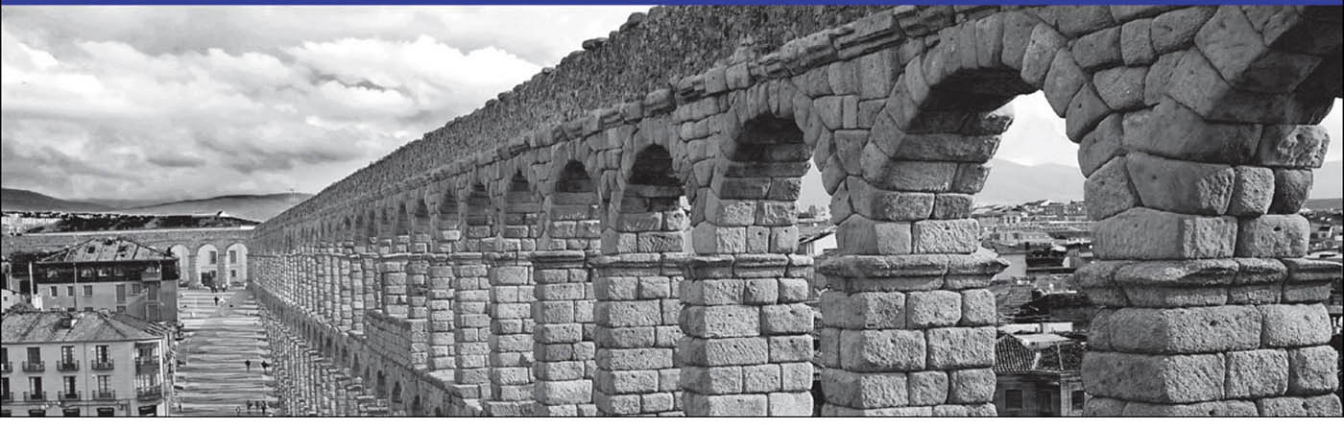
Luke Welling
Laura Thomson

New
PHP 7
Coverage

PHP and MySQL® Web Development

Fifth Edition



FREE SAMPLE CHAPTER

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The **Aqueduct of Segovia** is one of the greatest surviving monuments of Roman engineering. Built during the time of the emperor Trajan in the first century A.D., it was designed to bring water from the foothills of the Sierra de Guadarrama to the city of Segovia, Spain, some 18 kilometers away.

The structure is built with over 20,000 roughhewn granite blocks, held together entirely without cement or clamps. The 278 meter-long section of the aqueduct that winds through the center of the city has two levels of arches, forming an elegant latticework of stone 34 meters above the city's streets.

After 2,000 years of weathering both natural and man-made calamities, this timeless example of human ingenuity is still in use today providing a supplemental water supply for the city.

"I've never purchased a better programming book… This book proved to be the most informative, easiest to follow, and had the best examples of any other computer-related book I have ever purchased. The text is very easy to follow!"

—Nick Landman

"This book by Welling & Thomson is the only one which I have found to be indispensable. The writing is clear and straightforward but never wastes my time. The book is extremely well laid out. The chapters are the right length and chapter titles quickly take you where you want to go."

—Wright Sullivan, President,
A&E Engineering, Inc.,
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"I just wanted to tell you that I think the book PHP and MySQL Web Development rocks! It's logically structured, just the right difficulty level for me (intermediate), interesting and easy to read, and, of course, full of valuable information!"

—CodE-E, Austria

"There are several good introductory books on PHP, but Welling & Thomson is an excellent handbook for those who wish to build up complex and reliable systems. It's obvious that the authors have a strong background in the development of professional applications and they teach not only the language itself, but also how to use it with good software engineering practices."

—Javier Garcia, senior telecom engineer, Telefonica R&D Labs, Madrid

"I picked up this book two days ago and I am half way finished. I just can't put it down. The layout and flow is perfect. Everything is presented in such a way so that the information is very palatable. I am able to immediately grasp all the concepts. The examples have also been wonderful. I just had to take some time out to express to you how pleased I have been with this book."

—Jason B. Lancaster

"This book has proven a trusty companion, with an excellent crash course in PHP and superb coverage of MySQL as used for Web applications. It also features several complete applications that are great examples of how to construct modular, scalable applications with PHP. Whether you are a PHP newbie or a veteran in search of a better desk-side reference, this one is sure to please!"

—WebDynamic

"The true PHP/MySQL bible, PHP and MySQL Web Development by Luke Welling and Laura Thomson, made me realize that programming and databases are now available to the commoners. Again, I know 1/10000th of what there is to know, and already I'm enthralled."

—Tim Luoma, TnTLuoma.com

"Welling and Thomson's book is a good reference for those who want to get to grips with practical projects straight off the bat. It includes webmail, shopping cart, session control, and web-forum/weblog applications as a matter of course, and begins with a sturdy look at PHP first, moving to MySQL once the basics are covered."

—twilight30 on Slashdot

"This book is absolutely excellent, to say the least…. Luke Welling and Laura Thomson give the best in-depth explanations I've come across on such things as regular expressions, classes and objects, sessions etc. I really feel this book filled in a lot of gaps for me with things I didn't quite understand…. This book jumps right into the functions and features most commonly used with PHP, and from there it continues in describing real-world projects, MySQL integration, and security issues from a project manager's point of view. I found every bit of this book to be well organized and easy to understand."

—notepad on codewalkers.com

"A top-notch reference for programmers using PHP and MySQL. Highly recommended."

—The Internet Writing Journal

"This book rocks! I am an experienced programmer, so I didn't need a lot of help with PHP syntax; after all, it's very close to C/C++. I don't know a thing about databases, though, so when I wanted to develop a book review engine (among other projects) I wanted a solid reference to using MySQL with PHP. I have O'Reilly's mSQL and MySQL book, and it's probably a better pure-SQL reference, but this book has earned a place on my reference shelf…Highly recommended."

—Paul Robichaux

"One of the best programming guides I've ever read."

—jackofsometrades from Lahti, Finland

"This is a well-written book for learning how to build Internet applications with two of the most popular open-source Web development technologies…. The projects are the real jewel of the book. Not only are the projects described and constructed in a logical, component-based manner, but the selection of projects represents an excellent cross-section of common components that are built into many web sites."

—Craig Cecil

"The book takes an easy, step-by-step approach to introduce even the clueless programmer to the language of PHP. On top of that, I often find myself referring back to it in my Web design efforts. I'm still learning new things about PHP, but this book gave me a solid foundation from which to start and continues to help me to this day."

—Stephen Ward

"This book is one of few that really touched me and made me 'love' it. I can't put it in my bookshelf; I must put it in a touchable place on my working bench as I always like to refer from it. Its structure is good, wordings are simple and straight forward, and examples are clear and step by step. Before I read it, I knew nothing of PHP and MySQL. After reading it, I have the confidence and skill to develop any complicated Web application."

