# Statistics 434 Homework No. 3:
# WRDS and Testing for Normality

As preparation, you should skim the material in Zivot and Wang on the creation of time series objects and the use of the timeDate() function, but the e-Handout WRDStoFinMet.txt will have most of the news you can use. Do take time to familiarize yourself with Wharton Research Data Services by poking around at http://wrds1.wharton.upenn.edu.

- Download from WRDS the series of daily returns for an NYSE stock of interest to you. You can pick your, time period (up to 1000 returns). Follow the plan in WRDStoFinMet.txt to put your series into into S-Plus and to put it into a finmetrics time series structure.
- Now here is a question of serious practical importance: "Is it reasonable to regard the returns as Gaussian?"
    1. What does normalTest() suggest? Explore all three methods: "sw" "jb" and "sw95". It seems that "sw95" is now the default but the conventional view is that "sw" and "sw95" almost always agree. Another bit of conventional wisdom is that "jb" is more sensitive to the tails. Is this what you find?
    2. What does qqnorm() suggest? Technical Note: You will need to use seriesData() to extract the data series to feed to qqnorm(). See the e-Handout for the example we did in class.
    3. Use qqplot() to compare the distribution of your stock returns to the distribution of the t-statistic for various degrees of freedom. If you had to model your returns as a t-statistic, what choice would you make for the degree of freedom. For example, are your returns more like normals or more like t's with df=4?
- Now a follow-up question: Is it reasonable to regard the returns as independent? Specifically, does your series exhibit significant autocorrelation? You should use the S-Plus functions acf() and autocorTest() to address these questions. Explore both the default and your own choices of the lag.n parameter.
- Write up your exploration in the usual form: a one page executive summary followed by any needed exhibits. Incorporate any *collected wisdom about writing professional reports.* This time, be particularly ready to discuss your results in class. We'll make a great table of your discoveries!

**Philosophical Perspective on the Black-Scholes Model**

It is worth recalling that the Black-Scholes formula is based on the model assumption that continuous returns can be viewed as Gaussian white noise, i.e. independent Gaussians. It is probable that your empirical investigations suggest that for the series you choose, the returns did not behave like Gaussian white noise. Can we really be so lucky as to draw a valid conclusion (the Black-Scholes formula) from an empirically unsupported model (geometric Brownian motion)?