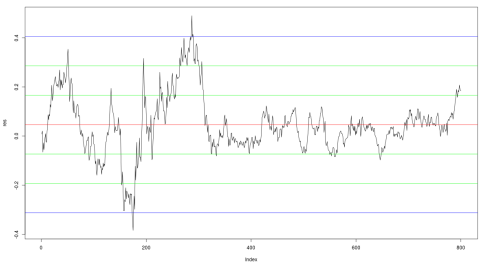
Review Test Submission: MBC638 Quiz #13 - Time series (due Sunday, Dec. 9, 11:59pm)

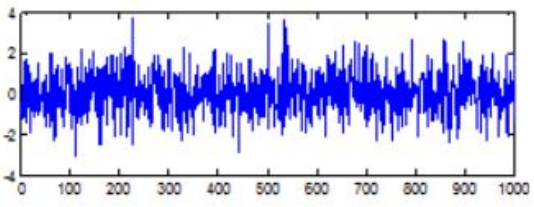
User	David Forteguerre
Course	MBC.638.M001.FALL18.Data Anls & Decisn Making
Test	MBC638 Quiz #13 - Time series (due Sunday, Dec. 9, 11:59pm)
Started	12/9/18 10:37 PM
Submitted	12/9/18 11:05 PM
Status	Completed
Attempt Score	100 out of 100 points
Time Elapsed	27 minutes out of 1 hour and 30 minutes
Results Displayed	All Answers, Submitted Answers, Feedback, Incorrectly Answered Questions

Question 1

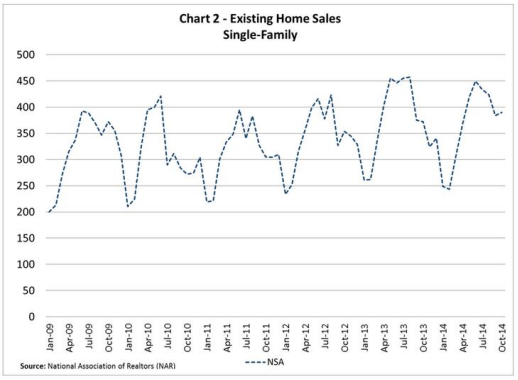
5 out of 5 points



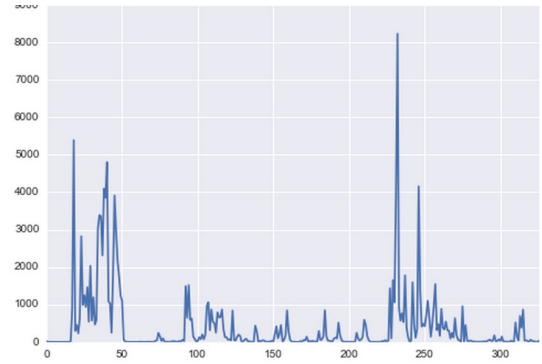
Is this data stationary or non-stationary? **[a]**



Is this data stationary or non-stationary? **[b]**

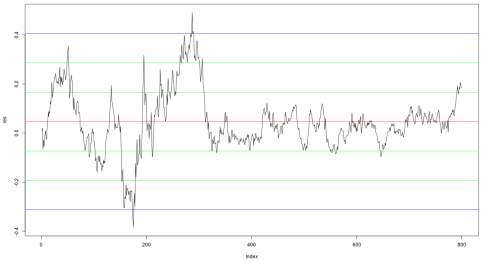


Is this data stationary or non-stationary? **[c]**

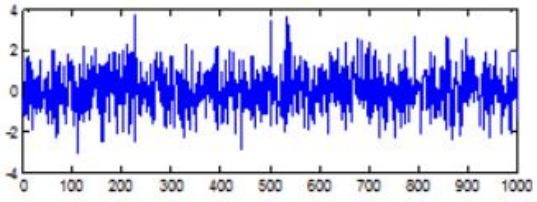


Is this data stationary or non-stationary? **[d]**

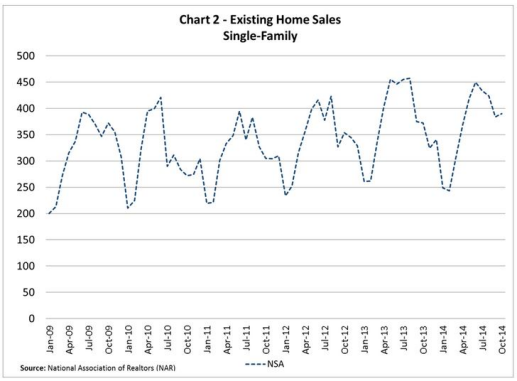
Selected Answer:



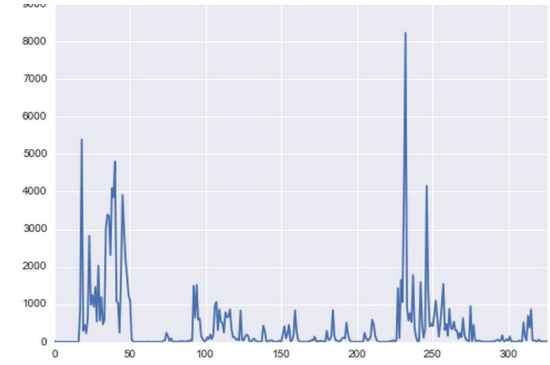
Is this data stationary or non-stationary? **non-stationary**



Is this data stationary or non-stationary? **stationary**



Is this data stationary or non-stationary? **non-stationary**



Is this data stationary or non-stationary? **non-stationary**

Answers:

- stationary
- non-stationary

Response Feedback:

Question 2

5 out of 5 points

For each of the following, determine whether the time series data is stationary or non-stationary.