—Power Wong

"This book is God…. I highly recommend this book to anyone who wants to jump in the deep end with database driven Web application programming. I wish more computer books were organized this way."

—Sean C Schertell

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Fifth Edition

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Luke Welling
Laura Thomson

Addison-Wesley

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Technical Editor
Julie Meloni

Contents at a Glance

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Lead Authors

Laura Thomson is Director of Engineering at Mozilla Corporation. She was formerly a principal at both OmniTI and Tangled Web Design, and she has worked for RMIT University and the Boston Consulting Group. She holds a Bachelor of Applied Science (Computer Science) degree and a Bachelor of Engineering (Computer Systems Engineering) degree with honors. In her spare time she enjoys riding horses, arguing about free and open source software, and sleeping.

Luke Welling is a software engineer and regularly speaks on open source and web development topics at conferences such as OSCON, ZendCon, MySQLUC, PHPCon, OSDC, and LinuxTag. He has worked for OmniTI, for the web analytics company Hitwise.com, at the database vendor MySQL AB, and as an independent consultant at Tangled Web Design. He has taught computer science at RMIT University in Melbourne, Australia, and holds a Bachelor of Applied Science (Computer Science) degree. In his spare time, he attempts to perfect his insomnia.

Contributing Authors

Julie C. Meloni is a software development manager and technical consultant living in Washington,D.C. She has written several books and articles on web-based programming languages and database topics, including the bestselling *Sams Teach Yourself PHP, MySQL and Apache All in One*.

John Coggeshall is the owner of Internet Technology Solutions, LLC—an Internet and PHP consultancy serving customers worldwide, as well as the owner of CoogleNet, a subscription based WiFi network. As former senior member of Zend Technologies' Global Services team, he got started with PHP in 1997 and is the author of four published books and over 100 articles on PHP technologies.

Jennifer Kyrnin is an author and web designer who has been working on the Internet since 1995. Her other books include *Sams Teach Yourself Bootstrap in 24 Hours*, *Sams Teach Yourself Responsive Web Design in 24 Hours*, and *Sams Teach Yourself HTML5 Mobile Application Development in 24 Hours*.

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As the reader of this book, *you* are our most important critic and commentator. We value your opinion and want to know what we're doing right, what we could do better, what areas you'd like to see us publish in, and any other words of wisdom you're willing to pass our way.

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Introduction

Welcome to *PHP and MySQL Web Development*. Within its pages, you will find distilled knowledge from our experiences using PHP and MySQL, two of the most important and widely used web development tools around.

Key topics covered in this introduction include

- Why you should read this book
- What you will be able to achieve using this book
- What PHP and MySQL are and why they're great
- What's changed in the latest versions of PHP and MySQL
- How this book is organized

Let's get started.

> **Note**
>
> Visit our website and register this book at **informit.com/register** for convenient access to any updates, downloads, or errata that might be available for this book.

Why You Should Read This Book

This book will teach you how to create interactive web applications from the simplest order form through to complex, secure web applications. What's more, you'll learn how to do it using open-source technologies.

This book is aimed at readers who already know at least the basics of HTML and have done some programming in a modern programming language before but have not necessarily programmed for the web or used a relational database. If you are a beginning programmer, you should still find this book useful, but digesting it might take a little longer. We've tried not to leave out any basic concepts, but we do cover them at speed. The typical readers of this book want to master PHP and MySQL for the purpose of building a large or commercial website. You might already be working in another web development language; if so, this book should get you up to speed quickly.

We wrote the first edition of this book because we were tired of finding PHP books that were basically function references. These books are useful, but they don't help when your boss or client has said, "Go build me a shopping cart." In this book, we have done our best to make every example useful. You can use many of the code samples directly in your website, and you can use many others with only minor modifications.

What You Will Learn from This Book

Reading this book will enable you to build real-world, dynamic web applications. If you've built websites using plain HTML, you realize the limitations of this approach. Static content from a pure HTML website is just that—static. It stays the same unless you physically update it. Your users can't interact with the site in any meaningful fashion.

Using a language such as PHP and a database such as MySQL allows you to make your sites dynamic: to have them be customizable and contain real-time information.

We have deliberately focused this book on real-world applications, even in the introductory chapters. We begin by looking at simple systems and work our way through the various parts of PHP and MySQL.

We then discuss aspects of security and authentication as they relate to building a real-world website and show you how to implement these aspects in PHP and MySQL. We also introduce you to integrating front-end and back-end technologies by discussing JavaScript and the role it can play in your application development.

In the final part of this book, we describe how to approach real-world projects and take you through the design, planning, and building of the following projects:

- User authentication and personalization
- Web-based email
- Social media integration

You should be able to use any of these projects as is, or you can modify them to suit your needs. We chose them because we believe they represent some the most common web applications built by programmers. If your needs are different, this book should help you along the way to achieving your goals.

What Is PHP?

PHP is a server-side scripting language designed specifically for the web. Within an HTML page, you can embed PHP code that will be executed each time the page is visited. Your PHP code is interpreted at the web server and generates HTML or other output that the visitor will see.

PHP was conceived in 1994 and was originally the work of one man, Rasmus Lerdorf. It was adopted by other talented people and has gone through several major rewrites to bring us the

broad, mature product we see today. According to Google's Greg Michillie in May 2013, PHP ran more than three quarters of the world's websites, and that number had grown to over 82% by July 2016.

PHP is an open-source project, which means you have access to the source code and have the freedom to use, alter, and redistribute it.

PHP originally stood for *Personal Home Page* but was changed in line with the GNU recursive naming convention (GNU = Gnu's Not Unix) and now stands for *PHP Hypertext Preprocessor*.

The current major version of PHP is 7. This version saw a complete rewrite of the underlying Zend engine and some major improvements to the language. All of the code in this book has been tested and validated against the most recent release of PHP 7 at the time of writing, as well as the latest version in the PHP 5.6 family of releases, which is still officially supported.

The home page for PHP is available at http://www.php.net.

The home page for Zend Technologies is http://www.zend.com.

What Is MySQL?

MySQL (pronounced *My-Ess-Que-Ell*) is a very fast, robust, *relational database management system (RDBMS)*. A database enables you to efficiently store, search, sort, and retrieve data. The MySQL server controls access to your data to ensure that multiple users can work with it concurrently, to provide fast access to it, and to ensure that only authorized users can obtain access. Hence, MySQL is a multiuser, multithreaded server. It uses *Structured Query Language* (SQL), the standard database query language. MySQL has been publicly available since 1996 but has a development history going back to 1979. It is the world's most popular open-source database and has won the Linux Journal Readers' Choice Award on a number of occasions.

