May 14, 2021 Name:_____

CS 611, Spring 2021

Final Exam, Due on May 21, 2021

100 total points

Use R to perform all necessary calculations. Attach your code and output. Give interpretation and discuss all relevant statistical measures.

Problem 1. (50 points) We want to use our knowledge of ARIMA and Holt-Winters (HW) models to invest successfully. Download the daily closing stock prices of Facebook, Apple, Intel, IBM, Nvidia, Sirius, Moderna, Google, Amazon, Wells-Fargo, GE, Ebay, Sprint, Verizon, Walt Disney, Nike, Netflix, Walmart, Tesla, and Target for the last 5 years.

a) (25 points) We want to see how often various ARIMA models were appropriate for these stocks (ARIMA(0,0,1), ARIMA(1,0,0), etc). Split each stock in non-overlapping windows of size 100 and find the best model for each window using auto.arima(). Create a frequency table that displays the number of times a particular ARIMA model was selected.

b) (25 points) Focus on the last 500 days of the data. Find the best ARIMA and HW models for each stock using days 500 to 401 and forecast the value for day 400. Compare it to the actual value at day 400. If the direction of the forecasted value and the true value were the same (compared to day 401), count this as a successful forecast. Shift the window one day to the right and redo the analysis. Keep shifting the window until you forecast day 1 using days 101 to 2. Obtain the Box-Pierce test p-values for both models for each window to assess goodness-of-fit. As we know p-values above and below 0.05 indicate good and poor fit respectively. Report the percent of times good and poor fit was achieved for each method. Summarize the results in a table by reporting the percent of time ARIMA and HW successfully forecasted each stock one step ahead direction over the last 400 trading days within the two groups of good and poor fit.

Problem 2. (20 points) Consider the classical random walk with absorbing barriers at 0 and N (gambler's ruin) where a gambler starts with k dollars, bets 1 dollar at each step, wins 1 dollar with probability p and loses his 1 dollar stake with probability q=1-p; he either wins (N-k) dollars to get his fortune to N dollars (the random walk gets absorbed at barrier N) and buys a car or goes bankrupt and quits (the random walk gets absorbed at barrier 0). Find the average number of the random walk steps until hitting the absorbing barriers.

Problem 3. (10 points) Exercise 10.1 on page 246.

Problem 4. (10 points) Exercise 10.2 on page 246.

Problem 5. (10 points) Exercise 10.9 on page 248.