1. U.S. population (in millions) between 1950 and 2017. **[a]**
2. Quarterly sales of beer for Syracuse Beer Inc. during 2010-2017. **[b]**
3. Daily temperature between 1/1/2016 and 12/31/2016. **[c]**
4. Average number of courses undergraduate business school students take per semester in their first three years of college. **[d]**

Selected Answer:

For each of the following, determine whether the time series data is stationary or non-stationary.

1. U.S. population (in millions) between 1950 and 2017. **non-stationary**
2. Quarterly sales of beer for Syracuse Beer Inc. during 2010-2017. **non-stationary**
3. Daily temperature between 1/1/2016 and 12/31/2016. **non-stationary**
4. Average number of courses undergraduate business school students take per semester in their first three years of college. **stationary**

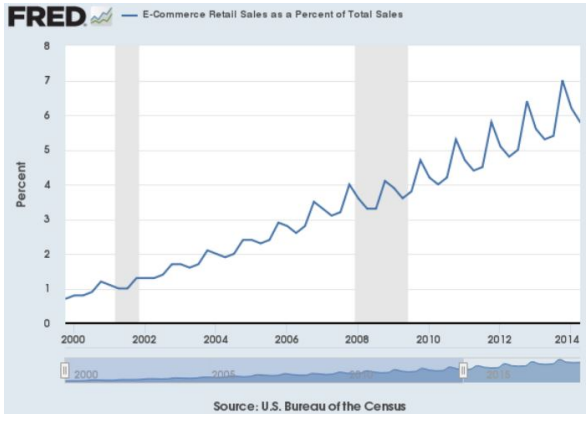
Answers:

- stationary
- non-stationary

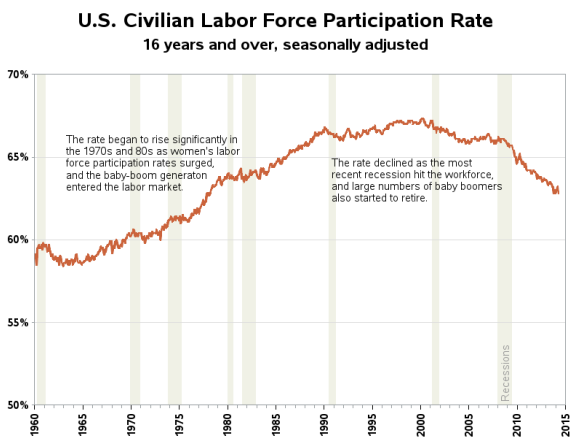
Response Feedback:

Question 3

5 out of 5 points

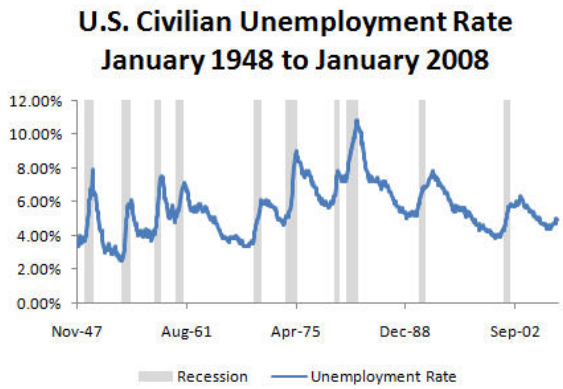


To model this time series data using a regression, the explanatory variables



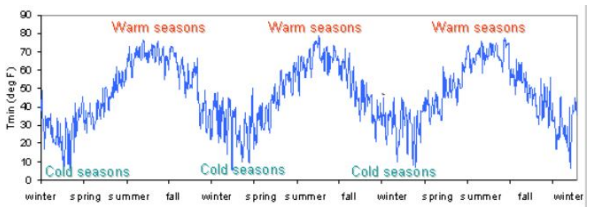
To model this time series data using a regression, the explanatory variables

