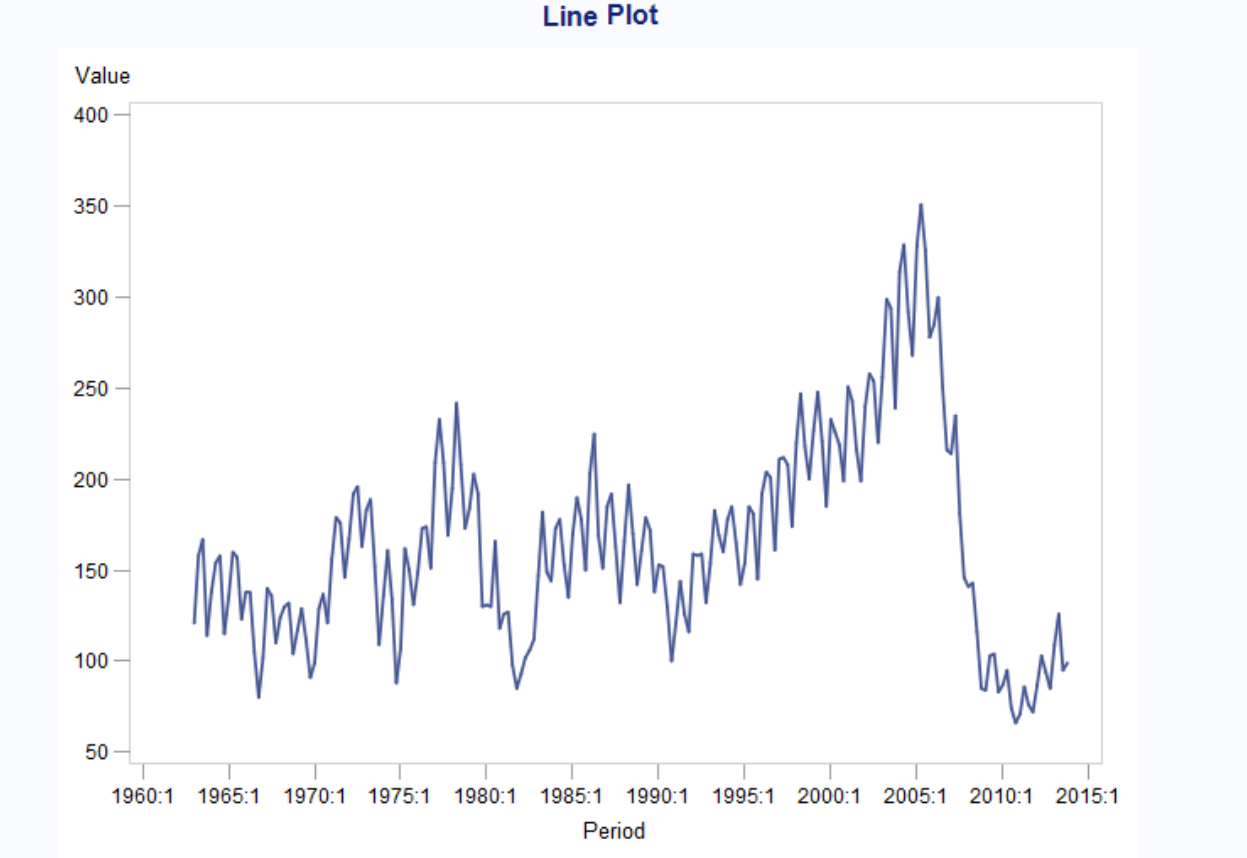
Practice Exercise (0 Points)

