Due Date: **Tuesday, September 20 at 5:45 pm**

Deliverable Format: HTML or PDF version of R markdown.

\* Perform *tasks* by writing code that creates output

\* Answer corresponding *task* *questions* by inserting markdown text

1. (10 points) For this exercise, use the price of a dozen eggs in the United States from 1900–1993 (data set ‘eggs’ ).
   1. Experiment with the various options in the holt() function to see how much the forecasts change with damped or exponential trend. Try changing the parameter values for α and β to see how they affect the forecasts. You should do at least 5 forecasts. (5)
   2. Try to develop an intuition of what each parameter and argument is doing to the forecasts. [Hint: use h=100 when calling holt() so you can clearly see the differences between the various options when plotting the forecasts.] How would you explain that intuition? (3)
   3. Which model gives the best RMSE? (2)
2. (20 points) For this exercise, use the quarterly UK passenger vehicle production data from 1977:1–2005:1. (Data set ukcars.)
   1. Plot your data and describe the main features of the series. (2)
   2. Decompose the series using STL and obtain the seasonally adjusted data. (1)
   3. Forecast the next two years of the series using Holt’s linear trend method applied to the seasonally adjusted data. (2)
   4. What are the parameters of the method? What do they tell you about how quickly the slope and level are changing over time? (3)
   5. Reseasonalize the forecasts using the following code where decomp is the output from stl() and fit is the output from holt(): (2)

lastyear <- rep(decomp$time.series[110:113,"seasonal"],2) fc <- fit$mean + lastyear

* 1. Do the re-seasonalized forecasts look reasonable? Why or why not? (2)
  2. Use ets() to choose a seasonal model for the data. How would you explain the results? (3)
  3. Compare the RMSE of the fitted model with the RMSE of the model above. Which gives the better in-sample fits? How would you explain that? (3)
  4. Now compare the forecasts from the two approaches? Which seems most reasonable? Why? (2)

1. (12 points) For this exercise, use the monthly Australian short-term overseas visitors data, May 1985–April 2005. (Data set: visitors.)
   1. Make a time plot of your data and describe the main features of the series. (2)
   2. Forecast the next two years using Holt-Winters’ multiplicative method. Why is multiplicative seasonality necessary here? (2)
   3. Experiment with making the trend exponential and/or damped, investigating at least two alternatives. Why did you choose the options you did? (3)
   4. Compare the RMSE of the one-step forecasts from the various methods. Which do you prefer? Why? (2)
   5. Now use the ets() function to select a model automatically. Does it choose the same model you did? How would you explain that? (3)
2. (8 points) Using the external data from previous exercises (or external data that are NOT annual)
   1. Plot the data. How would you describe the trend and seasonality of these data? How did you determine that? (3)
   2. Which forecasting model fits these data best? What is your intuition for why that is so? (3)
   3. Can you find an example where it does not give reasonable forecasts? Why do you think that is? (2)