must include **[a]**



To model this time series data using a regression, the explanatory variables

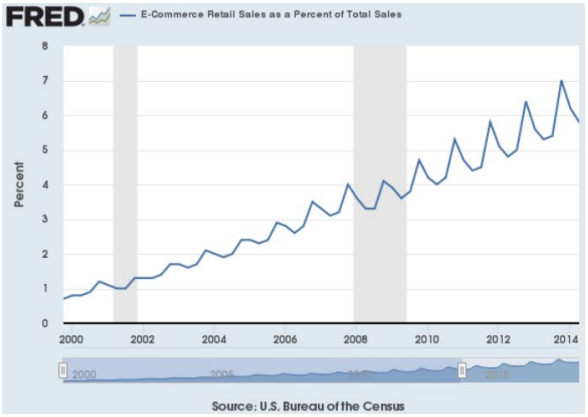
must include **[b]**



To model this time series data using a regression, the explanatory variables

must include **[c]**

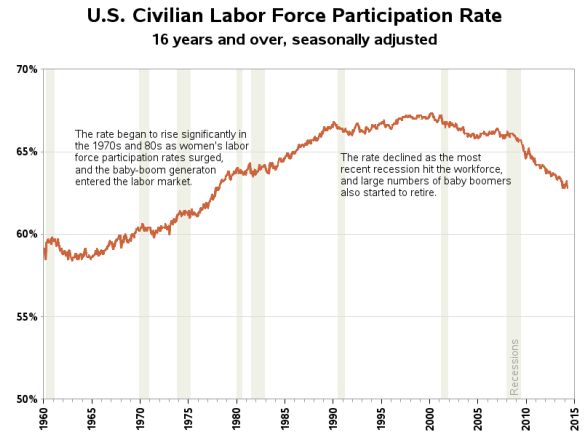
Selected Answer:



To model this time series data using a regression, the explanatory variables

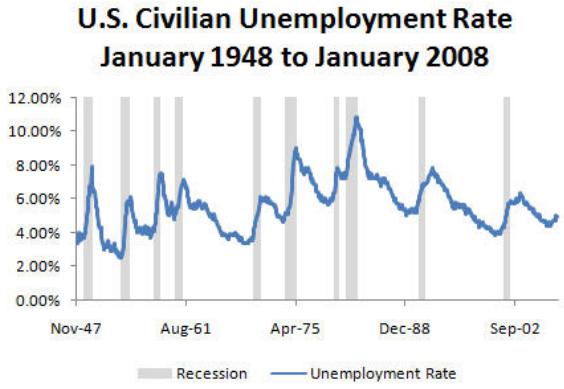
must include **linear trend and seasonal effects**

must include **[d]**



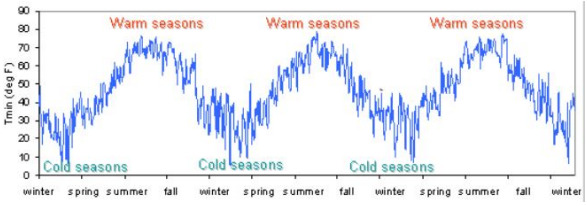
To model this time series data using a regression, the explanatory variables

must include **linear and quadratic trend**



To model this time series data using a regression, the explanatory variables

must include **neither linear trend nor seasonality**



To model this time series data using a regression, the explanatory variables

must include **seasonal effects only**

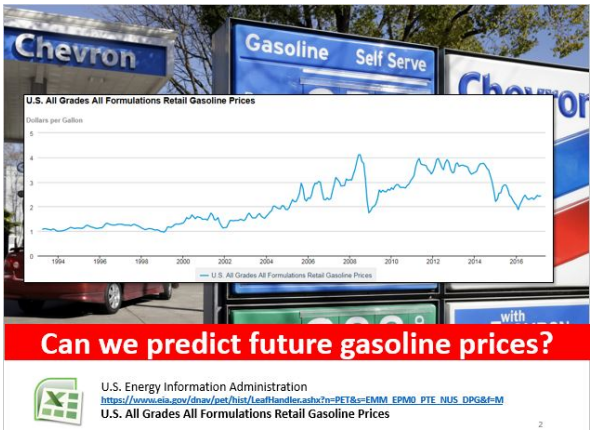
Answers:

- linear trend only
- linear and quadratic trend
- quadratic trend only
- seasonal effects only
- linear trend and seasonal effects
- neither linear trend nor seasonality

Response Feedback:

Question 4

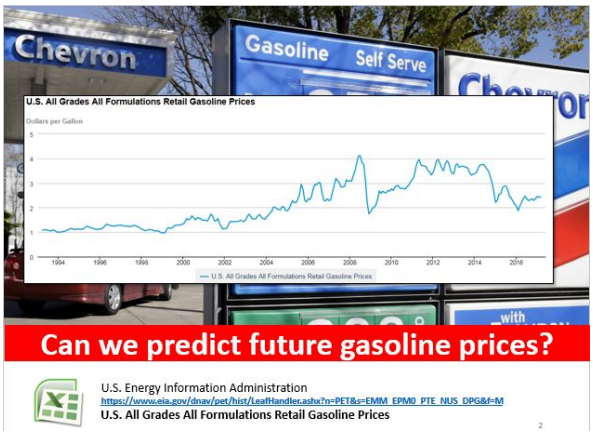
10 out of 10 points



On slide 2 of Lecture 14 we saw a time series plot for the monthly prices per gallon of gasoline in the United States during April 1993 - March 2017. The data is contained in the Excel file: **U.S. Monthly Retail Gasoline Prices 1993-2017.xlsx**

