FRE-6971 Final Part 2 of 2, Spring 2021 (due 5/21/2021 at 9pm)

Your work for this final must be independent. Incomplete work is not a failure, but copying somebody else's work is.

Data:

'Constant_Maturity_ED.csv' in your class Resources contains constant-maturity Eurodollar rates. There are 20 time series in the file: 3m future, 6m future.... 5y futures rates on 3M LIBOR.

Historical samples:

1/1/2011 through 1/1/2014, Training Sample (A)

1/1/2014 through 1/1/2016, Cross-Validation Sample (B)

1/1/2016 through 1/1/2017, Testing Sample (C)

1. Use Sample A to compute 5 cointegrated pairs of futures rates: [2y,3y], [3y,4y], [4y,5y], [2y,4y], [3y,5y]
2. Use the same Sample A to construct the following:
   a. AR(1) model fitted to each of the 5 cointegrated vectors (Signal 1)
   b. AR(1) model fitted to each {cointegrated vector - EMA(λ)} (Signal 2)

      http://pandas.pydata.org/pandas-docs/stable/computation.html#exponentially-weighted-windows
3. Compute half-lives for all signals. Pick λ to make sure that half-life of Signal 2 is ~5 days
4. EXTRA CREDIT: Signal 3 is a linear combination(mixture) of signals 1 & 2. Weight of the mixture, $\boldsymbol{\theta}$, is a hyper-parameter you can try to determine using Cross-Validation Sample B.
5. Define a set of signal quality metrics, and use Cross-Validation Sample B to choose $\boldsymbol{\theta}$ that is maximizing the quality of signal metrics you chose. For simplicity, we will only use all the AR(1) estimations from the Training Sample A.
   a. Signal quality metrics will measure correlation between a forecast, E[z(t+H)|t], and realized z(t+H) for Signals 1,2,3 and all cointegrated pairs z(t)
   b. H=Horizon; Use H = 10 days
   c. Implement at least 2 different metrics
   d. $\alpha(t) =$ E[z(t+H)|t] - z(t), only consider $|\alpha(t)|>0.1$ in your signal quality analysis
6. Run your signal quality analysis using a testing sample C. Beak the test sample into 4 quarters, and see how your results evolve from quarter to quarter. Analyze all results.