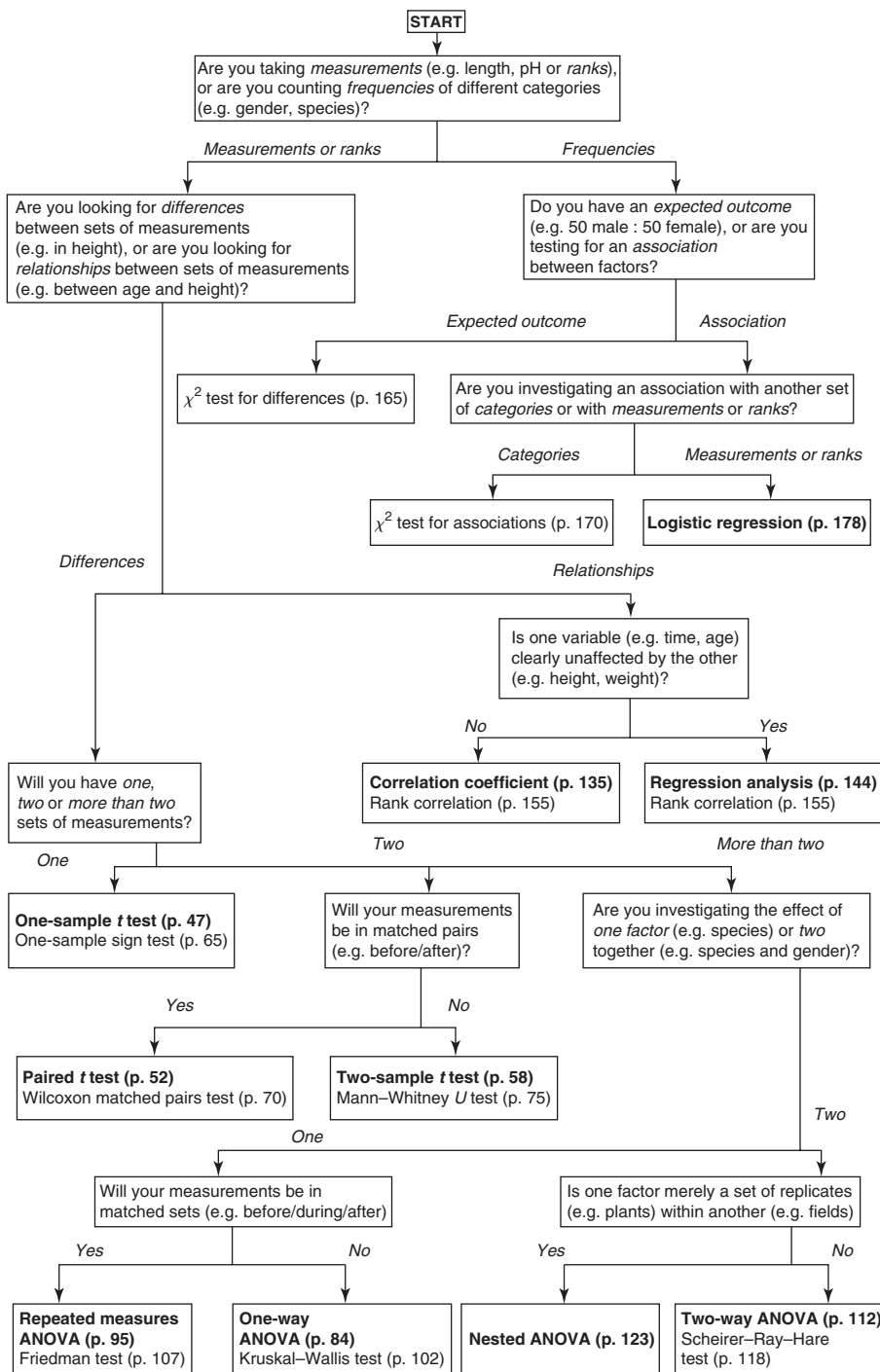


Statistical and Data Handling Skills in Biology

Fourth Edition

Roland Ennos &
Magnus L. Johnson



Statistical and Data Handling Skills in Biology

Table of Contents

Cover

Inside Front Cover

Title Page

Copyright Page

Dedication

Brief contents

Contents

List of figures and tables

Preface

Publishers acknowledgements

1 An introduction to statistics

1.1 Becoming a biologist

1.2 Awkward questions

1.3 Why biologists have to repeat everything

1.4 Why biologists have to bother with statistics

1.5 Why statistical logic is so strange

1.6 Why there are so many statistical tests

1.7 Using the decision chart

1.8 Using this text

2 Dealing with variability

2.1 Introduction

2.2 Examining the distribution of data

2.3 The normal distribution

2.4 Describing the normal distribution

Table of Contents

- 2.5 The variability of samples
- 2.6 Confidence limits
- 2.7 Presenting descriptive statistics and confidence limits
- 2.8 Introducing computer programs
- 2.9 Calculating descriptive statistics
- 2.10 Self-assessment problems

3 Testing for normality and transforming data

- 3.1 The importance of normality testing
- 3.2 The ShapiroWilk test
- 3.3 What to do if your data has a significantly different distribution from the normal
- 3.4 Examining data in practice
- 3.5 Transforming data
- 3.6 The complete testing procedure
- 3.7 Self-assessment problems

4 Testing for differences from an expected value or between two groups

- 4.1 Introduction
- 4.2 Why we need statistical tests for differences
- 4.3 How we test for differences
- 4.4 One- and two-tailed tests
- 4.5 The types of t test and their non-parametric equivalents
- 4.6 The one-sample t test
- 4.7 The paired t test
- 4.8 The two-sample t test
- 4.9 Introduction to non-parametric tests for differences
- 4.10 The one-sample sign test
- 4.11 The Wilcoxon matched pairs test
- 4.12 The MannWhitney U test

Table of Contents

4.13 Self-assessment problems

5 Testing for differences between more than two groups: ANOVA and its non-parametric equivalents

5.1 Introduction

5.2 One-way ANOVA

5.3 Deciding which groups are different post hoc tests

5.4 Presenting the results of one-way ANOVAs