1. **MODEL #1**: Use **Weighted Moving Average** method with k=3 and weights 0.7, 0.2, 0.1 to forecast gasoline prices. What is **RMSE** of your forecast? **0. [a] [b] [c] [d]** What price per gallon do you forecast for April 2017? **[e] . [f] [g] [h]**.
2. **MODEL #2**: Use **Exponential Smoothing** method with α=0.7 to forecast gasoline prices. What is **RMSE** of your forecast? **0. [i] [j] [k] [l]** What price per gallon do you forecast for April 2017? **[m] . [n] [o] [p]**.
3. Which of the two models provides a more accurate forecast? MODEL # **[q]**

Selected Answer:



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1. **MODEL #1**: Use **Weighted Moving Average** method with k=3 and weights 0.7, 0.2, 0.1 to forecast gasoline prices. What is **RMSE** of your forecast? **0. 1 7 2 5** What price per gallon do you forecast for April 2017? **2 . 4 3 5**.
2. **MODEL #2**: Use **Exponential Smoothing** method with α=0.7 to forecast gasoline prices. What is **RMSE** of your forecast? **0. 1 7 1 3** What price per gallon do you forecast for April 2017? **2 . 4 3 2**.
3. Which of the two models provides a more accurate forecast? MODEL # **2**

Answers:

- 0
- 1
- 2
- 3
- 4
- 5
- 6
- 7
- 8
- 9

Response Feedback:

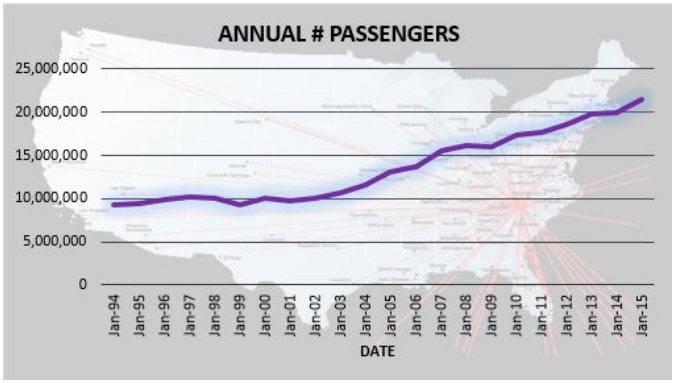
Question 5

10 out of 10 points

You are a manager at United Airlines and want to forecast the number of passengers in the U.S. domestic market. This would help you to determine the airfare prices, staffing, aircraft numbers and sizes, as well as various costs.

You collect data on the number of passengers from 1994 until 2015. The table below shows a portion of the data, accompanied by the time series plot.

DATE	Observation #	ANNUAL # PASSENGERS
Dec-94	1	9,250,390
Dec-95	2	9,434,001
Dec-96	3	9,830,053
...	...	...
Dec-13	20	19,838,690
Dec-14	21	20,001,271
Dec-15	22	21,423,822



Clearly, the data exhibits an increase over time with a **nonlinear trend**. You obtain the following time series regression equation:

$$\text{Forecasted \# Passengers} = 9{,}147{,}774.5 - 28{,}436.3 * X + 27{,}677.8 * X^2$$

Use the model to forecast the number of passengers in the year-end **2,021**. (Round your answer to

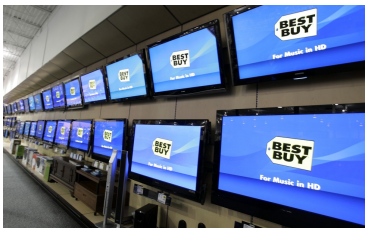
the closest whole number. Please ignore the comma in the year!)

Selected Answer: 30,050,953

Response Feedback:

Question 6

10 out of 10 points

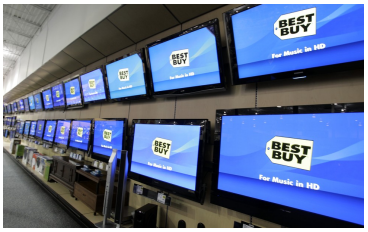


The Excel data **TVSales.xlsx** contains information on the number of TVs (in 1000s) sold between 2010 and 2013.

Based on the time series plot, a relevant model would be a model with trend, seasonality, or both.

1. For Model #1 with linear trend, what is MSE? **0 . [a] [b] [c] [d]** . What is the forecast number of TVs sold (in thousands) for the fourth quarter of the year 2014? **[e] . [f] [g] [h] [i]**.
2. For Model #2 with linear trend and seasonality, what is MSE? **0 . [j] [k] [l] [m]** . What is the forecast number of TVs sold (in thousands) for the fourth quarter of the year 2014 ? **[n] . [o] [p] [q] [r]**.
3. Which of the two models -- Model #1 (linear trend only) or Model #2 (linear trend + seasonality) -- provides a more accurate forecast? Model # **[t]**.

Selected Answer:



The Excel data **TVSales.xlsx** contains information on the number of TVs (in 1000s) sold between 2010 and 2013.