MySQL is available under a dual licensing scheme. You can use it under an open-source license (the GPL) free as long as you are willing to meet the terms of that license. If you want to distribute a non-GPL application including MySQL, you can buy a commercial license instead.

Why Use PHP and MySQL?

When setting out to build a website, you could use many different products.

You need to choose the following:

- Where to run your web servers: the cloud, virtual private servers, or actual hardware
- An operating system
- Web server software
- A database management system or other datastore
- A programming or scripting language

You may end up with a hybrid architecture with multiple datastores. Some of these choices are dependent on the others. For example, not all operating systems run on all hardware, not all web servers support all programming languages, and so on.

In this book, we do not pay much attention to hardware, operating systems, or web server software. We don't need to. One of the best features of both PHP and MySQL is that they work with any major operating system and many of the minor ones.

The majority of PHP code can be written to be portable between operating systems and web servers. There are some PHP functions that specifically relate to the filesystem that are operating system dependent, but these are clearly marked as such in the manual and in this book.

Whatever hardware, operating system, and web server you choose, we believe you should seriously consider using PHP and MySQL.

Some of PHP's Strengths

Some of PHP's main competitors are Python, Ruby (on Rails or otherwise), Node.js, Perl, Microsoft .NET, and Java.

In comparison to these products, PHP has many strengths, including the following:

- Performance
- Scalability
- Interfaces to many different database systems
- Built-in libraries for many common web tasks
- Low cost
- Ease of learning and use
- Strong object-oriented support
- Portability
- Flexibility of development approach
- Availability of source code
- Availability of support and documentation

A more detailed discussion of these strengths follows.

Performance

PHP is very fast. Using a single inexpensive server, you can serve millions of hits per day. It scales down to the smallest email form and up to sites such as Facebook and Etsy.

Scalability

PHP has what Rasmus Lerdorf frequently refers to as a "shared-nothing" architecture. This means that you can effectively and cheaply implement horizontal scaling with large numbers of commodity servers.

Database Integration

PHP has native connections available to many database systems. In addition to MySQL, you can directly connect to PostgreSQL, Oracle, MongoDB, and MSSQL, among others. PHP 5 and PHP 7 also have a built-in SQL interface to flat files, called SQLite.

Using the *Open Database Connectivity* (ODBC) standard, you can connect to any database that provides an ODBC driver. This includes Microsoft products and many others.

In addition to native libraries, PHP comes with a database access abstraction layer called *PHP Database Objects* (PDOs), which allows consistent access and promotes secure coding practices.

Built-in Libraries

Because PHP was designed for use on the Web, it has many built-in functions for performing many useful web-related tasks. You can generate images on the fly, connect to web services and other network services, parse XML, send email, work with cookies, and generate PDF documents, all with just a few lines of code.

Cost

PHP is free. You can download the latest version at any time from http://www.php.net for no charge.

Ease of Learning PHP

The syntax of PHP is based on other programming languages, primarily C and Perl. If you already know C or Perl, or a C-like language such as C++ or Java, you will be productive using PHP almost immediately.

Object-Oriented Support

PHP version 5 had well-designed object-oriented features, which continued to be refined and improved in PHP version 7. If you learned to program in Java or C++, you will find the features (and generally the syntax) that you expect, such as inheritance, private and protected attributes and methods, abstract classes and methods, interfaces, constructors, and destructors. You will even find some less common features such as iterators and traits.

Portability

PHP is available for many different operating systems. You can write PHP code on free UNIX-like operating systems such as Linux and FreeBSD, commercial UNIX versions, OS X, or on different versions of Microsoft Windows.

Well-written code will usually work without modification on a different system running PHP.

Flexibility of Development Approach

PHP allows you to implement simple tasks simply, and equally easily adapts to implementing large applications using a framework based on design patterns such as Model-View-Controller (MVC).

Source Code

You have access to PHP's source code. With PHP, unlike commercial, closed-source products, if you want to modify something or add to the language, you are free to do so.

You do not need to wait for the manufacturer to release patches. You also don't need to worry about the manufacturer going out of business or deciding to stop supporting a product.

Availability of Support and Documentation

Zend Technologies (http://www.zend.com), the company behind the engine that powers PHP, funds its PHP development by offering support and related software on a commercial basis.

The PHP documentation and community are mature and rich resources with a wealth of information to share.

Key Features of PHP 7

In December 2015, the long-awaited PHP 7 release was made available to the public. As mentioned in this introduction, the book covers both PHP 5.6 and PHP 7, which might lead you to ask "what happened to PHP 6?" The short answer is: there is no PHP 6 and never was for the general public. There was a development effort around a codebase that was referred to as "PHP 6" but it never came to fruition; there were many ambitious plans and subsequent complications that made it difficult for the team to continue to pursue. PHP 7 is *not* PHP 6 and doesn't include the features and code from that development effort; PHP 7 is its own release with its own focus—specifically a focus on performance.

Under the hood, PHP 7 includes a refactor of the Zend Engine that powers it, which resulted in a significant performance boost to many web applications—sometimes upwards of 100%! While increased performance and decreased memory use were key to the release of PHP 7, so was backward-compatibility. In fact, relatively few backward-incompatible language changes were introduced. These are discussed contextually throughout this book so that the chapters

remain usable with PHP 5.6 or PHP 7, as widespread adoption of PHP 7 has not yet occurred by commercial web-hosting providers.

Some of MySQL's Strengths

MySQL's main competitors in the relational database space are PostgreSQL, Microsoft SQL Server, and Oracle. There is also a growing trend in the web application world toward use of NoSQL/non-relational databases such as MongoDB. Let's take a look at why MySQL is still a good choice in many cases.

MySQL has many strengths, including the following:

- High performance
- Low cost
- Ease of configuration and learning
- Portability
- Availability of source code
- Availability of support

A more detailed discussion of these strengths follows.

Performance

MySQL is undeniably fast. You can see the developers' benchmark page at http://www.mysql.com/why-mysql/benchmarks/.

Low Cost

MySQL is available at no cost under an open-source license or at low cost under a commercial license. You need a license if you want to redistribute MySQL as part of an application and do not want to license your application under an open-source license. If you do not intend to distribute your application—typical for most web applications—or are working on free or open-source software, you do not need to buy a license.

Ease of Use

Most modern databases use SQL. If you have used another RDBMS, you should have no trouble adapting to this one. MySQL is also easier to set up and tune than many similar products.

Portability

MySQL can be used on many different UNIX systems as well as under Microsoft Windows.

Source Code

As with PHP, you can obtain and modify the source code for MySQL. This point is not important to most users most of the time, but it provides you with excellent peace of mind, ensuring future continuity and giving you options in an emergency.

