1. Report which two models fit GDP data best based on the AIC and the BIC and your results from the full data sample for GDP. Note: You already did this question on Homework 7. If you got full credit on HW7, you can cut and paste the results for those two models. You do not have include the results for all 8 models I asked you to estimate on HW7, just the two best ones. If you lost points on that question on homework 7, you should look at the answer key and estimate the models again to select the two most reasonable ones. In particular:
   1. report the parameter estimates and the standard errors for the parameters
      1. Model 1:  
         AR1: -0.206 (0.309)  
         AR2: 0.310 (0.101)
      2. Model 2:   
         AR1: 1.264 (0.181)  
         AR2: -0.646 (0.161)
   2. the AIC, and the BIC for the two best models you estimated.
      1. Model 1:   
         AIC: 2.578  
         BIC: 2.642
      2. Model 2:   
         AIC: 2.572  
         BIC: 2.649
   3. The sample size for the full data set. You can report the results for a)-c) in a single table, in multiple tables, or as equations
      1. N = 247
2. For this question you don’t need to write up an answer, but you need to make changes to the code and submit your updated script. Deliverables: code changes. Change the models to your two best models models: The code is set up to produce forecasts from an AR(2) model and an ARMA(1,1) model. You may need to change the script to forecast based on the two models you selected as best. You do not need to write an answer to this question, but you will need to make several changes to the code. Add comments in the code to indicate where you changed the script to estimate your preferred models. I added comments that indicate where you need to make changes. Using the Edit->find-> type in change in the search bar might save you some time.
   1. Adjusting the sample: The code is set up to use data through 2009. You will need to change the script to include the full sample.
      1. Line 199
   2. You will need to update the data, and change the lines in the script where the end dates for the data are aligned. Again, using the Edit->find->type in change in the search bar might save you some time, but you can also read the code line by line.
      1. Line 20
   3. Change the models to your two best models
      1. Lines 90 and115
3. Report the ACF graph for the holdout (training sample). Are your two best models for the full sample still reasonable for the holdout sample?

A graph of a series of data

Description automatically generated with medium confidence

1. Report and discuss the graphs for you in-sample-forecasts you obtained from your model 1 and model 2. Is the actual value of GDP growth within the bounds for both of the models? Are there any periods when one or both of the model overpredict or underpredict? Do the two models produce visually similar point forecasts?

A graph of different types of data

Description automatically generated with medium confidence

* 1. The graphs are very visually similar to both the actual movement of the line (direction not magnitude) as well as eachother which is evident with the third graph. The blue line seems to disappear behind the red line of model 2.

1. Report and discuss the graph with the out-of-sample predictions from each of the models for the next 3 years. You can report either the graphs based on the sarima.for() function or the graphs based on the forecast() function, whichever ones you like better. They will look almost identical, but the color scheme and the labeling are slightly different. The code will generate both sets of graphs for you to show you how to use both approaches. You only need to report the forecast() or the sarima.for() graphs. You can pick the set of graphs that looks more visually appealing to you, both functions produce the same output, the graphs just use different colors/ patterns.

A graph of a sample model

Description automatically generated with medium confidence

* 1. The out of sample predictions for model 2 are slightly more optimistic than model 1, but there is a slight bit more variance.

1. Based on the graph, does either model indicate that the recession is coming?
   1. Both models predict that GDP growth will stay steady and not dip below 0 meaning that a recession is not likely.
2. (Open-ended question) In 1-2 sentences, discuss what are some factors that could cause a recession that are not included in our model.
   1. Supply shocks are hard to predict and can destabilize local and national economies. Events like the Baltimore bridge incident that happened recently and the Sues canal blockage in 2020 have drastic and long lasting consequences.
3. Report and discuss the in sample and out of sample performance of each model. In particular. report the training-set RMSE for each model and report the test set RMSE for each model.
   1. The RMSC for the training set (0.862) was much higher than the test set (0.585) in model 1 meaning that the test is better than the training (obviously) the RMSC for the training set in model 2 is slightly lower (0.857) while the test set (0.586) stayed about the same.
4. Which model would you pick as the “best” forecasting model based on the results you got from this assignment? Are the results still ambiguous? (They may or may not be.)
   1. Based on the analysis done in this code I would give the edge to model 2 for being slightly more accurate. The results are still ambiguous although slightly more certain,