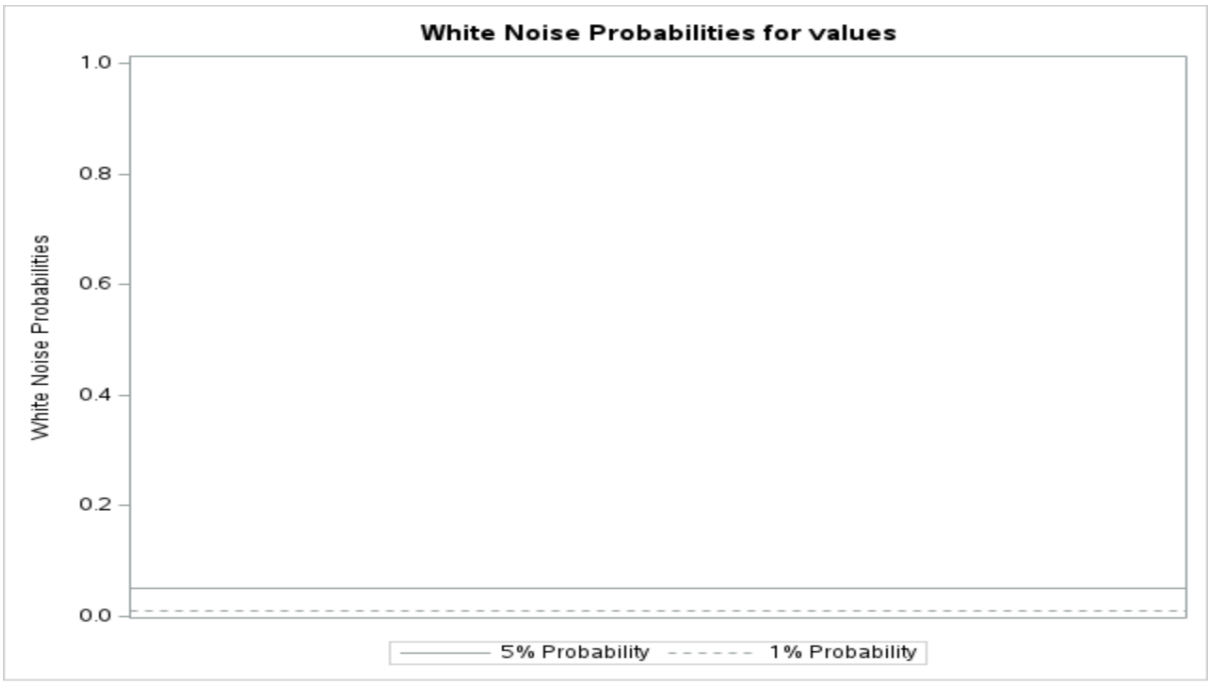

White Noise Probabilities for values
White Noise Probabilities
Lag
1.0
0.8
0.6
0.4
0.2
0.0
0
5
10
15
20
5% Probability
1% Probability

Assignment

1- White Noise Graphs

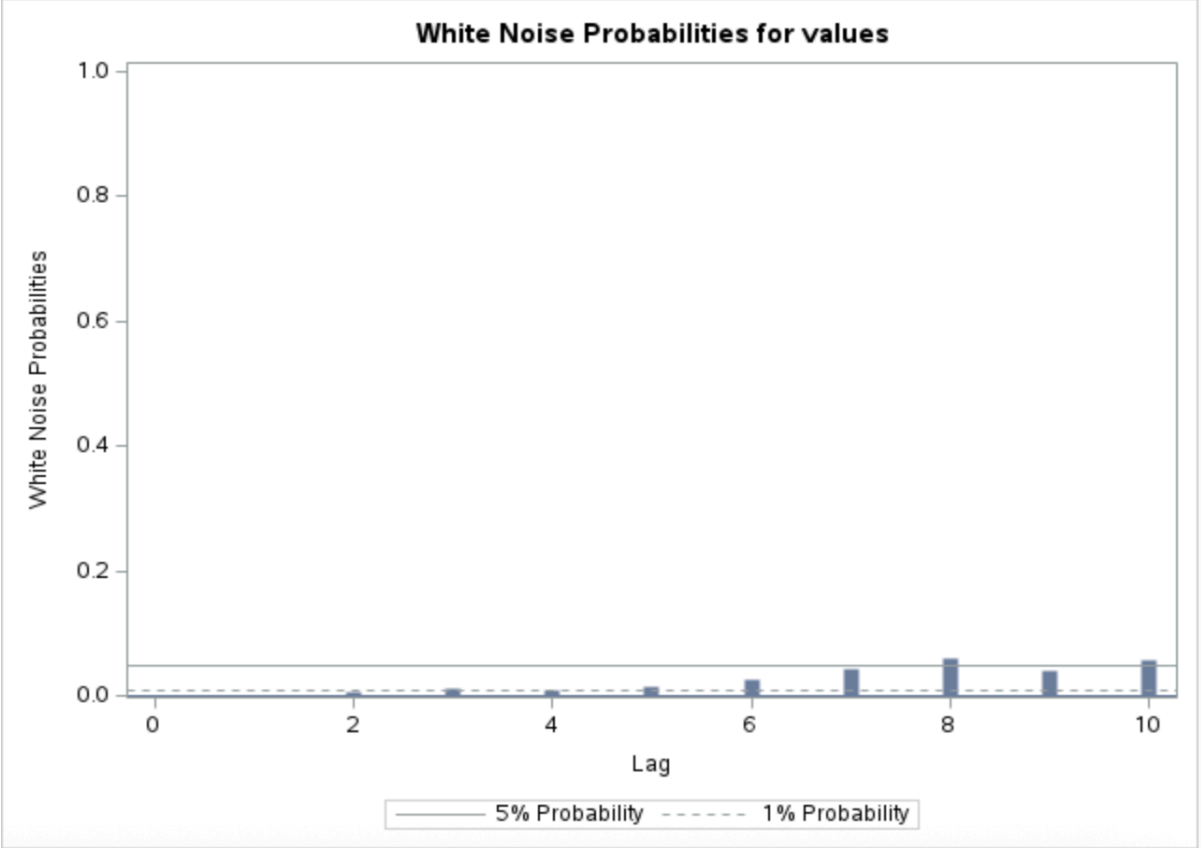
I created and visualized a white noise process made up of 100 random values generated from N(0,1).White noise is a random process with mean zero and constant variance.It shows no pattern or autocorrelation, meaning each value is completely independent.