In fact, there are now several forks and drop-in replacements for MySQL that you may consider using, including MariaDB, written by the original authors of MySQL, including Michael 'Monty' Widenius (https://mariadb.org).

Availability of Support

Not all open-source products have a parent company offering support, training, consulting, and certification, but you can get all of these benefits from Oracle (who acquired MySQL with their acquisition of Sun Microsystems, who had previously acquired the founding company, MySQL AB).

What Is New in MySQL (5.x)?

At the time of writing, the current version of MySQL was 5.7.

Features added to MySQL in the last few releases include

- A wide range of security improvements
- FULLTEXT support for InnoDB tables
- A NoSQL-style API for InnoDB
- Partitioning support
- Improvements to replication, including row-based replication and GTIDs
- Thread pooling
- Pluggable authentication
- Multicore scalability
- Better diagnostic tools
- InnoDB as the default engine
- IPv6 support
- Plugin API
- Event scheduling
- Automated upgrades

Other changes include more ANSI standard compliance and performance improvements.

If you are still using an early 4.x version or a 3.x version of the MySQL server, you should know that the following features were added to various versions from 4.0:

- Views
- Stored procedures
- Triggers and cursors
- Subquery support
- GIS types for storing geographical data
- Improved support for internationalization
- The transaction-safe storage engine InnoDB included as standard
- The MySQL query cache, which greatly improves the speed of repetitive queries as often run by web applications

How Is This Book Organized?

This book is divided into five main parts:

Part I, "Using PHP," provides an overview of the main parts of the PHP language with examples. Each example is a real-world example used in building an e-commerce site rather than "toy" code. We kick off this section with Chapter 1, "PHP Crash Course." If you've already used PHP, you can whiz through this chapter. If you are new to PHP or new to programming, you might want to spend a little more time on it.

Part II, "Using MySQL," discusses the concepts and design involved in using relational database systems such as MySQL, using SQL, connecting your MySQL database to the world with PHP, and advanced MySQL topics, such as security and optimization.

Part III, "Web Application Security," covers some of the general issues involved in developing a web application using any language. We then discuss how you can use PHP and MySQL to authenticate your users and securely gather, transmit, and store data.

Part IV, "Advanced PHP Techniques," offers detailed coverage of some of the major built-in functions in PHP. We have selected groups of functions that are likely to be useful when building a web application. You will learn about interaction with the server, interaction with the network, image generation, date and time manipulation, and session handling.

Part V, "Building Practical PHP and MySQL Projects," is our favorite section. It deals with practical real-world issues such as managing large projects and debugging, and provides sample projects that demonstrate the power and versatility of PHP and MySQL.

Accessing the Free Web Edition

Your purchase of this book in any format includes access to the corresponding Web Edition, which provides several special features to help you learn:

- The complete text of the book online
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- Bonus chapters not included in the print or e-book editions
- Updates and corrections as they become available

The Web Edition can be viewed on all types of computers and mobile devices with any modern web browser that supports HTML5.

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Finally

We hope you enjoy this book and enjoy learning about PHP and MySQL as much as we did when we first began using these products. They are really a pleasure to use. Soon, you'll be able to join the many thousands of web developers who use these robust, powerful tools to easily build dynamic, real-time web applications.

1

PHP Crash Course

This chapter gives you a quick overview of PHP syntax and language constructs. If you are already a PHP programmer, it might fill some gaps in your knowledge. If you have a background using C, Perl, Python, or another programming language, it will help you get up to speed quickly.

In this book, you'll learn how to use PHP by working through lots of real-world examples taken from our experiences building real websites. Often, programming textbooks teach basic syntax with very simple examples. We have chosen not to do that. We recognize that what you do is get something up and running, and understand how the language is used, instead of plowing through yet another syntax and function reference that's no better than the online manual.

Try the examples. Type them in or download them from the website, change them, break them, and learn how to fix them again.

This chapter begins with the example of an online product order form to show how variables, operators, and expressions are used in PHP. It also covers variable types and operator precedence. You will learn how to access form variables and manipulate them by working out the total and tax on a customer order.

You will then develop the online order form example by using a PHP script to validate the input data. You'll examine the concept of Boolean values and look at examples using `if`, `else`, the `?:` operator, and the `switch` statement. Finally, you'll explore looping by writing some PHP to generate repetitive HTML tables.

Key topics you learn in this chapter include

- Embedding PHP in HTML
- Adding dynamic content
- Accessing form variables
- Understanding identifiers

- Creating user-declared variables
- Examining variable types
- Assigning values to variables
- Declaring and using constants
- Understanding variable scope
- Understanding operators and precedence
- Evaluating expressions
- Using variable functions
- Making decisions with `if`, `else`, and `switch`
- Taking advantage of iteration using `while`, `do`, and `for` loops

Before You Begin: Accessing PHP

To work through the examples in this chapter and the rest of the book, you need access to a web server with PHP installed. To gain the most from the examples and case studies, you should run them and try changing them. To do this, you need a testbed where you can experiment.

If PHP is not installed on your machine, you need to begin by installing it or having your system administrator install it for you. You can find instructions for doing so in Appendix A, "Installing Apache, PHP, and MySQL."

Creating a Sample Application: Bob's Auto Parts

One of the most common applications of any server-side scripting language is processing HTML forms. You'll start learning PHP by implementing an order form for Bob's Auto Parts, a fictional spare parts company. You can find all the code for the examples used in this chapter in the directory called `chapter01` on the CD-ROM.

Creating the Order Form

Bob's HTML programmer has set up an order form for the parts that Bob sells. This relatively simple order form, shown in Figure 1.1, is similar to many you have probably seen while surfing. Bob would like to be able to know what his customers ordered, work out the total prices of their orders, and determine how much sales tax is payable on the orders.

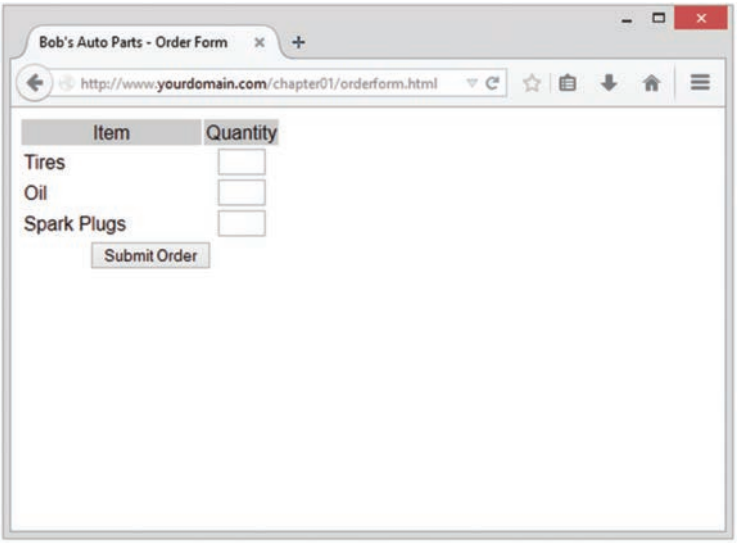

Figure 1.1 Bob's initial order form records only products and quantities

Part of the HTML for this form is shown in Listing 1.1.

