

STATS 326
Applied Time Series
ASSIGNMENT TWO
Due: 11 April, 11.00 am

(Worth 6% of your final grade)

Hand-in to the appropriate STATS 326 Hand-in box in the Student Resource Centre

This assignment will be marked out of 100. Please follow the instructions carefully. Marks will be deducted if you include **R** output, plots etc that are not asked for. Only include what is requested in each question in your answers. You are encouraged to print your assignment “2-up” to save paper.

The data for this assignment is contained in a text file “Barrow.CO2.quarterly.txt” that can be downloaded from Canvas. The data are quarterly measurements of atmospheric carbon dioxide in parts per million (ppm) recorded from Quarter 1, 2000 to Quarter 4, 2017. (The data have been rounded to 2 decimal places.) Your task is to find the “best” predicting model and generate predictions for the next 4 quarters, using your “best” predicting model. Please refer to the Course Notes (pages 74 – 77) for information on how to find the “best” predicting model.

Hint: You should build each model using a reduced time frame, 2000 – 2016. Then use a statistic, such as *RMSEP* to compare the various models’ forecasts with the actual observations for 2017.

Question One: [20 marks]

Use the Holt-Winters technique to build a model of the data (2000 to 2016). See pages 67 – 73 of the Course Notes. Use the predict function in **R** to forecast the 4 quarters of 2017. Compare the 2017 forecasts with the actual values for 2017.

In your assignment only include the **R** command and output used to produce your model, the **R** commands and output for the predictions and the **R** commands and output used to compare the predictions with the actual values for 2017. Include a plot of the Holt-Winters model and the predictions. Briefly comment on the plot and the predictions.

Question Two: [30 marks]

Using the de-seasonalising techniques (Moving Averages and Seasonal Trend Lowess), build Seasonally Adjusted models of the data (2000 to 2016). See pages 77 – 89 of the Course Notes. Calculate predictions for the 4 quarters of 2017 for each model. Compare each model’s forecasts with the actual values for 2017.

In your assignment only include the following for the **best predicting Seasonally Adjusted model**: a plot of the de-seasonalised data with a brief description of the plot, the seasonal estimates and any relevant comments, the **R** summary output for the best predicting model, the **R** commands and output used to do the predictions and the **R** commands and output used to compare the predictions with the actual values for 2017.

Question Three: [30 marks]

Write up a brief set of Technical Notes for the **best predicting Seasonally Adjusted model** from Question Two.

NOTE: You only need to discuss the seasonal estimates, the plot of the seasonally adjusted data and your final seasonally adjusted model. You should also discuss the predictions and their reliability.

Question Four: [20 marks]

Using the best predicting model from Questions One and Two, re-run the model using all the available data (2000 to 2017) and do predictions for the 4 quarters of 2018. You are not required to do any model building in this question. Just use your best predicting model from Questions One and Two.

In your assignment only include the **R** commands and output for the model and the **R** commands and output for the 2018 predictions. Briefly comment on the model.