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Starting Out with Java

Early Objects

FIFTH EDITION

Tony Gaddis

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Java[™]

Early Objects

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GLOBAL EDITION**

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Preface

Welcome to *Starting Out with Java: Early Objects*, Fifth Edition. This book is intended for a one-semester or a two-quarter CS1 course. Although it is written for students with no prior programming background, even experienced students will benefit from its depth of detail.

Early Objects, Late Graphics

The approach taken by this text can be described as “early objects, late graphics.” The student is introduced to object-oriented programming (OOP) early in the book. The fundamentals of control structures, classes, and the OOP paradigm are thoroughly covered before moving on to graphics and more powerful applications of the Java language.

As with all the books in the *Starting Out With* series, the hallmark of this text is its clear, friendly, and easy-to-understand writing. In addition, it is rich in example programs that are concise and practical.

New to this edition:

- **A New Chapter on JavaFX:** New to this edition is *Chapter 14: Creating GUI Applications with JavaFX*. JavaFX is the next-generation toolkit for creating GUIs and graphical applications in Java and is bundled with Java 7 and Java 8. This new chapter introduces the student to the JavaFX library and shows how to use Scene Builder (a free download from Oracle) to visually design GUIs. The chapter is written in such a way that it is independent from the existing chapters on Swing and AWT. The instructor can choose to skip the Swing and AWT chapters and go straight to JavaFX, or cover all of the GUI chapters.
- **Rewritten Database Chapter:** The database chapter, which is now Chapter 16, has been rewritten with more examples and more detailed explanations of various database operations.
- **Coverage of `System.out.printf` Has Been Expanded:** The section on `System.out.printf` in Chapter 2 has been completely rewritten and expanded to include diagrams and coverage of additional format specifiers.
- **`System.out.printf` Is Primarily Used For Formatting Console Output:** In this edition, `System.out.printf` is used as the primary method for formatting output in console programs. The `DecimalFormat` class is still introduced, but it is used to format numbers in GUI applications.

- **Discussion of Nested Loops Has Been Expanded:** In Chapter 4 the section on nested loops has been expanded to include an *In the Spotlight* section highlighting the use of nested loops to print patterns.
- **Usage of Random Numbers Has Been Expanded:** In Chapter 4 the section on random numbers has been expanded and now includes *In the Spotlight* sections demonstrating how random numbers can be used to simulate the rolling of dice.
- **New Motivational Example of Classes Has Been Added to Chapter 6:** In Chapter 6, a new motivational example of classes has been added. The example shows how a variation of the game of Cho-Han can be simulated with classes that represent the players, a dealer, and the dice.
- **Multi-Catch Exception Handling:** A discussion of multi-catch exception handling has been added to Chapter 10.
- **Equipping Swing GUI Applications with a Static `main` Method is Introduced Earlier:** In Chapter 11, *GUI Applications—Part 1*, the topic of equipping a GUI class with a static `main` method has been moved to a point very early in the chapter.
- **New Exercises and Programming Problems:** New, motivational programming problems have been added to many of the chapters.

Organization of the Text

The text teaches Java step-by-step. Each chapter covers a major set of topics and builds knowledge as students progress through the book. Although the chapters can be easily taught in their existing sequence, there is some flexibility. Figure P-1 shows chapter dependencies. Each box represents a chapter or a group of chapters. A solid-line arrow points from one chapter to the chapter that must be covered previously. A dotted-line arrow indicates that only a section or minor portion of the chapter depends on another chapter.