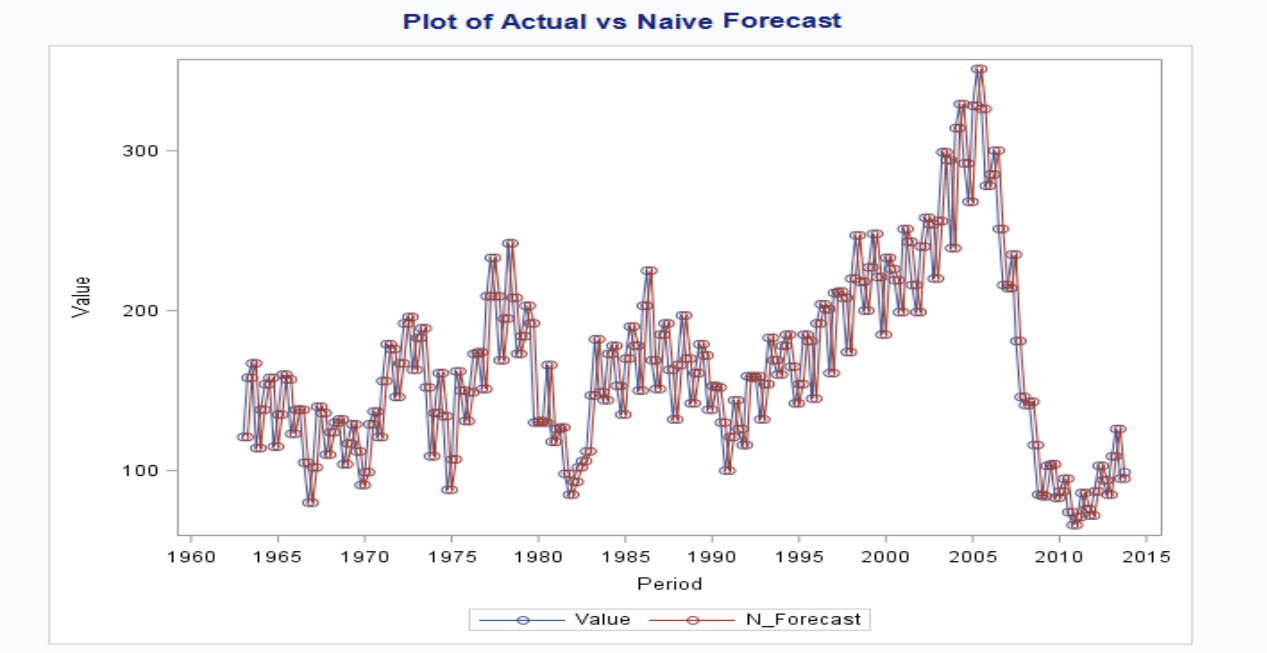
For this assignment, use the data set data set **new_home_sales** available in SAS format. This data set contains two variables: Period (Year and Quarter) and Value (new single family home sales in USA in thousands of units – downloaded from the census.gov site).

1. Plot the data and comment about what do you see in the plot about time series components? Do the data make general sense given what you know about the US Housing market? (**1 point**)



There are a lot of peaks in the data – it likely reflects seasonality. There is an increasing trend in the data after 1990. It also has seasonality and cyclic component. There is an irregular variation in the year 2008 due to the recession. The entire data series seem to have changed post the recession.