Plotting Series for N_LAG=0

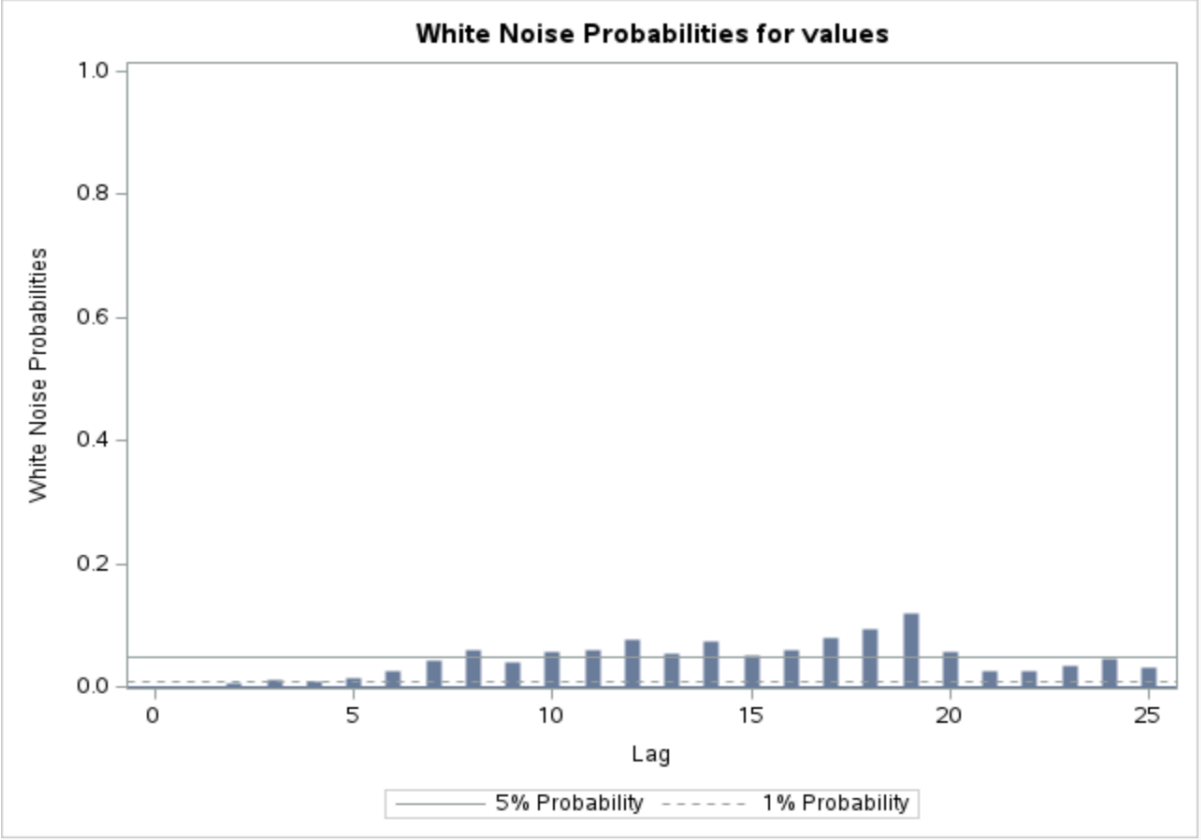


For N_LAG = 0, the autocorrelation was nearly zero, meaning there is almost no probability of finding a pattern within the series itself, each value behaves completely independently.

