

MSiA 420, HW #4  
due Sunday 3/15/20, 11:59 pm

As with all HW (unless otherwise noted), upload your solutions for this assignment on Canvas, as a Word or pdf file, by the due date/time. For all problems for which you use R, include your R script in an appendix to your homework (clearly label which parts of the script correspond to which homework problems).

- 1) HW4\_data.xls contains monthly airline passenger data from January 1949 through December 1960. For all of the plots in this question, include the past data along with any forecasts, if relevant.
  - (a) Use an appropriate moving average filter to smooth out the seasonality in the data.
  - (b) Calculate and plot EWMA forecasts for the next two years (1961 and 1962). What is the optimal EWMA parameter  $\alpha$ ? Discuss the nature of the  $k$ -step-ahead forecasts for this optimal  $\alpha$  value.
  - (c) Calculate and plot the Holt method forecasts for the next two years (1961 and 1962). What optimal Holt parameters  $\alpha$  and  $\beta$ ? Discuss the nature of the  $k$ -step-ahead forecasts and how they differ from the EWMA forecasts in part (b).
  - (d) Calculate and plot the Holt-Winters forecasts for the next two years (1961 and 1962) for an additive model. What optimal Holt-Winters parameters  $\alpha$ ,  $\beta$ , and  $\gamma$ ? Interpret the seasonality coefficients.
  - (e) Repeat part (d) but for a Holt-Winters multiplicative model?
  - (f) Which method do you think produces the most appropriate forecasts? Explain.
- 2) This problem pertains to the same airline passenger data that you analyzed in Problem 1.
  - (a) Fit an additive decomposition model to the data. Interpret the trend and seasonality indices. Construct a plot of the original time series and the fitted values, both on the same plot. Discuss the extent to which the variability in the data are accounted for by the trend and seasonality.
  - (b) Repeat for a multiplicative decomposition model. Which model – additive or multiplicative – do you think better represents the data?