Statistics 434: Bullet Points for Day 4
Autocorrelation in Theory, Practice, and Tests

The first question that one must ask of a *stationary time series* is simply
"Do I have any reason to believe that there is any dependence among these
values, or do they behave like independent random variables?"

Historically, the autocorrelation function (or ACF) has provided the first
line of approach. A second level tool is the Ljung-Box statistic, which provides
us with a more global view than values of the ACF. In many applications, these
tools have serve us well, but, to be sure, they have limitations. Specifically they
only help us to see only *certain kinds* of dependence. Still, they are reasonably
robust to the kinds of alternatives that appear in practice, and, as a result, these
tools are perhaps even more useful than pure theory might suggest.

- Begin with questions and comments on HW1

- Introduce the theoretical ACF

- The theoretical ACF for AR(1) — Issue of exponential decay

- The sample ACF and feasibility diagnostics for AR(1)

- Introducing the Finmetrics module

    1. acf — and help(acf). Note: We use the acf, function — not ACF.

    2. Discussion of the arima.sim function in Finmetrics

    3. Accessing the components using the "$" list extractor

    4. Plotting commands including multiple plots on a page

- Preparation for the Ljung-Box Statistic — the tools and concepts

    1. Review of the Chi-square distribution (especially the definition!)

    2. Comments on the role of the Chi-square distribution in the t-statistic

    3. Another pass at the qqplot() — this time for the Chi squared distri-
       bution

    4. Introduction to "Tests to determine dependence" — and the Ljung-
       Box Statistic

**Perspective on our Challenge**

Today we have set up the machinery to start to understand if a return series
is just "pure noise" or if there is some structure that we might be able to exploit.
This conversation requires that one understand the words "distribution," "joint
distribution," and "independence." A intuitive understanding of these words is
very important, yet such an understanding has limitations. You should confirm
for yourself that you also know the actual mathematical definition of these terms.