Plotting Series for N_LAG=10



Plotting Series for N_LAG=25



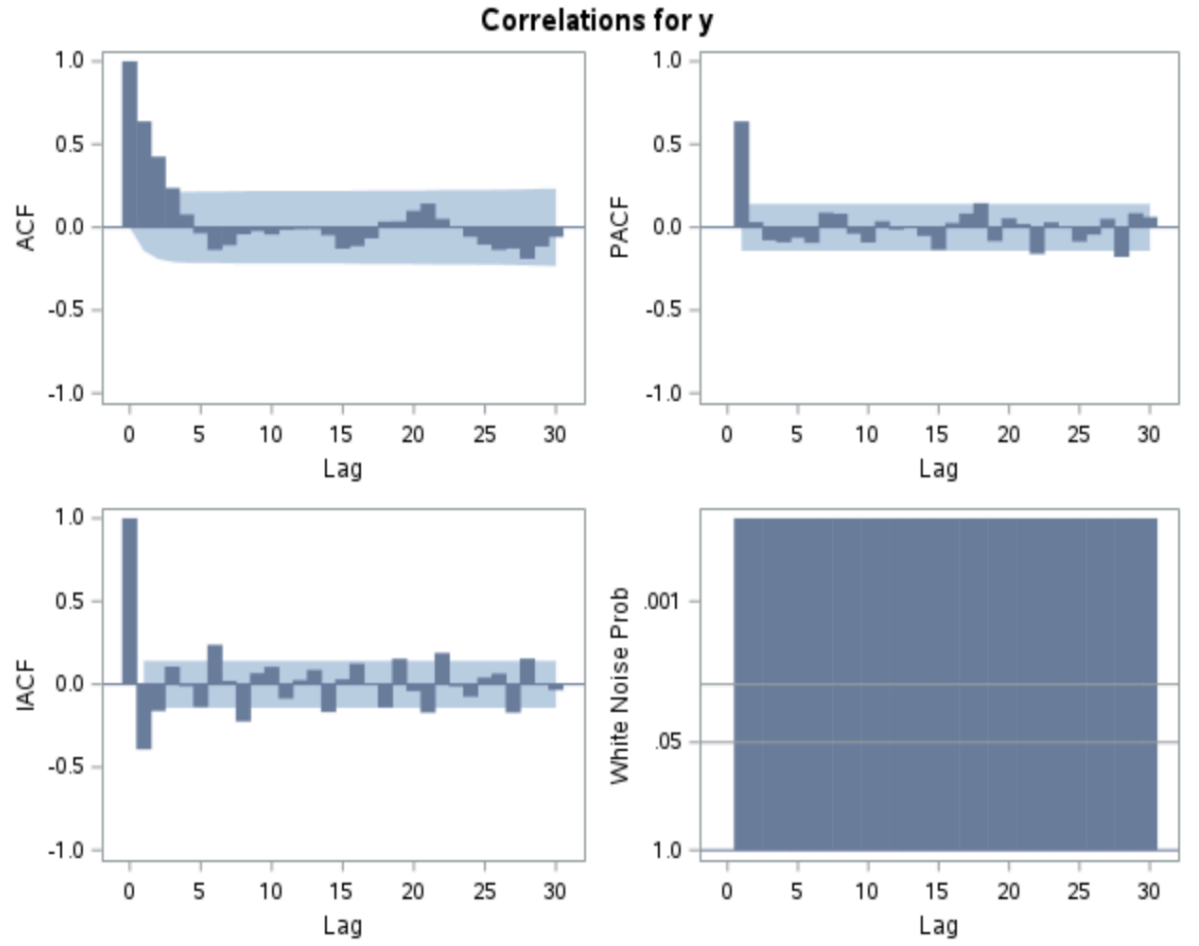
When I increased the lag values to 10 and 25, I observed small random fluctuations in the autocorrelation plot, but these remained within the 95% confidence limits. This indicates that the variations are due to randomness rather than any real correlation. Overall, this shows that my generated data follows the expected behavior of white noise.

2-Moving Average Graphs

2.1. 1st Plot: Correlation Analysis (ACF, PACF, IACF, White Noise Probability)

Steps are followed as lecture.

Plot series and compute ACF.



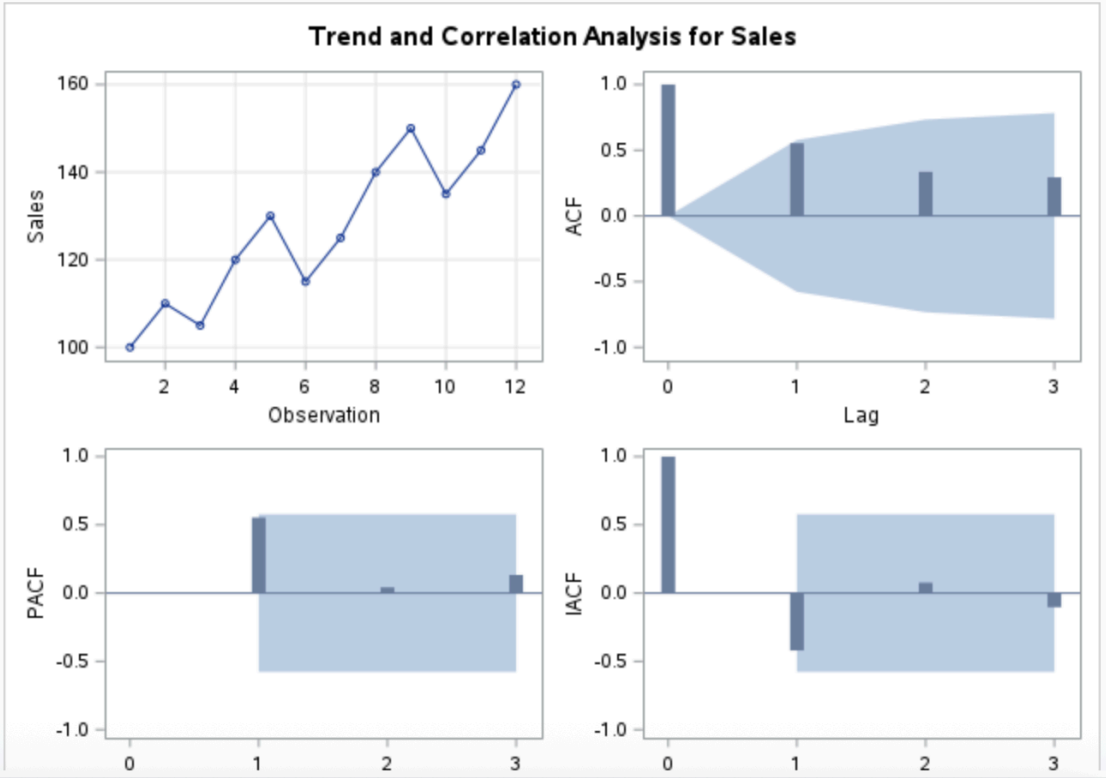
The ACF and PACF plots show no significant correlations after lag 1, confirming that the residuals behave like white noise.
This means the MA(3) model adequately captures the structure of the time series.