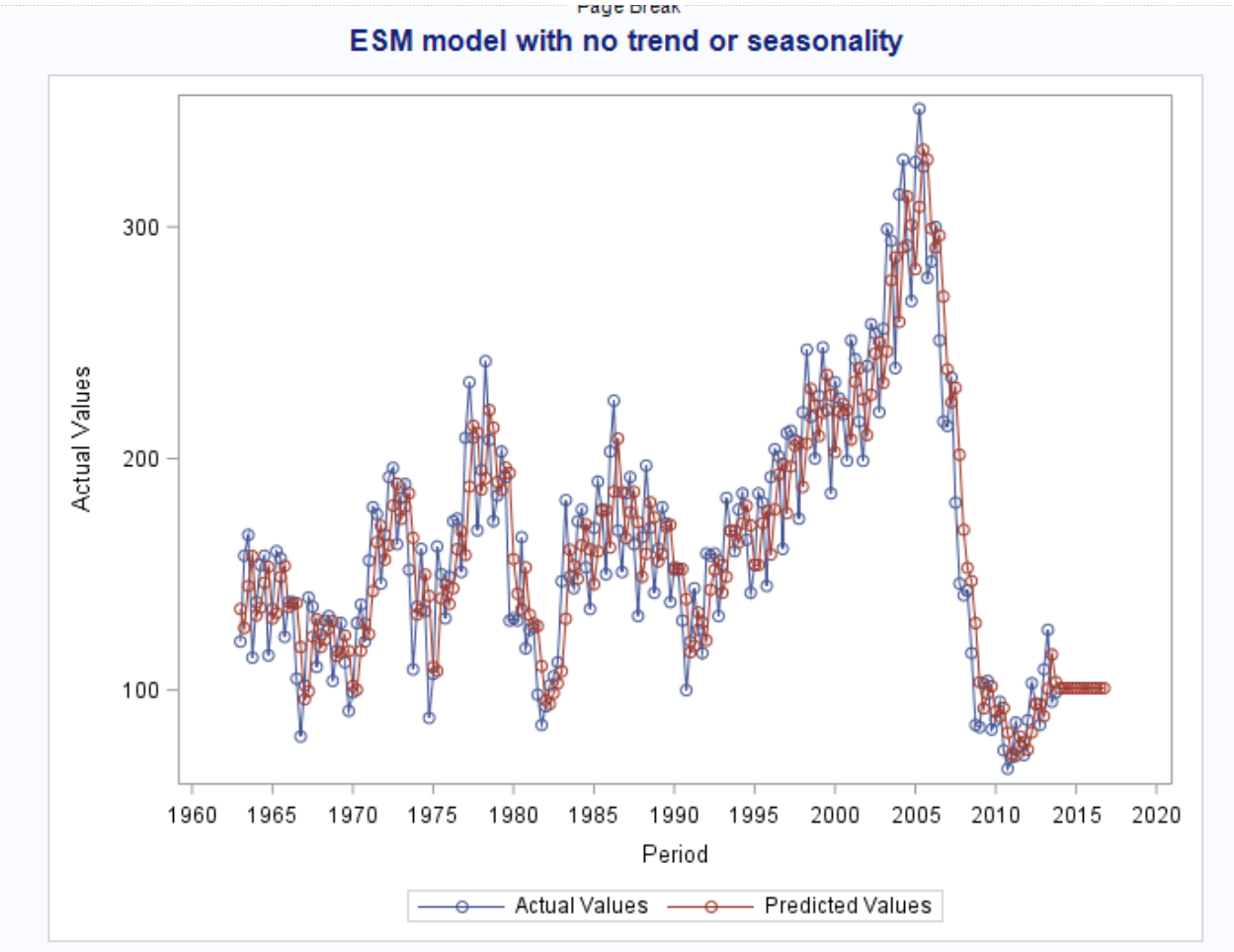
2. Create a Naïve forecast and plot this forecast against the actual values. How does the plot look? Do you think the Naïve forecast is doing a good job? (**1 point**)



There are a lot of peaks in the data and this forecast is only looking at the previous value for forecasting. It is leading to a big difference between the actual and the forecasted value. Hence, it's not doing a good job.

3. Run an ESM model (no trend and seasonality) and plot this forecast against the actual values. How well did this model perform? Are the parameters in the model significant? How does the plot look? Do you think this forecast is doing a better job than the forecasts you have seen so far? Why or why not? (**2 points**)

   P value is less than the significance levels so the leve weight(alpha) is significant. This model performs better than the Naïve forecast. Forecasted value is constant over time and there is no seasonality or trend capture so this model is also not doing a great job.