Based on the time series plot, a relevant model would be a model with trend, seasonality, or both.

1. For Model #1 with linear trend, what is MSE? **0 . 6 7 2 9** . What is the forecast number of TVs sold (in thousands) for the fourth quarter of the year 2014? **8 . 4 4 9 6**.
2. For Model #2 with linear trend and seasonality, what is MSE? **0 . 0 3 2 3** . What is the forecast number of TVs sold (in thousands) for the fourth quarter of the year 2014 ? **8 . 9 8 1 3**.
3. Which of the two models -- Model #1 (linear trend only) or Model #2 (linear trend + seasonality) -- provides a more accurate forecast? Model # **2**.

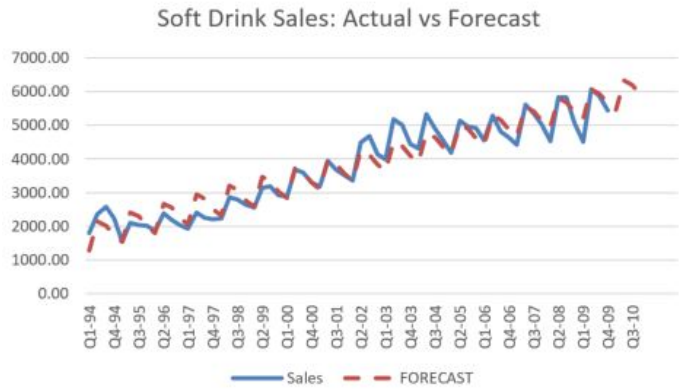
Answers:

- 0
- 1
- 2
- 3
- 4
- 5
- 6
- 7
- 8
- 9

Response Feedback:

Question 7

10 out of 10 points

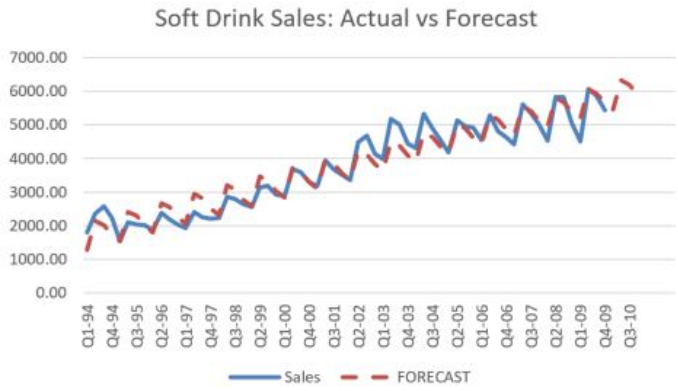


Please see Excel file **Soft Drink Sales.xlsx** . It contains soft drink sales data for the period 1994 Q1 until 2009 Q4.

The figure above illustrates the actual amount of sales ($ millions) and the forecast amount. From the figure, you need to understand what model was used to model the sales data.

1. What is the adjusted R-squared of this model? **0 . [a] [b] [c] [d]**
2. Based on the model, what is the sales forecast ($ millions) for 2010 Q4? **[e] [f] [g] [h] . [i] [j]**

Selected Answer:



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The figure above illustrates the actual amount of sales ($ millions) and the forecast amount. From the figure, you need to understand what model was used to model the sales data.

1. What is the adjusted R-squared of this model? **0 . 9 4 1 3**
2. Based on the model, what is the sales forecast ($ millions) for 2010 Q4? **5 9 1 2 . 7 6**

Answers:

- 0
- 1
- 2
- 3
- 4
- 5
- 6
- 7
- 8
- 9

Response Feedback:

Question 8

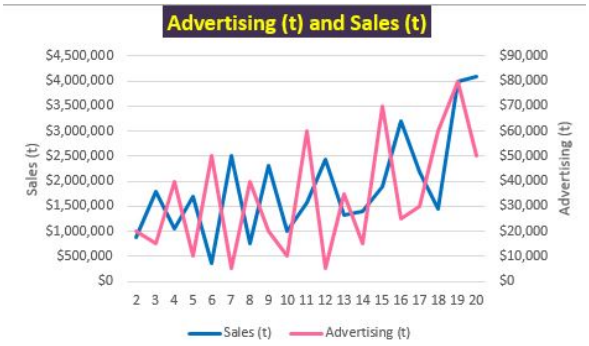
15 out of 15 points

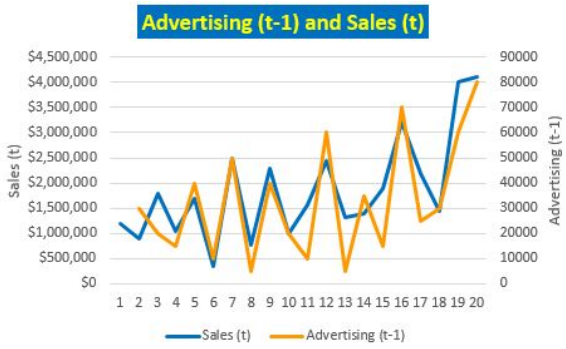
The Excel file **Motel revenue & advertising.xlsx** contains data on a motel chain's quarterly revenue and advertising. The following two time series plots suggest that:

(1) sales data exhibits a linear trend,

(2) there is no seasonality, and

(3) sales are closely affected by last quarter's advertising expenses.





a. Build an appropriate time series regression model that would capture these effects on sales.
b. Forecast sales for the next several quarters, assuming that advertising expenses remain at $50,000 a quarter.
c. What is your forecast for **Quarter 1** of the year **2017**? (Round your answer to 2 decimal places.)

