# Statistics 956 Homework No. 4
## Due Monday February 7.

**Reading**

- Review the material in Zivot and Wang on arima.sim, arima.mle, and arima.forecast. Also review the information on these functions using the S-Plus help(). Also look at the "related" functions.

- The MLE approach used by S-Plus provides what are called "conditional" estimates, but the state space approach will give us "unconditional estimates." It will take a while before these distinctions can be made precise. We will start sneaking up on the material of ZW Chapter 15. You can take a peak, but don't let the notation scare you.

**Simulation and Estimation of an ARIMA (2,0,1) process**

- Let $\phi_1 = 0.3$, $\phi_2 = 0.1$, $\theta_1 = .5$ and $\sigma = .25$. Simulate a series of length 1000 from the ARIMA (2,0,1) model with these parameters by making appropriate use of the `innov` and `start.innov` function parameters. Call the series $X$. Plot $X$, calculate the sample mean and variance of $X$, and provide a qqnorm plot. Is your simulation consistent with your understanding of a stationary time series?

- Use a shotgun approach with arima.mle(). Fit all of the $ARIMA(p, 0, q)$ models with $p \leq 3$ and $q \leq 3$. Consider the qqnorm() plots of the residuals. Does these plots suggest a good choice of $p$ and $q$? Does the message you get correspond to what you know to be the correct answer? Is the evidence compelling, or could you have been fooled? Incidentally, do be sure that you have correctly interpreted arima.mle(), given its convention for the sign of the thetas.

- Now let's think about making bets using your model.

  1. Use simulation to decide what percentage of your bets would win if you bet that $y_{t+1}$ is positive when $y_t$ is positive.

  2. Use simulation to decide what percentage of your bets would win if you bet that $y_{t+1}$ is positive when $y_t$ is positive *and* $y_{t-1}$ is positive.

**General Perspective**

This problem covers the basic technology of ARIMA simulation and fitting. It also provides a caricature of a *trading system*. If you're favorably predisposed to such things, they can send a tingle down your spine. Dash Hammet might have called them "the stuff that dreams are made of."