2.2. 2nd Plot:Forecast for Sales

After followed steps in class, output is as follows:

Table of Contents

Name of Variable = Sales	
Mean of Working Series	127.9167
Standard Deviation	17.96505
Number of Observations	12



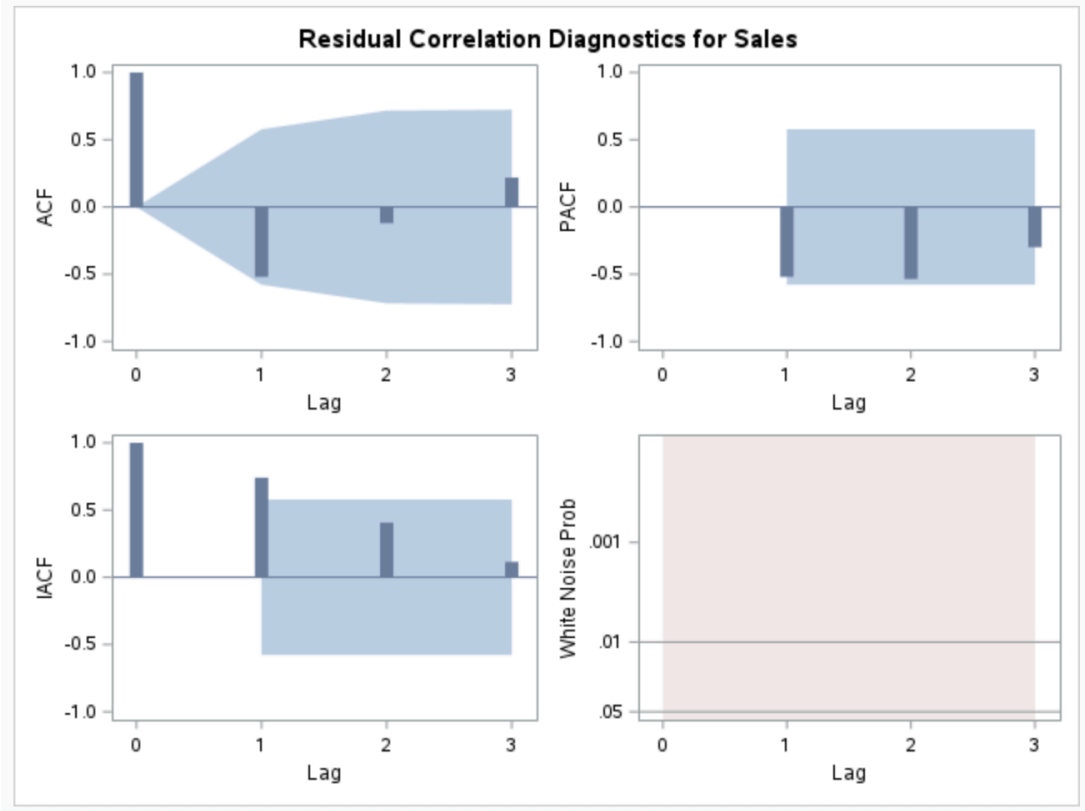
Conditional Least Squares Estimation					
Parameter	Estimate	Standard Error	t Value	Approx Pr > |t|	Lag
MA1,1	-1.47375	0.30077	-4.90	0.0008	1
MA1,2	-1.15657	0.42923	-2.69	0.0246	2
MA1,3	-0.43987	0.30245	-1.45	0.1798	3

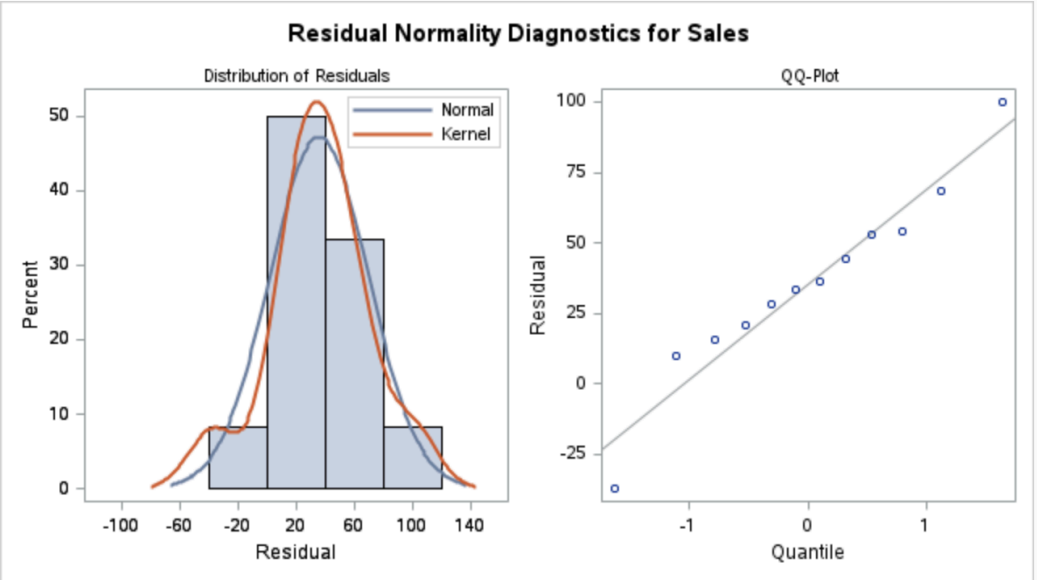
Variance Estimate	3082.212
Std Error Estimate	55.51767
AIC	133.0032
SBC	134.4579
Number of Residuals	12

