

4.4 Non-parametric tests

Name: _____ Class: _____ Date: _____ **Total: 11 marks**

KEY WORDS wilcoxon signed-rank 符号秩 • wilcoxon signed-rank test 威尔科克森符号秩检验
• rank-sum 秩和 • sign test 符号检验 • non-parametric tests 非参数检验

Objective

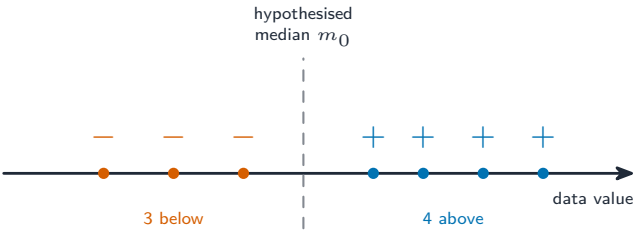
Build the skills to answer exam questions on **non-parametric tests** 非参数检验 — the **sign test** 符号检验, the **Wilcoxon signed-rank** 符号秩 (matched-pairs) test, and the **rank-sum** 秩和 test.

You must be able to:

- carry out a sign test using a binomial model
- carry out a Wilcoxon signed-rank test on paired data
- choose the right non-parametric test and state when to use one

1 Worked examples

■ The sign test



The sign test counts values above/below a proposed median, then tests the counts with a binomial model

Sign test for median = m_0 : count + and - signs; under H_0 the number of + is $\sim B(n, 0.5)$; a very lopsided count is significant.

2 Practice

2.1 State when a non-parametric test is preferred over a t-test. [1]

2.2 In a sign test, state the distribution of the number of positive signs under H_0 . [1]

3 Exam-style questions

3.1 The Wilcoxon signed-rank test uses, in addition to the signs of the differences: [1]

- | | |
|---|---|
| A | B |
| C | D |
- A nothing else
B the sizes (ranks) of the differences
C the sample mean
D the population variance

3.2 Ten people rate a product before and after a change. Eight rate it higher (+) and two lower (-).

(a) State H_0 and H_1 for a sign test of "no change" vs "an improvement". [2]

(b) Using $X \sim B(10, 0.5)$, find $P(X \geq 8)$ and state the conclusion at the 5% level. [4]

3.3 Explain why a non-parametric test might be chosen instead of a t-test for a small sample. [2]