Listing 1.1 **`orderform.html`— HTML for Bob's Basic Order Form**

```
<form action="processorder.php" method="post">
<table style="border: 0px;">
<tr style="background: #cccccc;">
  <td style="width: 150px; text-align: center;">Item</td>
  <td style="width: 15px; text-align: center;">Quantity</td>
</tr>
<tr>
  <td>Tires</td>
  <td><input type="text" name="tireqty" size="3"
 maxlength="3" /></td>
</tr>
<tr>
 <td>Oil</td>
 <td><input type="text" name="oilqty" size="3"
  maxlength="3" /></td>
</tr>
<tr>
 <td>Spark Plugs</td>
 <td><input type="text" name="sparkqty" size="3"
    maxlength="3" /></td>
</tr>
<tr>
```

```
     <td colspan="2" style="text-align: center;"><input type="submit" value="Submit
Order" /></td>
    </tr>
    </table>
    </form>
```

Notice that the form's action is set to the name of the PHP script that will process the customer's order. (You'll write this script next.) In general, the value of the `action` attribute is the URL that will be loaded when the user clicks the Submit button. The data the user has typed in the form will be sent to this URL via the HTTP method specified in the `method` attribute, either `get` (appended to the end of the URL) or `post` (sent as a separate message).

Also note the names of the form fields: `tireqty`, `oilqty`, and `sparkqty`. You'll use these names again in the PHP script. Because the names will be reused, it's important to give your form fields meaningful names that you can easily remember when you begin writing the PHP script. Some HTML editors generate field names like `field23` by default. They are difficult to remember. Your life as a PHP programmer will be easier if the names you use reflect the data typed into the field.

You should consider adopting a coding standard for field names so that all field names throughout your site use the same format. This way, you can more easily remember whether, for example, you abbreviated a word in a field name or put in underscores as spaces.

Processing the Form

To process the form, you need to create the script mentioned in the `action` attribute of the `form` tag called `processorder.php`. Open your text editor and create this file. Then type in the following code:

```
<!DOCTYPE html>
<html>
  <head>
    <title>Bob's Auto Parts - Order Results</title>
  </head>
  <body>
    <h1>Bob's Auto Parts</h1>
    <h2>Order Results</h2>
  </body>
</html>
```

Notice how everything you've typed so far is just plain HTML. It's now time to add some simple PHP code to the script.

Embedding PHP in HTML

Under the `<h2>` heading in your file, add the following lines:

```
<?php
  echo '<p>Order processed.</p>';
?>
```

Save the file and load it in your browser by filling out Bob's form and clicking the Submit Order button. You should see something similar to the output shown in Figure 1.2.

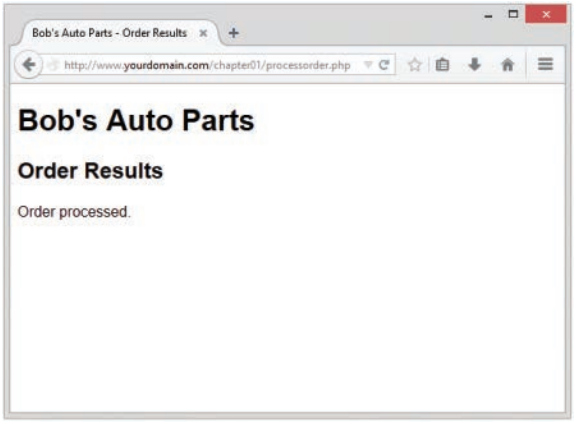

Figure 1.2 Text passed to PHP's `echo` construct is echoed to the browser

Notice how the PHP code you wrote was embedded inside a normal-looking HTML file. Try viewing the source from your browser. You should see this code `<!DOCTYPE html>`

```
<html>
  <head>
    <title>Bob's Auto Parts - Order Results</title>
  </head>
  <body>
    <h1>Bob's Auto Parts</h1>
    <h2>Order Results</h2>
    <p>Order processed.</p>
  </body>
</html>
```

None of the raw PHP is visible because the PHP interpreter has run through the script and replaced it with the output from the script. This means that from PHP you can produce clean HTML viewable with any browser; in other words, the user's browser does not need to understand PHP.

This example illustrates the concept of server-side scripting in a nutshell. The PHP has been interpreted and executed on the web server, as distinct from JavaScript and other client-side technologies interpreted and executed within a web browser on a user's machine.

The code that you now have in this file consists of four types of text:

- HTML
- PHP tags
- PHP statements
- Whitespace

You can also add comments.

Most of the lines in the example are just plain HTML.

PHP Tags

The PHP code in the preceding example began with `<?php` and ended with `?>`. This is similar to all HTML tags because they all begin with a less than (`<`) symbol and end with a greater than (`>`) symbol. These symbols (`<?php` and `?>`) are called *PHP tags*. They tell the web server where the PHP code starts and finishes. Any text between the tags is interpreted as PHP. Any text outside these tags is treated as normal HTML. The PHP tags allow you to *escape* from HTML.

There are actually two styles of PHP tags; each of the following fragments of code is equivalent:

- **XML style**

  ```
  <?php echo '<p>Order processed.</p>'; ?>
  ```

  This is the tag style that we use in this book; it is the preferred PHP tag style. The server administrator cannot turn it off, so you can guarantee it will be available on all servers, which is especially important if you are writing applications that may be used on different installations. This tag style can be used with Extensible Markup Language (XML) documents. In general, we recommend you use this tag style.

- **Short style**

  ```
  <? echo '<p>Order processed.</p>'; ?>
  ```

  This tag style is the simplest and follows the style of a Standard Generalized Markup Language (SGML) processing instruction. To use this type of tag—which is the shortest to type—you either need to enable the `short_open_tag` setting in your config file or compile PHP with short tags enabled. You can find more information on how to use this tag style in Appendix A. The use of this style is not recommended for use in code you plan to distribute. It will not work in many environments as it is no longer enabled by default.

PHP Statements

You tell the PHP interpreter what to do by including PHP statements between your opening and closing tags. The preceding example used only one type of statement:

```
echo '<p>Order processed.</p>';
```

As you have probably guessed, using the `echo` construct has a very simple result: It prints (or echoes) the string passed to it to the browser. In Figure 1.2, you can see the result is that the text `Order processed.` appears in the browser window.