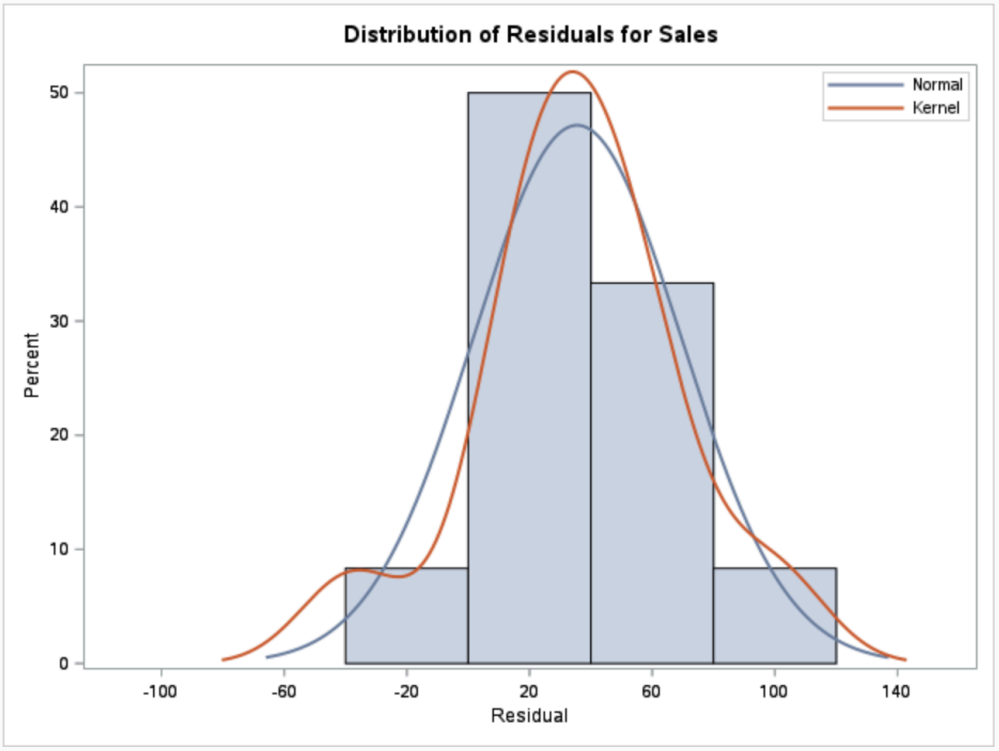
* AIC and SBC do not include log determinant.

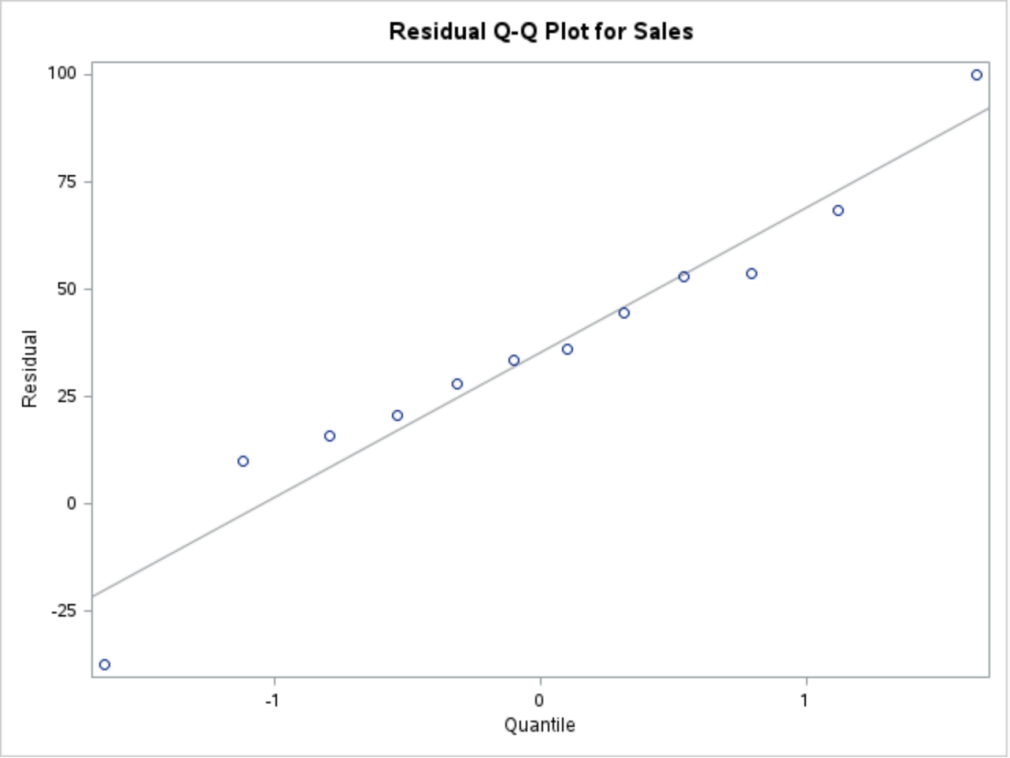
Correlations of Parameter Estimates			
Parameter	MA1,1	MA1,2	MA1,3
MA1,1	1.000	0.841	0.637
MA1,2	0.841	1.000	0.841
MA1,3	0.637	0.841	1.000

Autocorrelation Check of Residuals									
To Lag	Chi-Square	DF	Pr > ChiSq	Autocorrelations					
6	15.28	3	0.0016	0.184	0.391	0.498	0.380	0.165	0.373


Residual Correlation Diagnostics for Sales
ACF
PACF
IACF
White Noise Prob
Lag
1.0
0.5
0.0
-0.5
-1.0
0
1
2
3
.001
.01
.05