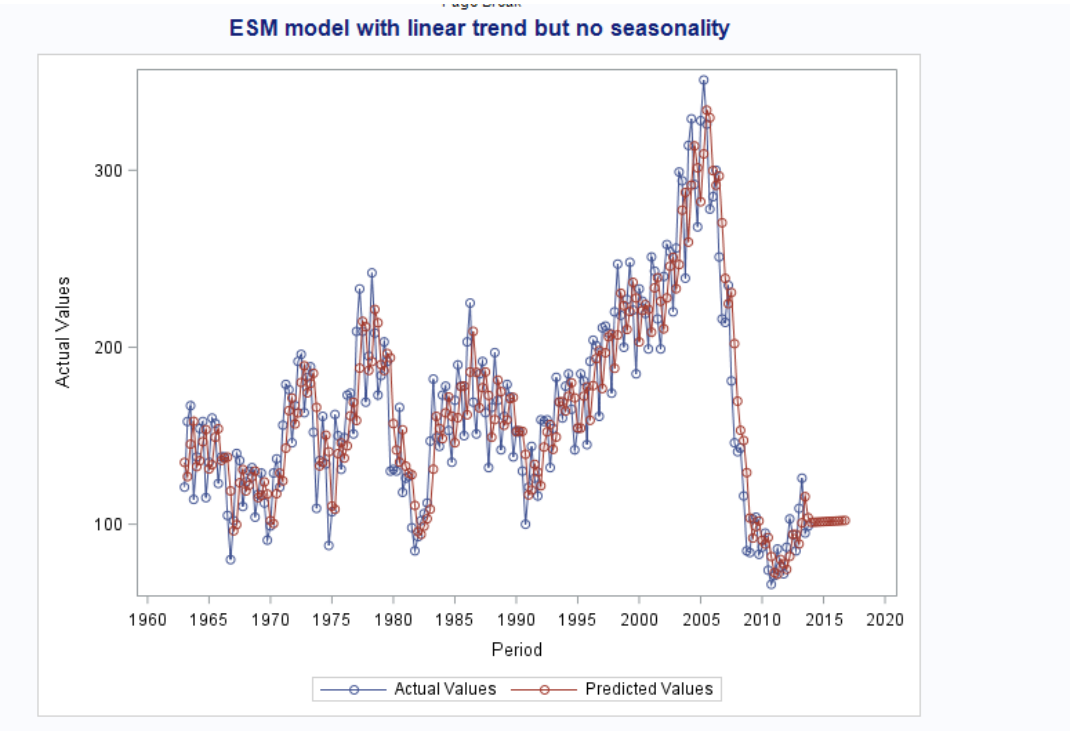
Statistics of Fit for Variable Value	
Root Mean Square Error	26.4085
Mean Absolute Percent Error	14.0380
R-Square	0.7837
Adjusted R-Square	0.7837
Akaike Information Criterion	1337.6642

Simple Exponential Smoothing Parameter Estimates

Parameter	Estimate	Standard Error	t Value	Approx Pr > |t|
Level Weight	0.58251	0.04500	12.94	<.0001

4. Run an ESM model (linear (Holt) trend and no seasonality) and plot this forecast against the actual values. How well did this model perform compared to the models built in earlier steps? Are the parameters in the model significant? How does the plot look? Do you think this forecast is doing a better job than the forecasts you have seen so far? Why or why not? **(2 points)**

   Fit statistics are similar to the previous model. Level weight is significant but the trend weight is not significant. There is a trend in the forecasted value and it increases over time. Seasonality is not captured so this model is also not doing a great job.