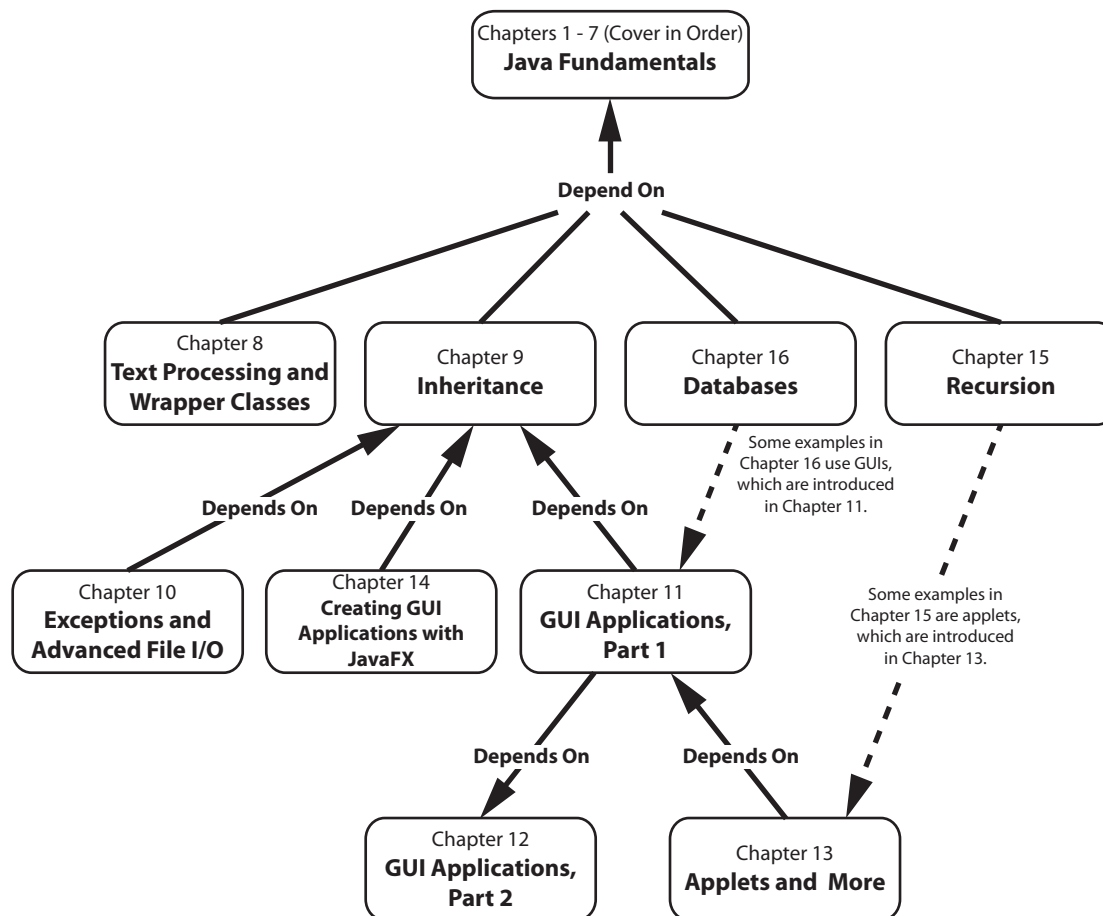
Brief Overview of Each Chapter

Chapter 1: Introduction to Computers and Java. This chapter provides an introduction to the field of computer science, and covers the fundamentals of hardware, software, and programming languages. The elements of a program, such as key words, variables, operators, and punctuation are discussed through the examination of a simple program. An overview of entering source code, compiling it, and executing it is presented. A brief history of Java is also given. The chapter concludes with a primer on OOP.

Chapter 2: Java Fundamentals. This chapter gets the student started in Java by introducing data types, identifiers, variable declarations, constants, comments, program output, and arithmetic operations. The conventions of programming style are also introduced. The student learns to read console input with the `Scanner` class, or as an option, through dialog boxes with `JOptionPane`.

Chapter 3: A First Look at Classes and Objects. This chapter introduces the student to classes. Once the student learns about fields and methods, UML diagrams are introduced as a design tool. The student learns to write simple `void` methods, as well as simple methods that return a value. Arguments and parameters are also discussed. Finally, the student learns how to write constructors, and the concept of the default constructor is discussed. A `BankAccount` class is presented as a case study, and a section on

Figure P-1 Chapter Dependencies



object-oriented design is included. This section leads the students through the process of identifying classes and their responsibilities within a problem domain. There is also a section that briefly explains packages and the `import` statement.

Chapter 4: Decision Structures. Here the student explores relational operators and relational expressions and is shown how to control the flow of a program with the `if`, `if/else`, and `if/else if` statements. The conditional operator and the `switch` statement are also covered. This chapter also discusses how to compare `String` objects with the `equals`, `compareTo`, `equalsIgnoreCase`, and `compareToIgnoreCase` methods. Formatting numeric output with the `DecimalFormat` class is covered. An object-oriented case study shows how lengthy algorithms can be decomposed into several methods.

Chapter 5: Loops and Files. This chapter covers Java's repetition control structures. The `while` loop, `do-while` loop, and `for` loop are taught, along with common uses for these devices. Counters, accumulators, running totals, sentinels, and other application-related topics are discussed. Simple file operations for reading and writing text files are also covered.

Chapter 6: A Second Look at Classes and Objects. This chapter shows students how to write classes with added capabilities. Static methods and fields, interaction between objects, passing objects as arguments, and returning objects from methods are discussed. Aggregation and the “has a” relationship is covered, as well as enumerated types. A section on object-oriented design shows how to use CRC (class, responsibilities, and collaborations) cards to determine the collaborations among classes.

Chapter 7: Arrays and the ArrayList Class. In this chapter students learn to create and work with single and multidimensional arrays. Numerous array-processing techniques are demonstrated, such as summing the elements in an array, finding the highest and lowest values, and sequentially searching an array are also discussed. Other topics, including ragged arrays and variable-length arguments (varargs), are also discussed. The `ArrayList` class is introduced, and Java’s generic types are briefly discussed and demonstrated.

Chapter 8: Text Processing and Wrapper Classes. This chapter discusses the numeric and character wrapper classes. Methods for converting numbers to strings, testing the case of characters, and converting the case of characters are covered. Autoboxing and unboxing are also discussed. More `String` class methods are covered, including using the `split` method to tokenize strings. The chapter also covers the `StringBuilder` and `StringTokenizer` classes.