Residual Normality Diagnostics for Sales
Distribution of Residuals
Normal
Kernel
Percent
Residual
50
40
30
20
10
0
-100
-60
-20
20
60
100
140
QQ-Plot
Residual
Quantile
100
75
50
25
0
-25
-1
0
1


Distribution of Residuals for Sales
Normal
Kernel
Percent
50
40
30
20
10
0
-100
-60
-20
20
60
100
140
Residual


Residual Q-Q Plot for Sales
Residual
100
75
50
25
0
-25
-1
0
1
Quantile

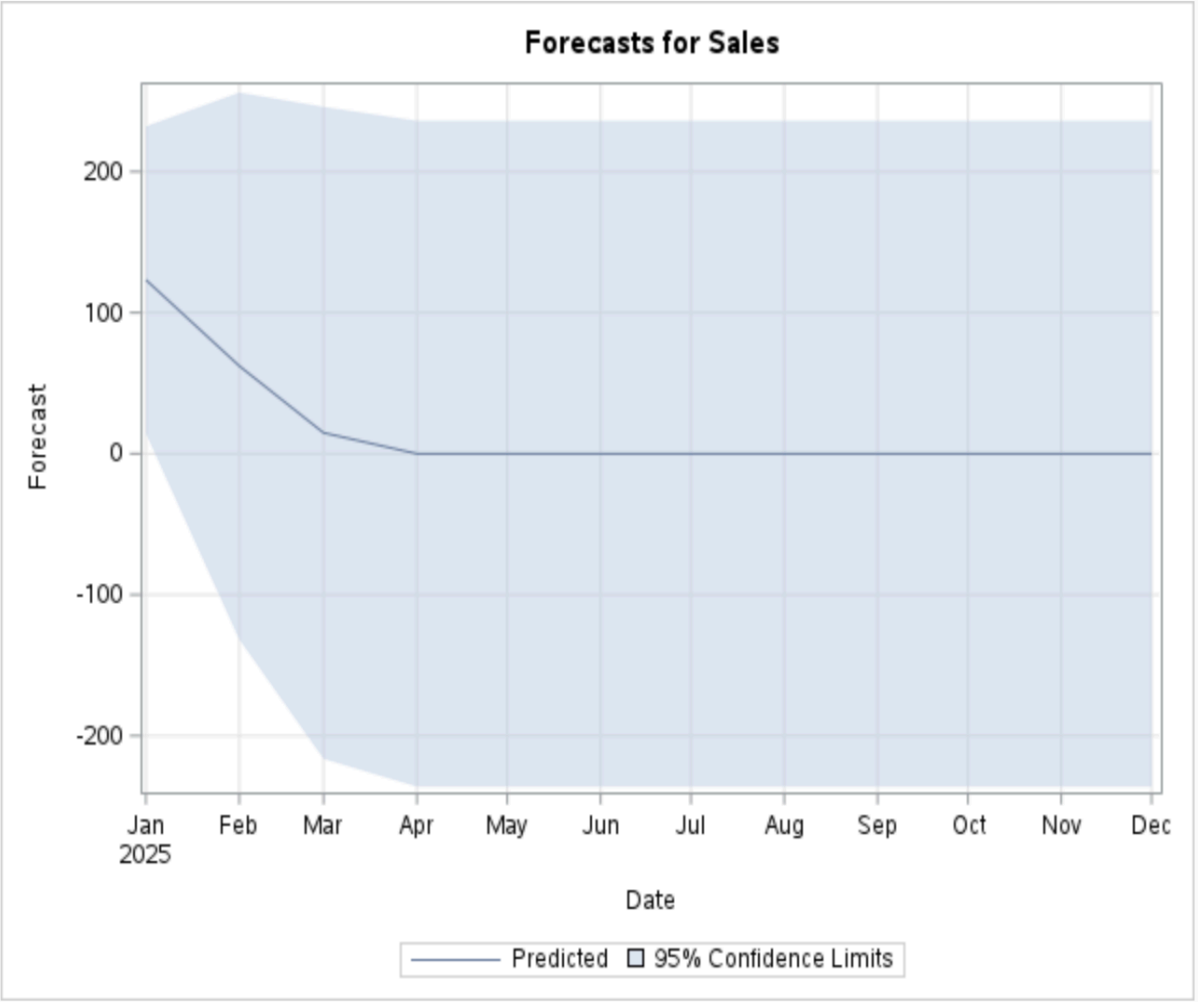
Model for variable Sales

No mean term in this model.

Moving Average Factors	
Factor 1:	1 + 1.47375 B**(1) + 1.15657 B**(2) + 0.43987 B**(3)

Forecasts for variable Sales				
Obs	**Forecast**	**Std Error**	**95% Confidence Limits**	
13	123.2293	55.5177	14.4166	232.0419
14	62.2159	98.8768	-131.5790	256.0108
15	14.7757	117.8962	-216.2966	245.8480
16	0.0000	120.3988	-235.9773	235.9773
17	0.0000	120.3988	-235.9773	235.9773
18	0.0000	120.3988	-235.9773	235.9773
19	0.0000	120.3988	-235.9773	235.9773
20	0.0000	120.3988	-235.9773	235.9773
21	0.0000	120.3988	-235.9773	235.9773
22	0.0000	120.3988	-235.9773	235.9773
23	0.0000	120.3988	-235.9773	235.9773
24	0.0000	120.3988	-235.9773	235.9773

This is the second significant graph.

