MS Module 3: Confidence intervals, *t* distributions, and variances (overview 3rd edition)

(The attached PDF file has better formatting.)

(Readings from the third 3rd edition of the Devore, Berk, and Carlton text.)

Read §8.3 Intervals for a Population Proportion

The textbook gives the more exact equation (8.15) instead of equation (8.16), which is the traditional Wald confidence interval, and it explains why the more exact equation is better. Confidence intervals for proportions are used in later modules, based on the reasoning behind equation 8.15. Review example 8.13.

Read the section on "Sample Size Determination." You need not know equation 8.17, but later modules discuss minimum sample sizes.

This course covers the arithmetic of statistical testing. If all assumptions are valid, the testing gives plausible results. In practice, the assumptions are often invalid. Half of the results presented in many social science fields are bogus, since the researchers use faulty assumptions. Most commonly, they omit numerous variables that affect the results. For instance, hundreds of papers conclude that police are racist, because blacks are more likely to be arrested than whites. But arrest rates depend on a host of factors, such as felony rates; the conclusions about police racism are usually unwarranted.

The textbook often discusses assumptions, but the final exam does not test these sections. For actuaries, the assumptions are critical to good work. An actuary may find that urban residents have more auto accidents than do rural residents. But urban residents may be younger, wealthier, better educated, less likely to be married, have fewer children; unless one adjusts for these other variables, results may be skewed.

Review end of chapter exercises 43 and 44.

Reading: §8.4 Confidence Intervals for the Population Variance and Standard Deviation

Confidence intervals for the variance of a population use the χ^2 distribution. This distribution is not symmetric, so the confidence interval is not symmetric about the point estimate. Know equations 8.18, 8.19, and 8.19, which are used in a later module.

Review end of chapter exercises 57, 58, and 59.

Skip §8.5 Bootstrap Confidence Intervals

Bootstrapping is especially useful when the underlying population distribution is not normal, but it requires high computing power and is not tested on the final exam.

Insurance regulation is concerned with extreme value distributions: hurricanes, epidemics, market crashes. The formulas for normal distributions do not apply to these risks, but insurers and financial economists have data bases of past events. They use bootstrapping to estimate tail values at risk and similar risk measures.