Notice that there is a semicolon at the end of the `echo` statement. Semicolons separate statements in PHP much like periods separate sentences in English. If you have programmed in C or Java before, you will be familiar with using the semicolon in this way.

Leaving off the semicolon is a common syntax error that is easily made. However, it's equally easy to find and to correct.

Whitespace

Spacing characters such as newlines (carriage returns), spaces, and tabs are known as *whitespace*. As you probably already know, browsers ignore whitespace in HTML, and so does the PHP engine. Consider these two HTML fragments:

```
<h1>Welcome to Bob's Auto Parts!</h1><p>What would you like to order today?</p>
```

and

```
<h1>Welcome             to Bob's
Auto Parts!</h1>
<p>What would you like
to order today?</p>
```

These two snippets of HTML code produce identical output because they appear the same to the browser. However, you can and are encouraged to use whitespace sensibly in your HTML as an aid to humans—to enhance the readability of your HTML code. The same is true for PHP. You don't need to have any whitespace between PHP statements, but it makes the code much easier to read if you put each statement on a separate line. For example,

```
echo 'hello ';
echo 'world';
```

and

```
echo 'hello ';echo 'world';
```

are equivalent, but the first version is easier to read.

Comments

Comments are exactly that: Comments in code act as notes to people reading the code. Comments can be used to explain the purpose of the script, who wrote it, why they wrote it the way they did, when it was last modified, and so on. You generally find comments in all but the simplest PHP scripts.

The PHP interpreter ignores any text in comments. Essentially, the PHP parser skips over the comments, making them equivalent to whitespace.

PHP supports C, C++, and shell script–style comments.

The following is a C-style, multiline comment that might appear at the start of a PHP script:

```
/* Author: Bob Smith
   Last modified: April 10
   This script processes the customer orders.
*/
```

Multiline comments should begin with a `/*` and end with `*/`. As in C, multiline comments cannot be nested.

You can also use single-line comments, either in the C++ style:

```
echo '<p>Order processed.</p>'; // Start printing order
```

or in the shell script style:

```
echo '<p>Order processed.</p>'; # Start printing order
```

With both of these styles, everything after the comment symbol (`#` or `//`) is a comment until you reach the end of the line or the ending PHP tag, whichever comes first.

In the following line of code, the text before the closing tag, `here is a comment`, is part of a comment. The text after the closing tag, `here is not`, will be treated as HTML because it is outside the closing tag:

```
// here is a comment ?> here is not
```

Adding Dynamic Content

So far, you haven't used PHP to do anything you couldn't have done with plain HTML.

The main reason for using a server-side scripting language is to be able to provide dynamic content to a site's users. This is an important application because content that changes according to users' needs or over time will keep visitors coming back to a site. PHP allows you to do this easily.

Let's start with a simple example. Replace the PHP in `processorder.php` with the following code:

```
<?php
  echo "<p>Order processed at ";
  echo date('H:i, jS F Y');
  echo "</p>";
?>
```

You could also write this on one line, using the concatenation operator (`.`), as

```
<?php
  echo "<p>Order processed at ".date('H:i, jS F Y')."</p>";
?>
```

In this code, PHP's built-in `date()` function tells the customer the date and time when his order was processed. This information will be different each time the script is run. The output of running the script on one occasion is shown in Figure 1.3.

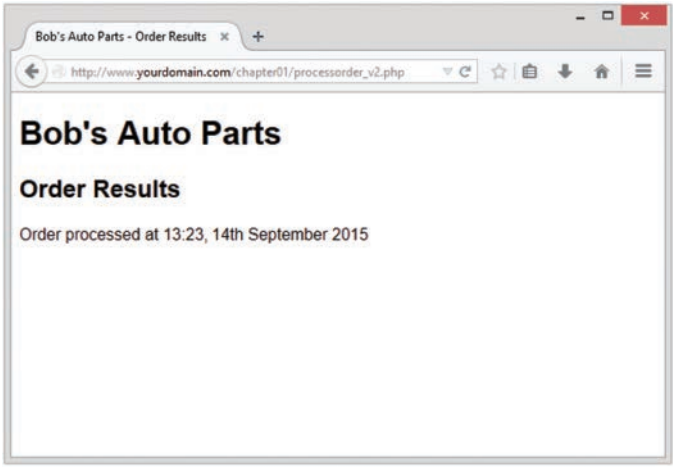

Figure 1.3 PHP's `date()` function returns a formatted date string

Calling Functions

Look at the call to `date()`. This is the general form that function calls take. PHP has an extensive library of functions you can use when developing web applications. Most of these functions need to have some data passed to them and return some data.

Now look at the function call again:

```
date('H:i, jS F')
```

Notice that it passes a string (text data) to the function inside a pair of parentheses. The element within the parentheses is called the function's *argument* or *parameter*. Such arguments are the input the function uses to output some specific results.

Using the `date()` Function

The `date()` function expects the argument you pass it to be a format string, representing the style of output you would like. Each letter in the string represents one part of the date and time. `H` is the hour in a 24-hour format with leading zeros where required, `i` is the minutes with a leading zero where required, `j` is the day of the month without a leading zero, `S` represents the ordinal suffix (in this case th), and `F` is the full name of the month.

> **Note**
>
> If `date()` gives you a warning about not having set the timezone, you should add the `date.timezone` setting to your `php.ini` file. More information on this can be found in the sample `php.ini` file in Appendix A.

For a full list of formats supported by `date()`, see Chapter 19, "Managing the Date and Time."

Accessing Form Variables

The whole point of using the order form is to collect customers' orders. Getting the details of what the customers typed is easy in PHP, but the exact method depends on the version of PHP you are using and a setting in your `php.ini` file.

Form Variables

Within your PHP script, you can access each form field as a PHP variable whose name relates to the name of the form field. You can recognize variable names in PHP because they all start with a dollar sign (`$`). (Forgetting the dollar sign is a common programming error.)

Depending on your PHP version and setup, you can access the form data via variables in different ways. In recent versions of PHP, all but one of these ways have been deprecated, so beware if you have used PHP in the past that this has changed.

You may access the contents of the field `tireqty` in the following way:

```
$_POST['tireqty']
```

$_POST is an array containing data submitted via an HTTP POST request—that is, the form method was set to POST. There are three of these arrays that may contain form data: `$_POST`, `$_GET`, and `$_REQUEST`. One of the `$_GET` or `$_POST` arrays holds the details of all the form variables. Which array is used depends on whether the method used to submit the form was `GET` or `POST`, respectively. In addition, a combination of all data submitted via `GET` or `POST` is also available through `$_REQUEST`.