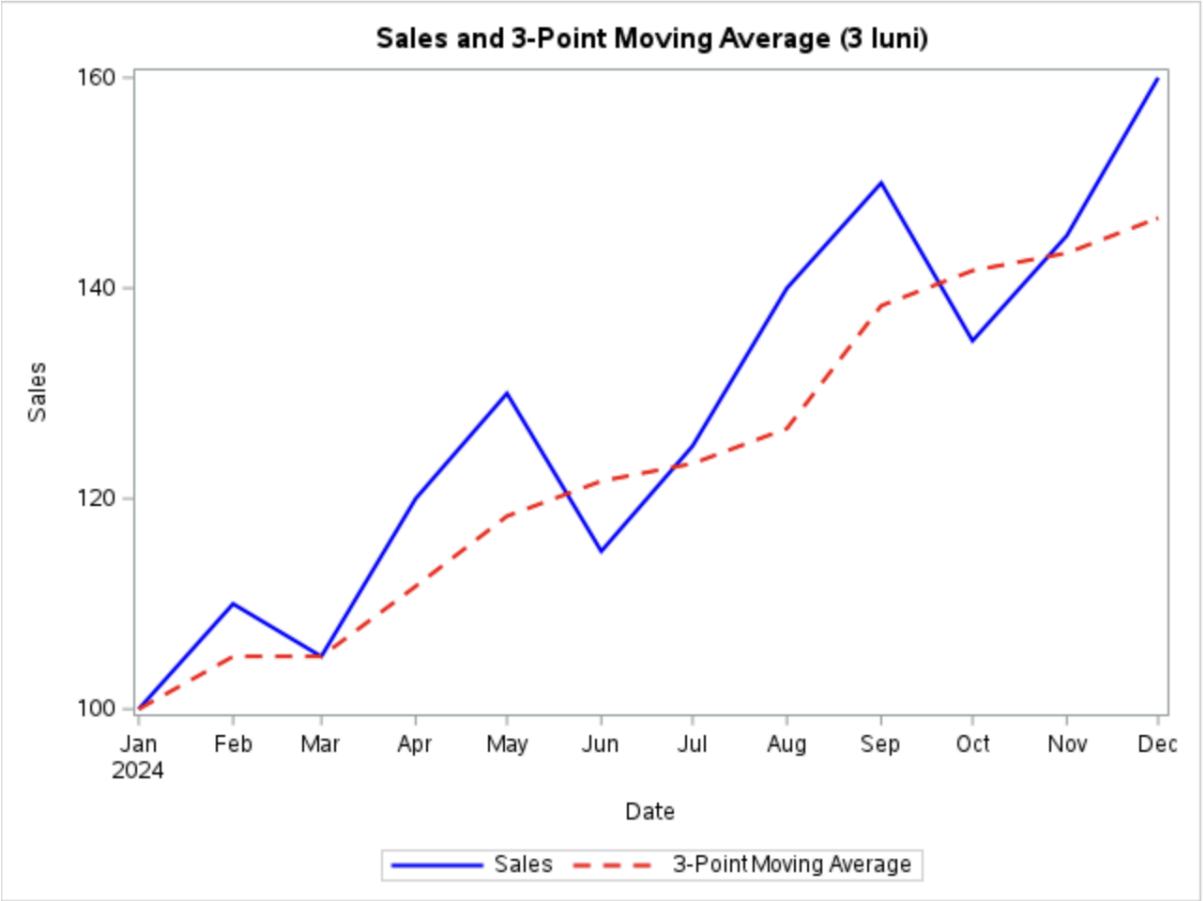


The forecast shows a short decline in predicted sales after March, followed by a stabilization.The wide confidence intervals suggest uncertainty increases over time, which is expected for future predictions.

Outlier Detection Summary	
Maximum number searched	1
Number found	0
Significance used	0.05

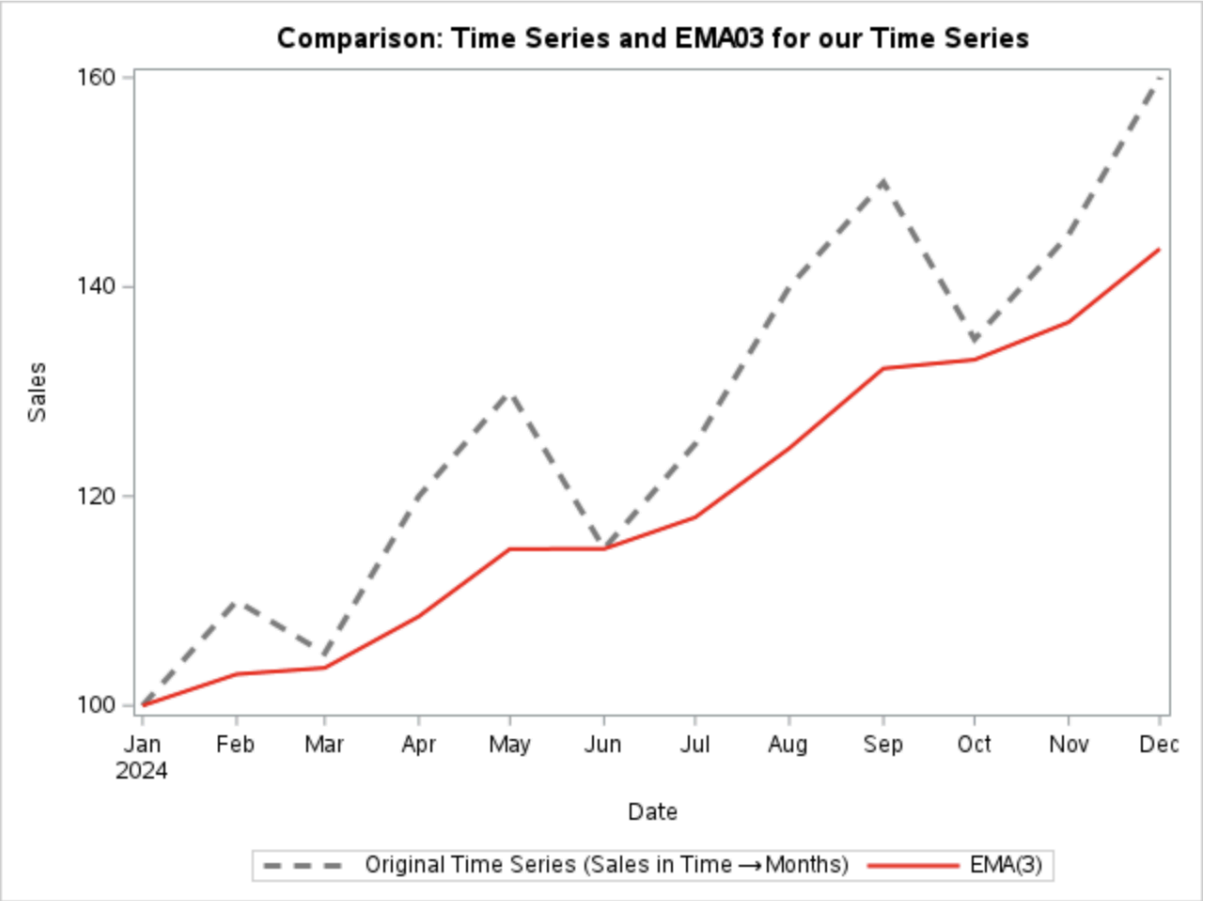
2.3. 3rd Plot: Sales and 3-Point Moving Average