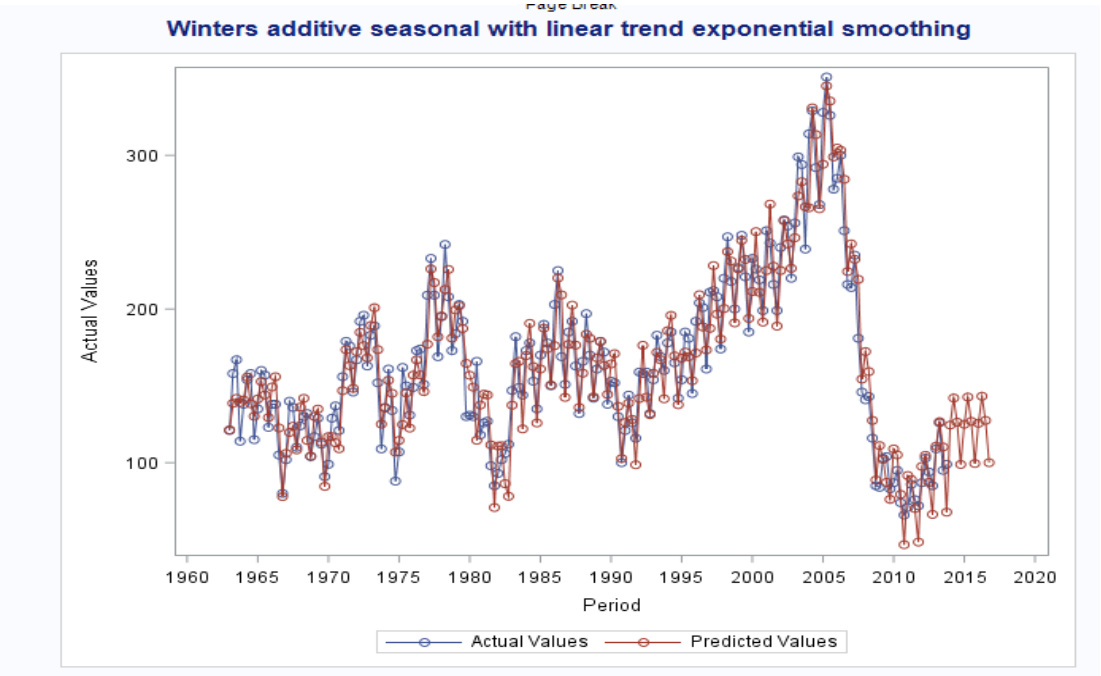


Statistics of Fit for Variable Value	
Root Mean Square Error	26.42
Mean Absolute Percent Error	14.05
R-Square	0.7834
Adjusted R-Square	0.7823
Akaike Information Criterion	1339.91

Linear Exponential Smoothing Parameter Estimates				
Parameter	Estimate	Standard Error	t Value	Approx Pr > |t|
Level Weight	0.58329	0.04543	12.84	<.0001
Trend Weight	0.0010000	0.01251	0.08	0.9364

5. Run an ESM model (linear (Holt) trend and additive seasonality) and plot this forecast against the actual values. How well did this model perform compared to the models built in earlier steps? Are the parameters in the model significant? How does the plot look? Do you think this forecast is doing a better job than the forecasts you have seen so far? Why or why not? **(2 points)**

   R Square, Adj R Square went up. MAPE, RMSE and AIC values are lower than the previous models. Based on the fit stats, we can say that this performed the best so far. Level parameter is significant but the trend and seasonality weight is not significant. Forecasted values have seasonality and trend so it can be concluded that this model performs best so far.

