

Math 362: Mathematical Statistics II

Le Chen

le.chen@emory.edu

Emory University
Atlanta, GA

Last updated on April 24, 2021

2021 Spring

Chapter 14. Nonparametric Statistics

§ 14.1 Introduction

§ 14.2 The Sign Test

§ 14.3 Wilcoxon Tests

§ 14.4 The Kruskal-Wallis Test

§ 14.5 The Friedman Test

§ 14.6 Testing for Randomness

Plan

§ 14.1 Introduction

§ 14.2 The Sign Test

§ 14.3 Wilcoxon Tests

§ 14.4 The Kruskal-Wallis Test

§ 14.5 The Friedman Test

§ 14.6 Testing for Randomness

Chapter 14. Nonparametric Statistics

§ 14.1 Introduction

§ 14.2 The Sign Test

§ 14.3 Wilcoxon Tests

§ 14.4 The Kruskal-Wallis Test

§ 14.5 The Friedman Test

§ 14.6 Testing for Randomness

Nonparametric statistics

- ▶ *Distribution-free methods* : do not rely on assumptions that the data are drawn from a given parametric family of probability distributions.
- ▶ *Nonparametric statistics*: a statistic is defined to be a function on a sample and there is no dependency on any parameters, such as

Nonparametric statistics

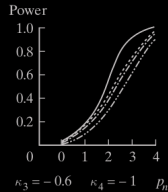
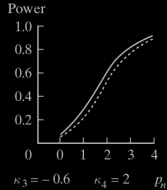
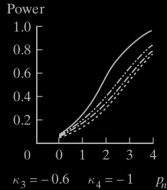
- ▶ *Distribution-free methods* : do not rely on assumptions that the data are drawn from a given parametric family of probability distributions.
- ▶ *Nonparametric statistics*: a statistic is defined to be a function on a sample and there is no dependency on any parameters, such as
 - *Order statistics*

Nonparametric statistics

- ▶ *Distribution-free methods* : do not rely on assumptions that the data are drawn from a given parametric family of probability distributions.
- ▶ *Nonparametric statistics*: a statistic is defined to be a function on a sample and there is no dependency on any parameters, such as
 - *Order statistics*

Nonparametric vs. Parametric methods

– Power of Test



► Solid line: one-sample t-test

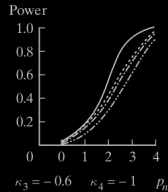
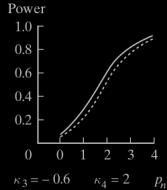
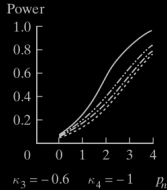
(parametric test)

► Dashed lines: the sign test

(nonparametric test)

Nonparametric vs. Parametric methods

– Power of Test



- ▶ Solid line: one-sample t-test (parametric test)
- ▶ Dashed lines: the sign test (nonparametric test)

Nonparametric vs. Parametric methods

Nonparametric methods usually produce

- ▶ Greater variance in point estimation
- ▶ Less power in hypothesis-testing
- ▶ Wider confidence intervals
- ▶ Lower probability of correct selection (in ranking and selection)
- ▶ Higher risk (in decision theory)

Hence, use nonparametric methods only when

The underlying assumptions for the probability distributions are seriously doubtful.

Nonparametric vs. Parametric methods

Nonparametric methods usually produce

- ▶ Greater variance in point estimation
- ▶ Less power in hypothesis-testing
- ▶ Wider confidence intervals
- ▶ Lower probability of correct selection (in ranking and selection)
- ▶ Higher risk (in decision theory)

Hence, use nonparametric methods only when

The underlying assumptions for the probability distributions are seriously doubtful.

Nonparametric vs. Parametric methods

Nonparametric methods usually produce

- ▶ Greater variance in point estimation
- ▶ Less power in hypothesis-testing
- ▶ Wider confidence intervals
- ▶ Lower probability of correct selection (in ranking and selection)
- ▶ Higher risk (in decision theory)

Hence, use nonparametric methods only when

The underlying assumptions for the probability distributions are seriously doubtful.

Nonparametric vs. Parametric methods

Nonparametric methods usually produce

- ▶ Greater variance in point estimation
- ▶ Less power in hypothesis-testing
- ▶ Wider confidence intervals
- ▶ Lower probability of correct selection (in ranking and selection)
- ▶ Higher risk (in decision theory)

Hence, use nonparametric methods only when

The underlying assumptions for the probability distributions are seriously doubtful.

Nonparametric vs. Parametric methods

Nonparametric methods usually produce

- ▶ Greater variance in point estimation
- ▶ Less power in hypothesis-testing
- ▶ Wider confidence intervals
- ▶ Lower probability of correct selection (in ranking and selection)
- ▶ Higher risk (in decision theory)

Hence, use nonparametric methods only when

The underlying assumptions for the probability distributions are seriously doubtful.