If the form was submitted via the `POST` method, the data entered in the `tireqty` box will be stored in `$_POST['tireqty']`. If the form was submitted via `GET`, the data will be in `$_GET['tireqty']`. In either case, the data will also be available in `$_REQUEST['tireqty']`.

These arrays are some of the *superglobal* arrays. We will revisit the superglobals when we discuss variable scope later in this chapter.

Let's look at an example that creates easier-to-use copies of variables.

To copy the value of one variable into another, you use the assignment operator, which in PHP is an equal sign (=). The following statement creates a new variable named `$tireqty` and copies the contents of `$ POST['tireqty']` into the new variable:

```
$tireqty = $_POST['tireqty'];
```

Place the following block of code at the start of the processing script. All other scripts in this book that handle data from a form contain a similar block at the start. Because this code

will not produce any output, placing it above or below the <html> and other HTML tags that start your page makes no difference. We generally place such blocks at the start of the script to make them easy to find.

```
<?php
  // create short variable names
  $tireqty = $_POST['tireqty'];
  $oilqty = $_POST['oilqty'];
  $sparkqty = $_POST['sparkqty'];
?>
```

This code creates three new variables—$tireqty, $oilqty, and $sparkqty—and sets them to contain the data sent via the POST method from the form.

You can output the values of these variables to the browser by doing, for example:

```
echo $tireqty.' tires<br />';
```

However, this approach is not recommended.

At this stage, you have not checked the variable contents to make sure sensible data has been entered in each form field. Try entering deliberately wrong data and observe what happens. After you have read the rest of the chapter, you might want to try adding some data validation to this script.

Taking data directly from the user and outputting it to the browser like this is an extremely risky practice from a security perspective. We do not recommend this approach. You should filter input data. We will start to cover input filtering in Chapter 4, "String Manipulation and Regular Expressions," and discuss security in depth in Chapter 14, "Web Application Security Risks."

For now, it's enough to know that you should echo out user data to the browser after passing it through a function called htmlspecialchars(). For example, in this case, we would do the following:

```
echo htmlspecialchars($tireqty).' tires<br />';
```

To make the script start doing something visible, add the following lines to the bottom of your PHP script:

```
  echo '<p>Your order is as follows: </p>';
  echo htmlspecialchars($tireqty).' tires<br />';
  echo htmlspecialchars($oilqty).' bottles of oil<br />';
  echo htmlspecialchars($sparkqty).' spark plugs<br />';
```

If you now load this file in your browser, the script output should resemble what is shown in Figure 1.4. The actual values shown, of course, depend on what you typed into the form.

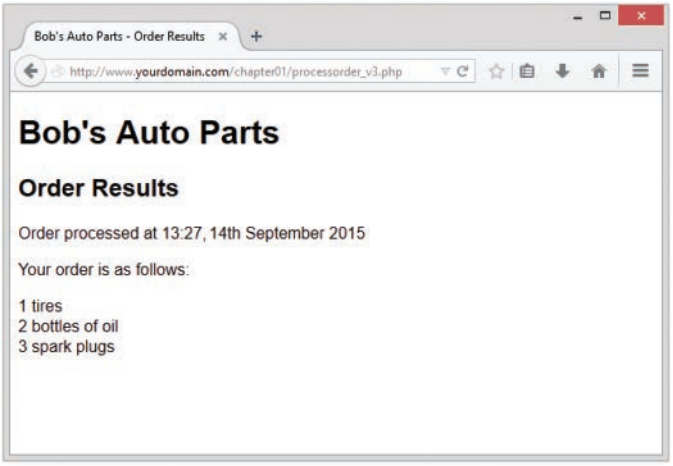

Figure 1.4 The form variables the user typed in are easily accessible in `processorder.php`

The following sections describe a couple of interesting elements of this example.

String Concatenation

In the sample script, `echo` prints the value the user typed in each form field, followed by some explanatory text. If you look closely at the `echo` statements, you can see that the variable name and following text have a period (.) between them, such as this:

```
echo htmlspecialchars($tireqty).' tires<br />';
```

This period is the string concatenation operator, which adds strings (pieces of text) together. You will often use it when sending output to the browser with `echo`. This way, you can avoid writing multiple `echo` commands.

You can also place simple variables inside a double-quoted string to be echoed. (Arrays are somewhat more complicated, so we look at combining arrays and strings in Chapter 4.) Consider this example:

```
$tireqty = htmlspecialchars($tireqty);
echo "$tireqty tires<br />";
```

This is equivalent to the first statement shown in this section. Either format is valid, and which one you use is a matter of personal taste. This process, replacing a variable with its contents within a string, is known as *interpolation*.

Note that interpolation is a feature of double-quoted strings only. You cannot place variable names inside a single-quoted string in this way. Running the following line of code

```
echo '$tireqty tires<br />';
```

simply sends `$tireqty tires<br />` to the browser. Within double quotation marks, the variable name is replaced with its value. Within single quotation marks, the variable name or any other text is sent unaltered.

Variables and Literals

The variables and strings concatenated together in each of the `echo` statements in the sample script are different types of things. Variables are symbols for data. The strings are data themselves. When we use a piece of raw data in a program like this, we call it a *literal* to distinguish it from a *variable*. `$tireqty` is a variable, a symbol that represents the data the customer typed in. On the other hand, `' tires<br />'` is a literal. You can take it at face value. Well, almost. Remember the second example in the preceding section? PHP replaced the variable name `$tireqty` in the string with the value stored in the variable.

Remember the two kinds of strings mentioned already: ones with double quotation marks and ones with single quotation marks. PHP tries to evaluate strings in double quotation marks, resulting in the behavior shown earlier. Single-quoted strings are treated as true literals.

There is also a third way of specifying strings using the heredoc syntax (`<<<`), which will be familiar to Perl users. Heredoc syntax allows you to specify long strings tidily, by specifying an end marker that will be used to terminate the string. The following example creates a three-line string and echoes it:

```
echo <<<theEnd
  line 1
  line 2
  line 3
theEnd
```

The token `theEnd` is entirely arbitrary. It just needs to be guaranteed not to appear in the text. To close a heredoc string, place a closing token at the start of a line.

Heredoc strings are interpolated, like double-quoted strings.

Understanding Identifiers

Identifiers are the names of variables. (The names of functions and classes are also identifiers; we look at functions and classes in Chapter 5, "Reusing Code and Writing Functions," and Chapter 6, "Object-Oriented PHP.") You need to be aware of the simple rules defining valid identifiers:

- Identifiers can be of any length and can consist of letters, numbers, and underscores.
- Identifiers cannot begin with a digit.
- In PHP, identifiers are case sensitive. `$tireqty` is not the same as `$TireQty`. Trying to use them interchangeably is a common programming error. Function names are an exception to this rule: Their names can be used in any case.
- A variable can have the same name as a function. This usage is confusing, however, and should be avoided. Also, you cannot create a function with the same name as another function.