Selected Answer: 3029668.32

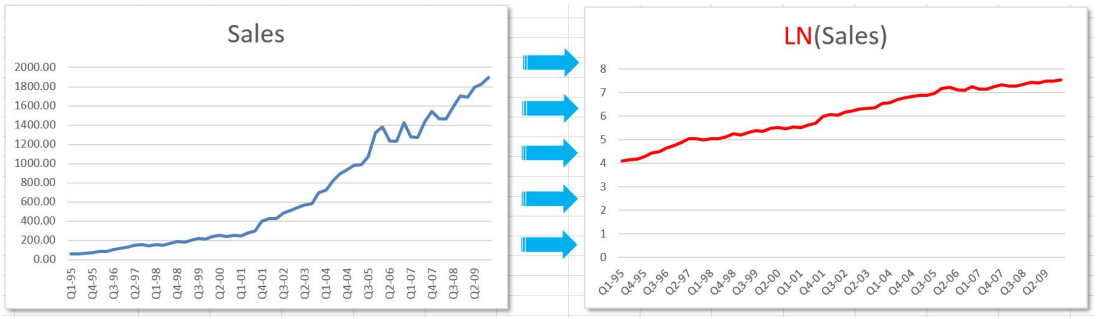
Response Feedback:

Question 9

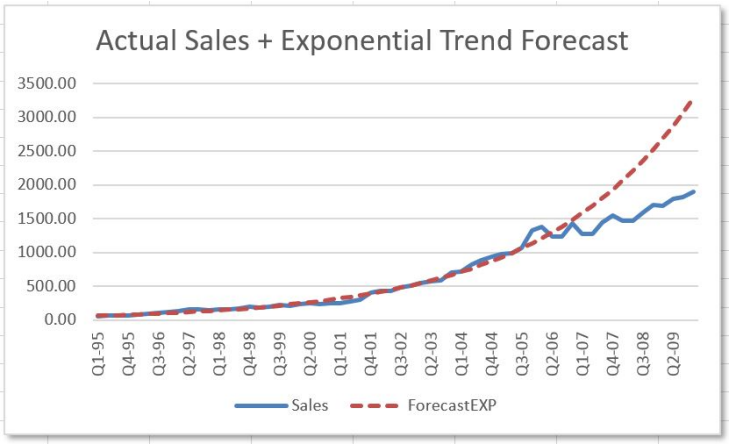
15 out of 15 points

See data **PC Device Sales.xlsx** . It contains information on quarterly sales (in $ mln) of a PC device between Q1 1995 and Q4 2009. We would like to be able to use historic data for forecasting future quarterly sales data.

The following two charts show the time series plots for the original sales data (left) and for the natural logarithm-transformed data (right).



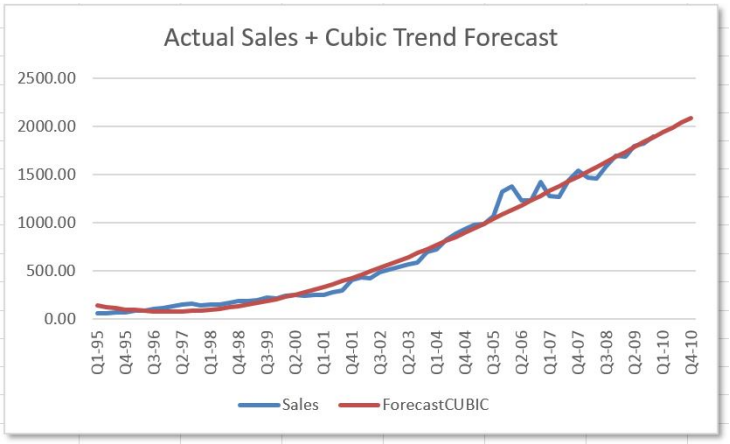
The curvature of the plot on the left along with the near-constant slope of the plot on the right suggest that an **exponential trend** model would be appropriate. However, we also observe a change in the slope and the overall pattern of sales data after the end of 2005. Therefore, please use the data only for Q1 1995 -- Q4 2005 to forecast sales for the following quarters using an exponential trend model. If your model is correct, then the actual vs. forecast sales would look as follows:



Based on your exponential trend model, between Q1 1995 and Q4 2005, **by how much are sales predicted to increase in every quarter?** By **[a]**. What is the ***R*-squared** of your model? **[b]** How much sales does your model predict for **Q3 2006** (in $ mln)? $ **[c]** mln.

.