Generated with using the code on slides

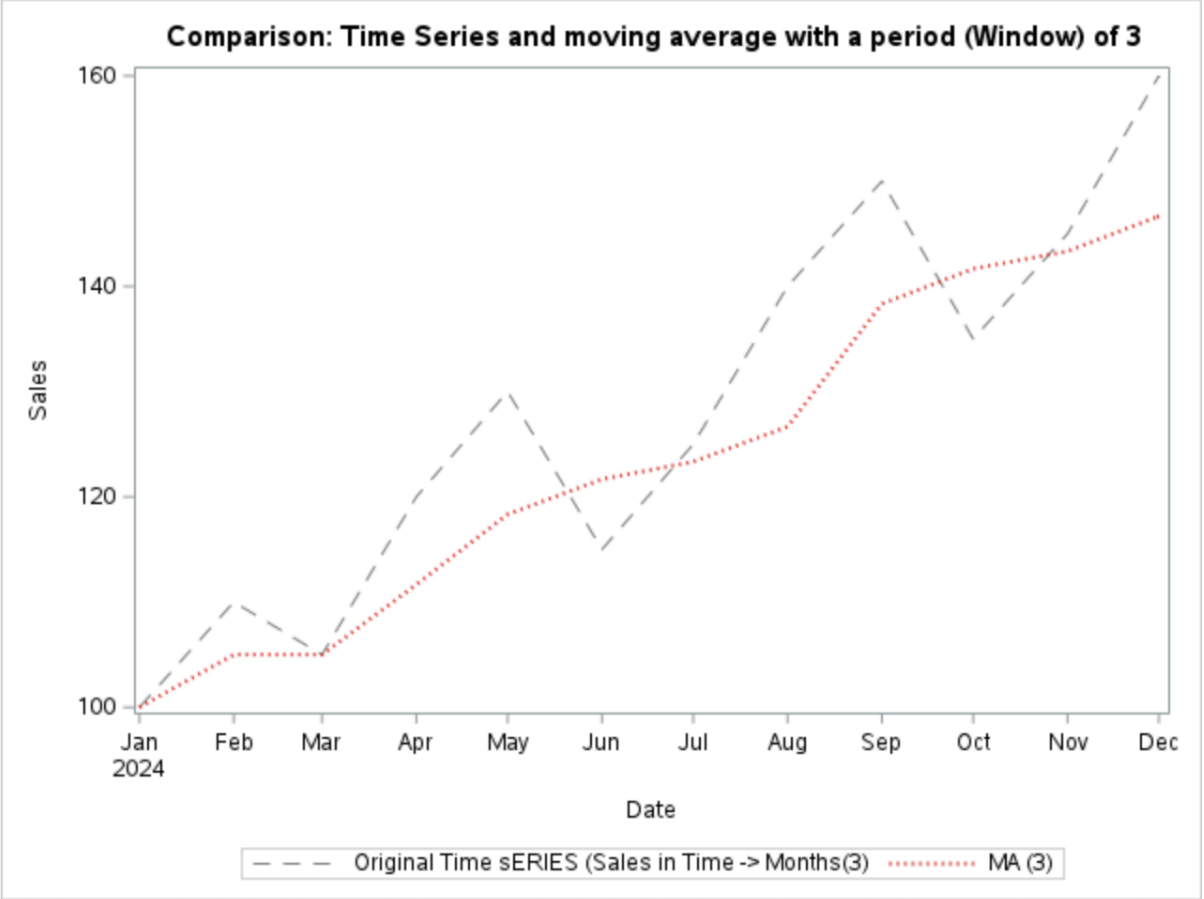


The 3-point moving average smooths out short-term fluctuations and highlights the general upward trend in sales.It clearly shows how the moving average follows the main pattern but eliminates sharp spikes.

3 -Exponential Moving Average Graphs



I noticed that EMA reacts faster to recent changes compared to the simple moving average.



I observed that the 3-point moving average smooths short-term changes and shows the general upward trend.

As a result, EMA follows new trends quicker, while MA is smoother and slower to adjust.