Econ 525 — Prof. Aguilar
Advanced Financial Economics — UNC at Chapel Hill

Student Name: _____
PID: _____
Honor Code Signature: _____

Matlab HW#4 - 02/22/19 @ 5:00pm

Instructions:

- You must state and justify any and all assumptions you make in the assignment.
- Your submission must be a professional presentation of your work.
- Students may collaborate, but each student must follow the honor code, and submit their own work. Obvious instances where more than one student utilizes the same spreadsheet or commentary will not be tolerated.
- This assignment must be completed using Matlab.
- Your deliverable should be a single m file with the following naming convention: "FirstName-LastName-HW#.m".
- This m file should be submitted to the 525 sakai dropbox by the due date and time stated above.
- The m file should include code for importing the data, as well as producing the requested figures.
- Provide any files (Excel, csv, etc) that are necessary for the m file to run.
- The m file should be heavily commented, detailing every step of your calculations. Please include the answers to the questions below within these comments.
- Please include the following in the preamble of your code:
  - %Purpose:
    %Econ 525-Spring2019
  - %Note:
    %This m-file is dependent upon xyz files.
  - %Author:
    - %Name — Date
    - %UNC Honor Pledge: I certify that no unauthorized assistance has been received or given in the completion of this work.

The goal of this assignment is to conduct static and dynamic forecasts via LSTM and ARMA(1,1) models for multiple assets. You will then evaluate and discuss the forecast performance of the models.

- Universe: SP500 as of 2/12/2019
- Databases: Quandl Wiki Database via API, WRDS web pull, or Factset via Excel.
- Estimation Period: January 1, 2015 to December 29, 2017
- Return Specification: Log returns, HPY; Daily
- Assets: You will only use the top 5 constituents by market cap of the SP500, not all 500.

1. You will forecast the returns for each of the top 5 constituents.

   a. Partition your training period equal to 90% of the estimation period. Conduct a one day ahead forecast with an ARMA(1,1) model for each individual asset. (2pts)

   Hint: You will use the arima function in Matlab to estimate the ARMA(1,1). You will use the forecast function in Matlab to forecast with the ARMA(1,1).

   b. Same partitioning of your training period equal to 90% of the estimation period. Conduct a one day ahead forecast with an LSTM model for each individual asset. (2pts)

   Hint: In class you did a LSTM example with dynamic updating. This was the part in the code that did the forecasting: [net,YPred(i,1)] = predictAndUpdateState(net,YPred(i-1,1),.... It is dynamic because at each iteration you are inputting the previous prediction. This question is asking about static forecasts. You will have to alter the above code to do static. This is similar to what you had in the code as well, [net,YPred] = predictAndUpdateState(net,YTrain(end));. Here, you are doing one step ahead forecasting. Note, one step ahead dynamic and static forecasting is the same. If you were going to do two days ahead it would need to be YTrain(end-1), three days ahead would need YTrain(end-2), and so on...

   c. Repeat part a for 2 days ahead, 3 days ahead, 4 days ahead and 5 days ahead. (2pts)

   d. Repeat part b for 2 days ahead, 3 days ahead, 4 days ahead and 5 days ahead. (2pts)

   e. Repeat part c, but now with a dynamic forecasting structure. (2pts)

   Hint: Use day 1's forecast as input into day 2's forecast, and so on.....

   f. Repeat part d, but now with a dynamic forecasting structure. (2pts)

   Hint: This is very similar to the LSTM in class Matlab code.

2. You will now create tables to present the forecasts and evaluate the forecast performance.

   a. Create a table that looks like table 1 one below, with asset names as the row labels and column labels as specified. Fill in your results. Then create a second table that looks like table 2 below and fill in the dynamic forecasting results. (1pt)

Table 1: Static Forecast Results

	static 1day ARMA	static 1day LSTM	static 2day ARMA	static 2day LSTM	static 3day ARMA	static 3day LSTM	static 4day ARMA	static 4day LSTM	static 5day ARMA	static 5day LSTM
asset1										
asset2										
asset3										
asset4										
asset5										

Table 2: Dynamic Forecast Results

	dyn. 1day ARMA	dyn. 1day LSTM	dyn. 2day ARMA	dyn. 2day LSTM	dyn. 3day ARMA	dyn. 3day LSTM	dyn. 4day ARMA	dyn. 4day LSTM	dyn. 5day ARMA	dyn. 5day LSTM
asset1										
asset2										
asset3										
asset4										
asset5										

b. Comment on the two tables. Be sure to discuss if the static and dynamic forecasts look very different for either of the models. (2pts)

c. Calculate the RMSE for the static forecasts for each asset and model. The RMSE is for forecasts 1 through 5 days ahead. i.e. Calculate the RMSE for asset1 using the static forecast structure for the ARMA(1,1) model. Then calculate the RMSE for asset2 using the static forecast structure for the ARMA(1,1) model and so on... Do the same for the LSTM model... (1pt)

d. Calculate the RMSE for the dynamic forecasts for each asset and model. The RMSE is for forecasts 1 through 5 days ahead. i.e. Calculate the RMSE for asset1 using the dynamic forecast structure for the ARMA(1,1) model. Then calculate the RMSE for asset2 using the dynamic forecast structure for the ARMA(1,1) model and so on... Do the same for the LSTM model... (1pt)

e. Create a table where you present the RMSE's calculated above with asset names as the row labels. See table below for guidance. Enter your calculatded RMSE's. (1pt)

Table 3: RMSE Forecast Results

	static RMSE ARMA	static RMSE LSTM	dyn. RMSE ARMA	dyn. RMSE LSTM
asset1				
asset2				
asset3				
asset4				
asset5				

f. Comment on the above table. Be sure to discuss which model had the lowest RMSE on average, static vs dynamic accuracy, assets with high accuracy, etc... (2pts)