Another forecast model that we can try based on the visual observation of the time series plot (top left) is a **cubic trend model**. Please use all available data, for Q1 1995 -- Q4 2009, to forecast sales for the following quarters using a cubic trend model. If your model is correct, then the actual vs. forecast sales would look as follows:



What is the ***R*-squared adjusted** of your model? **[d]** How much sales does your model predict for **Q3 2010** (in $ mln)? $ **[e]** mln.

.

Finally, which of the two models (exponential or cubic trend model) provides a better fit to the data based on ***R*-squared adjusted** values? **[f]** *(exponential / cubic)* trend model. Which of the two models (exponential or cubic trend model) provides a better forecast (up until Q4 2005) based on **RMSE**?***** **[g]** *(exponential / cubic)* trend model.

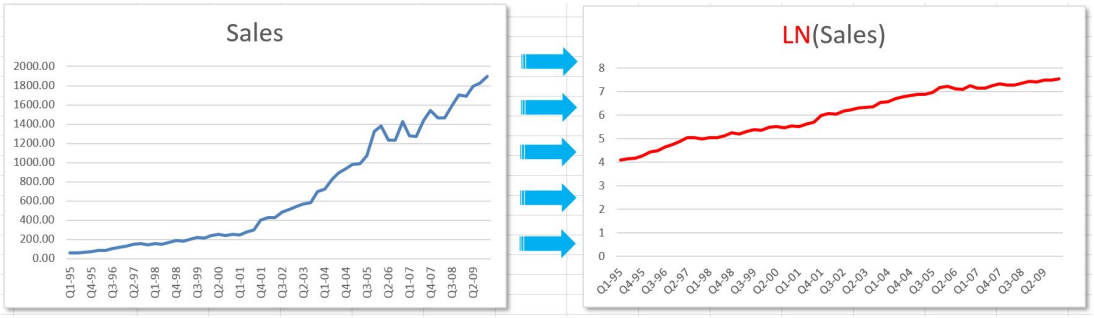
* For computing RMSE, use the reduced sample (data until Q4 2005) that you used to estimate the exponential trend model.

Selected Answer:

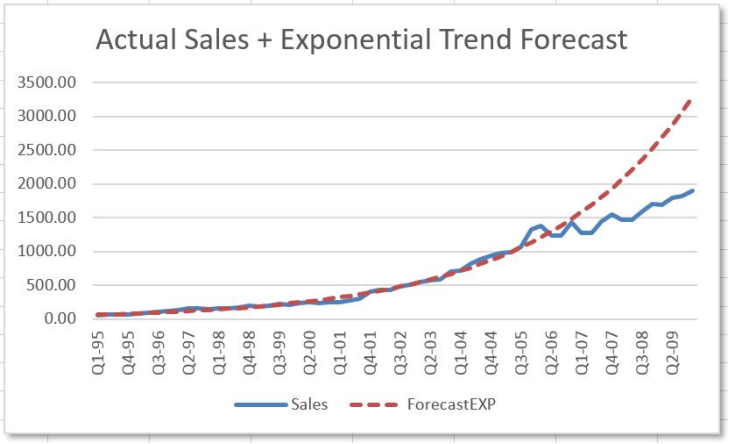
See data **PC Device Sales.xlsx** . It contains information on quarterly sales (in $ mln) of a PC device between Q1 1995 and Q4 2009. We would like to be able to use historic data for forecasting future quarterly sales data.

.

The following two charts show the time series plots for the original sales data (left) and for the natural logarithm-transformed data (right).



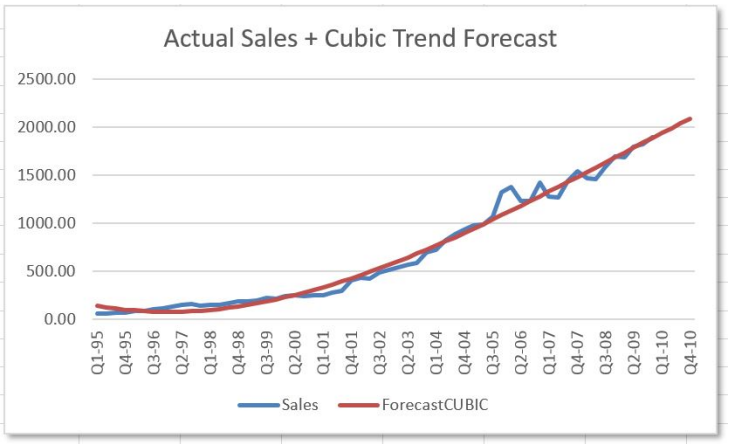
The curvature of the plot on the left along with the near-constant slope of the plot on the right suggest that an **exponential trend** model would be appropriate. However, we also observe a change in the slope and the overall pattern of sales data after the end of 2005. Therefore, please use the data only for Q1 1995 -- Q4 2005 to forecast sales for the following quarters using an exponential trend model. If your model is correct, then the actual vs. forecast sales would look as follows:



Based on your exponential trend model, between Q1 1995 and Q4 2005, **by how much are sales predicted to increase in every quarter?** By **6.63 %**. What is the ***R*-squared** of your model? **0.98437** How much sales does your model predict for **Q3 2006** (in $ mln)? $ **1,386.79** mln.

