Statistics 523 Nonparametric Statistics

(see Course Descriptions for the applicable academic year: http://www.ucalgary.ca/pubs/calendar/)

Reference Text: E.L. Lehmann, "Nonparametrics: Statistical Methods Based on Ranks", McGraw-Hill, New York, 1975. (not necessarily a required text)

The linear rank statistic material is from the book by Randles & Wolfe. The timing is very much book-dependent. Note the 20 hours devoted to the two independent samples problem.

Syllabus

Topics	**Number of Hours**
Introduction: parametric versus nonparametric theory; the sign test	1
Wilcoxon rank-sum test. Deriving the null distribution, p-values	2
Symmetry of the distribution; equivalence to the Mann-Whitney test (proofs), derivation of the mean and variance; asymptotic normality (proof later)	4
Treatment of ties; two-sided alternatives, tests for variability (Siegel-Tukey), Smirnov's test	4
Population models; power of the Wilcoxon rank sum test; unbiasedness	2
Asymptotic power (normal example), power for local alternatives (normal example)	2
Comparison with the t-test, efficiency, Pitman efficiency	2
Estimation and confidence intervals for the treatment effect	2
Further two-sample results: Behrens-Fisher problem, normal scores test, efficiency	1
Paired samples; Wilcoxon signed-rank test, derivation of the null distribution, p-value derivation of the mean and variance, asymptotic normality (proof later), tied ranks	3
Combining data from different blocks*	2
Population models for paired comparisons, sign test (power), Wilcoxon signed-rank test (power), comparisons with the t-distribution, estimation of location	3
Kruskal-Wallis test, tied observations, normal scores, Kiefer's test	1
Friedman test, tied observations, dichotomous responses*, aligned ranks	2
Linear rank statistics, examples, asymptotic normality (proof)	5

* Optional topics

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MDB 1991.03
Prereq change Fall 2009

Course Outcomes

By the end of the course, students will be expected to:

1. Differentiate between parametric and nonparametric statistics and identify their advantages and disadvantages

2. Describe the fundamental concepts used in developing nonparametric methods: empirical distribution, quantile, binomial distribution, permutation and transformation, rank statistic, etc

3. Explain the use of mathematics and probability theories behind the nonparametric methods

4. Determine and apply appropriate nonparametric methods for different data type and data structure

5. Implement nonparametric estimation and hypothesis testing with the use of software

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08:15:17 (course outcomes added)
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