MDSC 643.01, Biostatistics I
Brant, Fall 2002

Checking Assumptions

Sampling assumptions
- random sampling?
- stratification?
- "clustered" observations - pairs, matched groups?

Distributional assumptions
- Normality
- Equal variance

Importance of assumptions?
- Validity of results
  - Confidence intervals: actual coverage = nominal confidence level
  - Significance tests: type I error rate = nominal level (α)
- Optimality of results
  - C.I.'s: narrowest feasible
  - Signif. tests: most powerful test - best chance of significance

Under the standard assumptions, t-tests are valid and optimal!

If the assumptions are untrue?

Validity
- t-tests are reliable under mild to moderate deviations from assumptions
  - exception: t-test (unpaired): sample sizes unbalanced, variances markedly different

Efficiency (optimality)
- t-tests not so robust of efficiency
  - may have sub-optimal power, overly wide C.I.'s
- graphical inspection may indicate "simple" remedies

Examining assumptions

two schools of thought – test-based and graphical approaches

Significance tests for assumptions

- normality- e.g. Wilks-Shapiro test (based on normal quantile plot)
  - not widely recommended or used
- equality of variances
  - F-test for comparing variances is very non-robust.
  - Two sample t-test is quite robust (of validity) for nearly equal sample sizes
- outlier-tests
  - e.g. Rosner's ESD procedure
    - not widely applied
    - "boxplot" rules work about as well.
    - deleting outliers not an accepted procedure

Graphical approach

- Apply the IOT (intra-ocular trauma) test to Boxplots, Quantile plots
- Transformations, especially log transformations often cure both skewness and "heteroskedasticity" (unequal variances).
  - results need to be back-transformed
  - easiest for logarithms (multiplicative interpretation).