.

Another forecast model that we can try based on the visual observation of the time series plot (top left) is a **cubic trend model**. Please use all available data, for Q1 1995 -- Q4 2009, to forecast sales for the following quarters using a cubic trend model. If your model is correct, then the actual vs. forecast sales would look as follows:



What is the ***R*-squared adjusted** of your model? **0.9845** How much sales does your model predict for **Q3 2010** (in $ mln)? $ **2,042.65** mln.

.

Finally, which of the two models (exponential or cubic trend model) provides a better fit to the data based on ***R*-squared adjusted** values? **cubic** *(exponential / cubic)* trend model. Which of the two models (exponential or cubic trend model) provides a better forecast (up until Q4 2005) based on **RMSE**?* **exponential** *(exponential / cubic)* trend model.

* For computing RMSE, use the reduced sample (data until Q4 2005) that you used to estimate the exponential trend model.

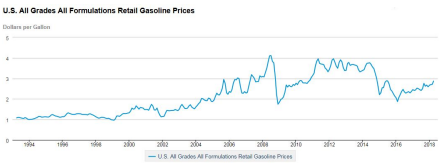
Answers:

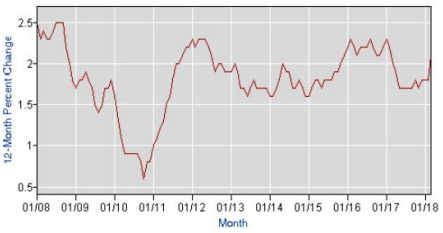
- $ 66,335
- 6.63 %
- $ 6.63 thousand
- 0.98437
- 0.9840
- 0.9853
- 0.9845
- 1,386.79
- 1,231.25
- 4,008.22
- 2,042.65
- exponential
- cubic

Response Feedback:

Question 10

15 out of 15 points





We would like to forecast **U.S. retail gasoline prices** (price per gallon, $). We believe that the prices might be partially driven by **inflation** (%). To obtain the necessary data, go to:

- The data for price per gallon: U.S. Energy Information Administration website (https://www.eia.gov).
- The data for inflation: U.S. Bureau of Labor Statistics (https://data.bls.gov).

Please download the necessary monthly data for the period **April 2016 -- April 2018** (inclusive).

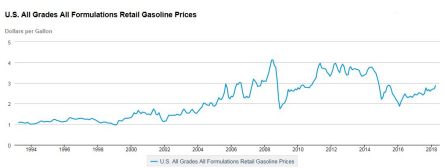
a) INFLATION. Apply a second-order autoregressive model, i.e., AR(2), for inflation. This means that inflation in the current month depends on its past values from the previous two months.

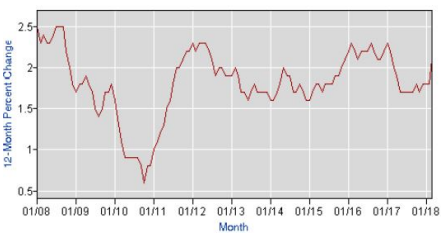
- What is the Adjusted R-Squared of this model? **[a]**
- What is your forecast of the inflation rate (in %) for **May 2018**? **[b]**

b) PRICE PER GALLON. You believe that price per gallon has a linear trend and also depends on the inflation rate. Create an appropriate regression model.

- What is the Adjusted R-Squared of this model? **[c]**
- Is **linear trend** a good predictor of price per gallon? (NO=0, YES=1) **[d]**
- Is **inflation** a good linear predictor of price per gallon? (NO=0, YES=1) **[e]**
- Using your results from part a) of this problem, what is your forecast of price per gallon ($) for **May 2018**? **[f]**

Selected Answer:





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- The data for price per gallon: U.S. Energy Information Administration website (https://www.eia.gov).
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Please download the necessary monthly data for the period **April 2016 -- April 2018** (inclusive).

a) INFLATION. Apply a second-order autoregressive model, i.e., AR(2), for inflation. This means that inflation in the current month depends on its past values from the previous two months.

- What is the Adjusted R-Squared of this model? **0.7657**
- What is your forecast of the inflation rate (in %) for **May 2018**? **2.0754**

b) PRICE PER GALLON. You believe that price per gallon has a linear trend and also depends on the inflation rate. Create an appropriate regression model.

- What is the Adjusted R-Squared of this model? **0.7752**
- Is **linear trend** a good predictor of price per gallon? (NO=0, YES=1) **1**
- Is **inflation** a good linear predictor of price per gallon? (NO=0, YES=1) **0**
- Using your results from part a) of this problem, what is your forecast of price per gallon ($) for **May 2018**? **2.7905**

Answers:

- 0
- 1
- 0.8151
- 0.7752
- 0.7657
- 0.7939
- 2.7905
- 2.1271
- 2.8032
- 2.0754
- 2.2476
- 2.6870

Response Feedback:

Sunday, December 9, 2018 11:25:15 PM EST

← OK