Chapter 9: Inheritance. The study of classes continues in this chapter with the subjects of inheritance and polymorphism. The topics covered include superclass and subclass constructors, method overriding, polymorphism and dynamic binding, protected and package access, class hierarchies, abstract classes and methods, and interfaces.

Chapter 10: Exceptions and Advanced File I/O. In this chapter the student learns to develop enhanced error trapping techniques using exceptions. Handling an exception is covered, as well as developing and throwing custom exceptions. This chapter also discusses advanced techniques for working with sequential access, random access, text, and binary files.

Chapter 11: GUI Applications—Part 1. This chapter presents the basics of developing graphical user interface (GUI) applications with Swing. Fundamental Swing components and the basic concepts of event-driven programming are covered.

Chapter 12: GUI Applications—Part 2. This chapter continues the study of GUI application development. More advanced components, as well as menu systems and look-and-feel, are covered.

Chapter 13: Applets and More. Here the student applies his or her knowledge of GUI development to the creation of applets. In addition to using Swing applet classes, Abstract Windowing Toolkit classes are also discussed for portability. Drawing simple graphical shapes is also discussed.

Chapter 14: Creating GUI Applications with JavaFX. This chapter introduces JavaFX, which is the next generation library for creating graphical applications in Java. This chapter also shows how to use Scene Builder, a free screen designer from Oracle, to visually design GUIs. This chapter is written in such a way that it is independent from the existing chapters on Swing and AWT. You can choose to skip Chapters 11, 12, and 13, and go straight to Chapter 14, or cover all of the GUI chapters.

Chapter 15: Recursion. This chapter presents recursion as a problem-solving technique. Numerous examples of recursion are demonstrated.

Chapter 16: Databases. This chapter introduces the student to database programming. The basic concepts of database management systems and SQL are first presented. Then the student learns to use JDBC to write database applications in Java. Relational data is covered, and numerous example programs are presented throughout the chapter.

Appendix A. Getting Started with Alice

Appendixes B–M and Case Studies 1-5 are available on the book’s online resource page at www.pearsonglobaleditions.com/Gaddis.

Features of the Text

Concept Statements Each major section of the text starts with a concept statement. This statement summarizes the ideas of the section.

Example Programs The text has an abundant number of complete example programs, each designed to highlight the topic currently being studied. In most cases, these are practical, real-world examples. Source code for these programs is provided so that students can run the programs themselves.

Program Output After each example program there is a sample of its screen output. This immediately shows the student how the program should function.



Checkpoints

Checkpoints are questions placed throughout each chapter as a self-test study aid. Answers for all Checkpoint questions are found in Appendix L (available for download) so students can check how well they have learned a new topic. To download Appendix L, go to the Gaddis resource page at www.pearsonglobaleditions.com/Gaddis.



NOTE: Notes appear at appropriate places throughout the text. They are short explanations of interesting or often misunderstood points relevant to the topic at hand.



WARNING! Warnings are notes that caution the student about certain Java features, programming techniques, or practices that can lead to malfunctioning programs or lost data.



VidoeNotes. A series of online videos, developed specifically for this book, are available for viewing at www.pearsonglobaleditions.com/Gaddis. Icons appear throughout the text alerting the student to videos about specific topics.

Case Studies Case studies that simulate real-world applications appear in many chapters throughout the text, with complete code provided for each. These case studies are designed to highlight the major topics of the chapter in which they appear.

Review Questions and Exercises Each chapter presents a thorough and diverse set of review questions and exercises. They include Multiple Choice and True/False, Find the Error, Algorithm Workbench, and Short Answer.

Programming Challenges Each chapter offers a pool of programming challenges designed to solidify students' knowledge of topics at hand. In most cases the assignments present real-world problems to be solved.



In the Spotlight. Many of the chapters provide an *In the Spotlight* section that presents a programming problem, along with detailed, step-by-step analysis showing the student how to solve it.

Supplements

Companion Website

Many student resources are available for this book from the book's Companion Website. Visit www.pearsonglobaleditions.com/Gaddis to access the following resources on the Companion Website using the Access Code printed on the inside of the front cover.

- The source code for each example program in the book
- Access to the book's companion VideoNotes
- Appendixes B–M (listed in the Table of Contents)
- A collection of five valuable Case Studies (listed in the Table of Contents)
- Links to download the Java™ Development Kit
- Links to download numerous programming environments, including jGRASP™, Eclipse™, TextPad™, NetBeans™, JCreator, and DrJava

Instructor Resources

The following supplements are available to qualified instructors only. Visit www.pearsonglobaleditions.com/Gaddis for information on how to access them:

- Answers to all Review Questions in the text
- Solutions for all Programming Challenges in the text
- PowerPoint presentation slides for every chapter
- Computerized test bank

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