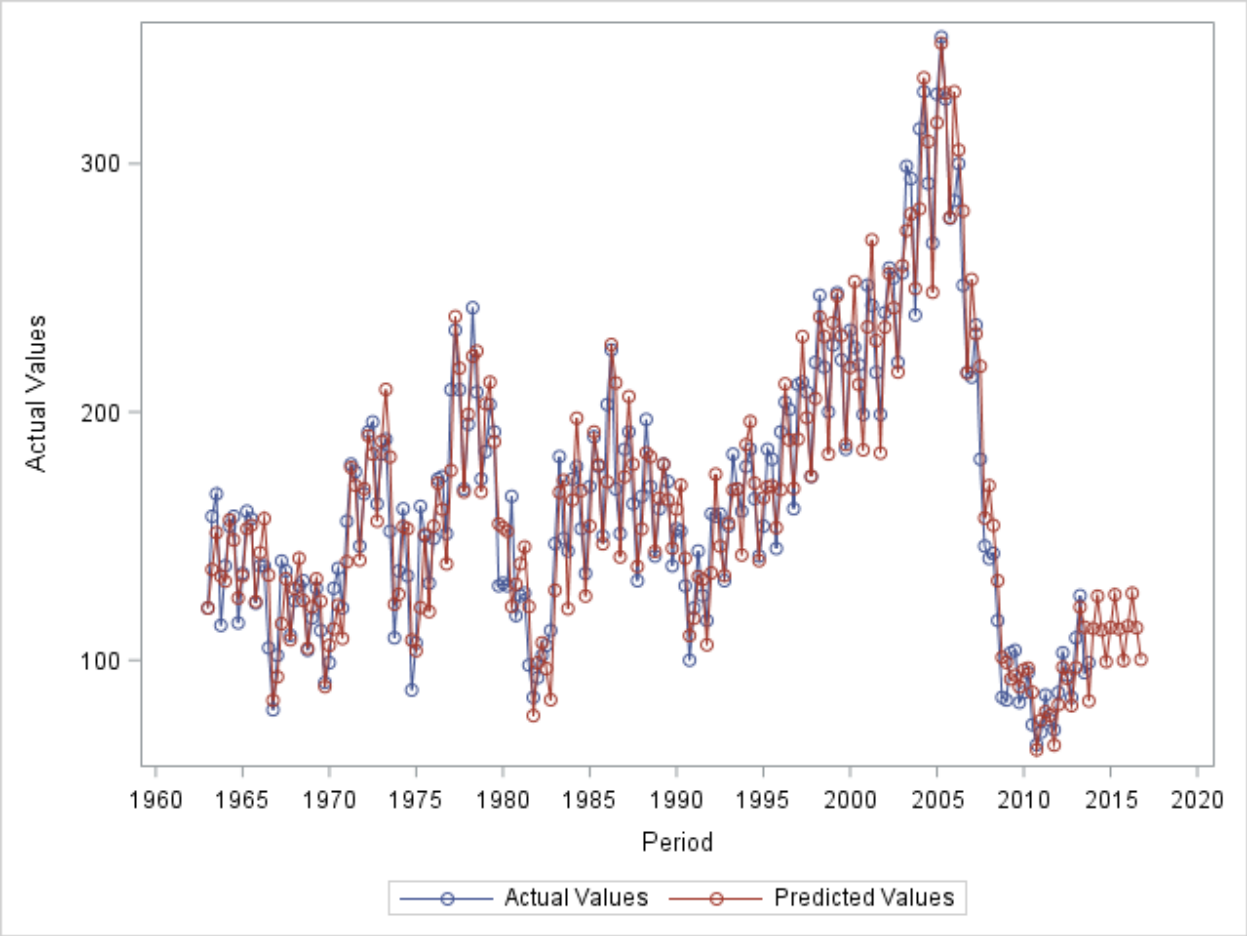


Statistics of Fit for Variable Value	
Root Mean Square Error	15.8462
Mean Absolute Percent Error	8.51
R-Square	0.9221
Adjusted R-Square	0.9213
Akaike Information Criterion	1133

Winters Method (Additive) Parameter Estimates				
Parameter	Estimate	Standard Error	t Value	Approx Pr > |t|
Level Weight	0.97880	0.05093	19.22	<.0001
Trend Weight	0.0010000	0.01457	0.07	0.9453
Seasonal Weight	0.0010000	0.43960	0.00	0.9982

6. Run an ESM model (linear (Holt) trend and multiplicative seasonality) and plot this forecast against the actual values. How well did this model perform compared to the models built in earlier steps? Are the parameters in the model significant? How does the plot look? Do you think this forecast is doing a better job than the forecasts you have seen so far? Why or why not? (**2 points**)

   R Square, Adj R Square went up. MAPE, RMSE and AIC values are lower than the previous models. Based on the fit stats, we can say that this performed the best so far. Level parameter is significant but the trend and seasonality weight are not significant. Forecasted values have seasonality and trend so it can be concluded that this model performs the best so far.



Winters Method (Multiplicative) Parameter Estimates				
Parameter	Estimate	Standard Error	t Value	Approx Pr > |t|
Level Weight	0.94566	0.04886	19.36	<.0001
Trend Weight	0.0010000	0.01314	0.08	0.9394
Seasonal Weight	0.99900	0.91529	1.09	0.2764

Statistics of Fit for Variable Value	
Root Mean Square Error	14.88
Mean Absolute Percent Error	7.58
R-Square	0.9313
Adjusted R-Square	0.9306
Akaike Information Criterion	1107