

Instruction:

- You will need to submit a document AND your codes, just like regular homework;
- Please write all document into one single pdf file and upload it to E3. For the code, please zip them into one zip file, also submit to E3.
- If you have any question, feel free to email me.
- **DUE TIME: April 18th, 00:00 AM.**

Problem 1. ARIMA model (50%)

For this problem, use the dataset **Dataset-ARIMA.txt**. The dataset consists the realized daily volatility series of Alcoa stock returns from January 2, 2003 to May 7, 2004. The volatility series is constructed using 20-minute intra-daily log returns.

- (10%): We first need to examine whether the data has unit root or not. Find the corresponding hypothesis test, state its null hypothesis, do the test, and determine whether the unit root exists or not.
- (10%): Suppose we want to build an $ARIMA(p, i, q)$ model on this data. How do you decide your (p, i, q) ? State your procedure and result.
- (10%): Based on your answer in (b), estimate the coefficient for the ARIMA model. Also report the significance.
- (10%) After we fit the model, we would like to examine whether the model is reasonable by checking whether the residual is white noise or not. How do you do this? And what's your conclusion?
- (10%) Based on your estimated model, report your k -step ahead forecasting for $k = 1$ to 5 as well as their confidence intervals.

Problem 2. GARCH model (50%)

For this problem, use the dataset **Dataset-GARCH.txt**. The dataset consists monthly return $(P_t - P_{t-1})/P_{t-1}$ of Intel stock from 1973 to 2003.

As a data pre-processing, compute the log-return of this data through $Y_t = \log(P_t/P_{t-1})$.

- (10%): Find the hypothesis testing for testing ARCH effect. State its null hypothesis, do the test, and report your conclusion.
- (10%): Build a GARCH model on Y_t . Report the system of equations for your fitted GARCH model.
- (10%): Similar to problem 1-(d), we would like to check whether the fitted GARCH model is reasonable by checking its residual. How do you do this for a GARCH model? What's your conclusion?
- (10%) Based on the GARCH model you fit, compute 1-step to 5-step ahead volatility forecasts at the forecast origin December 2003.
- (10%) Based on the GARCH model you fit, compute 1-step to 5-step ahead Y_t forecasts at the forecast origin December 2003.