Preface

After studying experimental design a researcher or statistician should be able to: (1) choose an experimental design that is appropriate for the research problem at hand; (2) construct the design (including performing proper randomization and determining the required number of replicates); (3) execute the plan to collect the data (or advise a colleague on how to do it); (4) determine the model appropriate for the data; (5) fit the model to the data; and (6) interpret the data and present the results in a meaningful way to answer the research question. The purpose of this book is to focus on connecting the objectives of research to the type of experimental design required, describing the actual process of creating the design and collecting the data, showing how to perform the proper analysis of the data, and illustrating the interpretation of results. Exposition on the mechanics of computation is minimized by relying on a statistical software package.

With the availability of modern statistical computing packages, the analysis of data has become much easier and is well covered in statistical methods books. In a book on the design and analysis of experiments, there is no longer a need to show all the computational formulas that were necessary before the advent of modern computing. However, there is a need for careful explanation of how to get the proper analysis from a computer package. The default analysis performed by most statistical software assumes the data have come from a completely randomized design. In practice, this is often a false assumption. This book emphasizes the connection between the experimental units, and the way treatments are randomized to experimental units, and the proper error term for an analysis of the data.

R is used throughout the book to illustrate both construction of experimental designs and analysis of data. R was chosen to be illustrated in the book because it is an open-source software that can be downloaded free of charge for Windows, Linux, and Macintosh operating systems from `www.r-project.org`. Additionally, user developed packages for R have given it extensive capabilities in both creating experimental designs and analyzing data. Information about many of these user written packages is available on the Web site `http://cran.r-project.org/web/views/ExperimentalDesign.html` that is maintained by Ulrike Groemping. User written packages along with base R functionality are illustrated in many examples in the text. The packages simplify things that could require extensive R coding without their use. The code examples in the book are available for download on the Web site `https://lawsonjsl7.netlify.app/webbook/`. The R code in this book duplicates