

EDUCATION

The Quantitative Methods Boot Camp: Teaching Quantitative Thinking and Computing Skills to Graduate Students in the Life Sciences

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Abstract

The past decade has seen a rapid increase in the ability of biologists to collect large amounts of data. It is therefore vital that research biologists acquire the necessary skills during their training to visualize, analyze, and interpret such data. To begin to meet this need, we have developed a “boot camp” in quantitative methods for biology graduate students at Harvard Medical School. The goal of this short, intensive course is to enable students to use computational tools to visualize and analyze data, to strengthen their computational thinking skills, and to simulate and thus extend their intuition about the behavior of complex biological systems. The boot camp teaches basic programming using biological examples from statistics, image processing, and data analysis. This integrative approach to teaching programming and quantitative reasoning motivates students’ engagement by demonstrating the relevance of these skills to their work in life science laboratories. Students also have the opportunity to analyze their own data or explore a topic of interest in more detail. The class is taught with a mixture of short lectures, Socratic discussion, and in-class exercises. Students spend approximately 40% of their class time working through both short and long problems. A high instructor-to-student ratio allows students to get assistance or additional challenges when needed, thus enhancing the experience for students at all levels of mastery. Data collected from end-of-course surveys from the last five offerings of the course (between 2012 and 2014) show that students report high learning gains and feel that the course prepares them for solving quantitative and computational problems they will encounter in their research. We outline our course here which, together with the course materials freely available online under a Creative Commons License, should help to facilitate similar efforts by others.

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Table of Contents Quantitative Methods For Computing Students

1. Understanding the eBook Quantitative Methods For Computing Students
 - The Rise of Digital Reading Quantitative Methods For Computing Students
 - Advantages of eBooks Over Traditional Books
2. Identifying Quantitative Methods For Computing Students
 - Exploring Different Genres
 - Considering Fiction vs. Non-Fiction
 - Determining Your Reading Goals
3. Choosing the Right eBook Platform
 - Popular eBook Platforms
 - Features to Look for in an Quantitative Methods For Computing Students
 - User-Friendly Interface
4. Exploring eBook Recommendations from Quantitative Methods For Computing Students
 - Personalized Recommendations
 - Quantitative Methods For Computing Students User Reviews and Ratings
 - Quantitative Methods For Computing Students and Bestseller Lists
5. Accessing Quantitative Methods For Computing Students Free and Paid eBooks
 - Quantitative Methods For Computing Students Public Domain eBooks

- Quantitative Methods For Computing Students eBook Subscription Services
- Quantitative Methods For Computing Students Budget-Friendly Options
- 6. Navigating Quantitative Methods For Computing Students eBook Formats
 - ePub, PDF, MOBI, and More
 - Quantitative Methods For Computing Students Compatibility with Devices
 - Quantitative Methods For Computing Students Enhanced eBook Features
- 7. Enhancing Your Reading Experience
 - Adjustable Fonts and Text Sizes of Quantitative Methods For Computing Students
 - Highlighting and Note-Taking Quantitative Methods For Computing Students
 - Interactive Elements Quantitative Methods For Computing Students
- 8. Staying Engaged with Quantitative Methods For Computing Students
 - Joining Online Reading Communities
 - Participating in Virtual Book Clubs
 - Following Authors and Publishers Quantitative Methods For Computing Students
- 9. Balancing eBooks and Physical Books Quantitative Methods For Computing Students
 - Benefits of a Digital Library
 - Creating a Diverse Reading Collection Quantitative Methods For Computing Students
- 10. Overcoming Reading Challenges
 - Dealing with Digital Eye Strain
 - Minimizing Distractions
 - Managing Screen Time
- 11. Cultivating a Reading Routine Quantitative Methods For Computing Students
 - Setting Reading Goals Quantitative Methods For Computing Students
 - Carving Out Dedicated Reading Time
- 12. Sourcing Reliable Information of Quantitative Methods For Computing Students
 - Fact-Checking eBook Content of Quantitative Methods For Computing Students
 - Distinguishing Credible Sources
- 13. Promoting Lifelong Learning
 - Utilizing eBooks for Skill Development
 - Exploring Educational eBooks

14. Embracing eBook Trends

- Integration of Multimedia Elements
- Interactive and Gamified eBooks

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