5.5 Repeated measures ANOVA

5.6 The KruskalWallis test

5.7 The Friedman test

5.8 Two-way ANOVA

5.9 The ScheirerRayHare Test

5.10 Nested ANOVA

5.11 Self-assessment problems

6 Investigating relationships

6.1 Introduction

6.2 Examining data for relationships

6.3 Examining graphs

6.4 Linear relationships

6.5 Statistical tests for linear relationships

6.6 Correlation

6.7 Regression

6.8 Studying common non-linear relationships

6.9 Dealing with non-normally distributed data: rank correlation

6.10 Self-assessment problems

7 Dealing with categorical data

7.1 Introduction

7.2 The problem of variation

Table of Contents

7.3 The χ^2 test for differences

7.4 The χ^2 test for association

7.5 Validity of χ^2 of tests

7.6 Logistic regression

7.7 Self-assessment problems

8 Designing experiments

8.1 Introduction

8.2 Preparation

8.3 Excluding confounding variables

8.4 Replication and pseudoreplication

8.5 Randomisation and blocking

8.6 Choosing the statistical test

8.7 Choosing the number of replicates: power calculations

8.8 Dealing with your results

8.9 Self-assessment problems

9 More complex statistical analysis

9.1 Introduction to complex statistics

9.2 Experiments investigating several factors

9.3 Experiments in which you cannot control all the variables

9.4 Investigating the relationships between several variables

9.5 Exploring data to investigate groupings

10 Presenting and writing about statistics

10.1 Introduction less is more!

10.2 The introduction section

10.3 The methods section

10.4 The results section

10.5 The discussion section

10.6 The abstract or summary

Table of Contents

Glossary

A
B
C
D
E
F
G
I
L
M
N
P
Q
R
S
T
V

Further reading

Solutions

Statistical tables

Table S1: Critical values for the t statistic

Table S2: Critical values for the correlation coefficient r

Table S3: Critical values for the χ^2 statistic

Table S4: Critical values for the Wilcoxon T distribution

Table S5: Critical values for the MannWhitney U distribution

Table S6: Critical values for the Friedman χ^2 distribution

Table S7: Critical values for the Spearman rank correlation coefficient

Table of Contents

Index

Inside Back Cover

Back Cover