You can declare and use your own variables in addition to the variables you are passed from the HTML form.

One of the features of PHP is that it does not require you to declare variables before using them. A variable is created when you first assign a value to it. See the next section for details.

You assign values to variables using the assignment operator (=) as you did when copying one variable's value to another. On Bob's site, you want to work out the total number of items ordered and the total amount payable. You can create two variables to store these numbers. To begin with, you need to initialize each of these variables to zero by adding these lines to the bottom of your PHP script.

```
$totalqty = 0;
$totalamount = 0.00;
```

Each of these two lines creates a variable and assigns a literal value to it. You can also assign variable values to variables, as shown in this example:

```
$totalqty = 0;
$totalamount = $totalqty;
```

Examining Variable Types

A variable's type refers to the kind of data stored in it. PHP provides a set of data types. Different data can be stored in different data types.

PHP's Data Types

PHP supports the following basic data types:

- **Integer**—Used for whole numbers
- **Float** (also called **double**)—Used for real numbers
- **String**—Used for strings of characters
- **Boolean**—Used for `true` or `false` values
- **Array**—Used to store multiple data items (see Chapter 3, "Using Arrays")
- **Object**—Used for storing instances of classes (see Chapter 6)

Three special types are also available: NULL, resource, and callable.

Variables that have not been given a value, have been unset, or have been given the specific value `NULL` are of type NULL.

Certain built-in functions (such as database functions) return variables that have the type resource. They represent external resources (such as database connections). You will almost certainly not directly manipulate a resource variable, but frequently they are returned by functions and must be passed as parameters to other functions.

Callables are essentially functions that are passed to other functions.

Type Strength

PHP is called a weakly typed or dynamically typed language. In most programming languages, variables can hold only one type of data, and that type must be declared before the variable can be used, as in C. In PHP, the type of a variable is determined by the value assigned to it.

For example, when you created `$totalqty` and `$totalamount`, their initial types were determined as follows:

```
$totalqty = 0;
$totalamount = 0.00;
```

Because you assigned `0`, an integer, to `$totalqty`, this is now an integer type variable. Similarly, `$totalamount` is now of type float.

Strangely enough, you could now add a line to your script as follows:

```
$totalamount = 'Hello';
```

The variable `$totalamount` would then be of type string. PHP changes the variable type according to what is stored in it at any given time.

This ability to change types transparently on the fly can be extremely useful. Remember PHP "automagically" knows what data type you put into your variable. It returns the data with the same data type when you retrieve it from the variable.

Type Casting

You can pretend that a variable or value is of a different type by using a type cast. This feature works identically to the way it works in C. You simply put the temporary type in parentheses in front of the variable you want to cast.

For example, you could have declared the two variables from the preceding section using a cast:

```
$totalqty = 0;
$totalamount = (float)$totalqty;
```

The second line means "Take the value stored in `$totalqty`, interpret it as a float, and store it in `$totalamount`." The `$totalamount` variable will be of type float. The cast variable does not change types, so `$totalqty` remains of type integer.

You can also use built-in functions to test and set type, which you will learn about later in this chapter.

Variable Variables

PHP provides one other type of variable: the variable variable. Variable variables enable you to change the name of a variable dynamically.

As you can see, PHP allows a lot of freedom in this area. All languages enable you to change the value of a variable, but not many allow you to change the variable's type, and even fewer allow you to change the variable's name.

A variable variable works by using the value of one variable as the name of another. For example, you could set

```
$varname = 'tireqty';
```

You can then use `$$varname` in place of `$tireqty`. For example, you can set the value of `$tireqty` as follows:

```
$$varname = 5;
```

This is equivalent to

```
$tireqty = 5;
```

This approach might seem somewhat obscure, but we'll revisit its use later. Instead of having to list and use each form variable separately, you can use a loop and variable variable to process them all automatically. You can find an example illustrating this in the section on `for` loops later in this chapter.

Declaring and Using Constants

As you saw previously, you can readily change the value stored in a variable. You can also declare constants. A constant stores a value just like a variable, but its value is set once and then cannot be changed elsewhere in the script.

In the sample application, you might store the prices for each item on sale as a constant. You can define these constants using the `define` function:

```
define('TIREPRICE', 100);
define('OILPRICE', 10);
define('SPARKPRICE', 4);
```

Now add these lines of code to your script. You now have three constants that can be used to calculate the total of the customer's order.

Notice that the names of the constants appear in uppercase. This convention, borrowed from C, makes it easy to distinguish between variables and constants at a glance. Following this convention is not required but will make your code easier to read and maintain.

One important difference between constants and variables is that when you refer to a constant, it does not have a dollar sign in front of it. If you want to use the value of a constant, use its name only. For example, to use one of the constants just created, you could type

```
echo TIREPRICE;
```

As well as the constants you define, PHP sets a large number of its own. An easy way to obtain an overview of them is to run the `phpinfo()` function:

```
phpinfo();
```

This function provides a list of PHP's predefined variables and constants, among other useful information. We will discuss some of them as we go along.

One other difference between variables and constants is that constants can store only boolean, integer, float, or string data. These types are collectively known as scalar values.

Understanding Variable Scope

The term *scope* refers to the places within a script where a particular variable is visible. The six basic scope rules in PHP are as follows:

- Built-in superglobal variables are visible everywhere within a script.
- Constants, once declared, are always visible globally; that is, they can be used inside and outside functions.
- Global variables declared in a script are visible throughout that script, but *not inside functions*.
- Variables inside functions that are declared as global refer to the global variables of the same name.
- Variables created inside functions and declared as static are invisible from outside the function but keep their value between one execution of the function and the next. (We explain this idea fully in Chapter 5.)
- Variables created inside functions are local to the function and cease to exist when the function terminates.

The arrays `$_GET` and `$_POST` and some other special variables have their own scope rules. They are known as *superglobals* and can be seen everywhere, both inside and outside functions.

The complete list of superglobals is as follows:

- `$GLOBALS`—An array of all global variables (Like the `global` keyword, this allows you to access global variables inside a function—for example, as `$GLOBALS['myvariable']`.)
- `$_SERVER`—An array of server environment variables
- `$_GET`—An array of variables passed to the script via the `GET` method
- `$_POST`—An array of variables passed to the script via the `POST` method
- `$_COOKIE`—An array of cookie variables
- `$_FILES`—An array of variables related to file uploads
- `$_ENV`—An array of environment variables
- `$_REQUEST`—An array of all user input including the contents of input including `$_GET`, `$_POST`, and `$_COOKIE` (but not including `$_FILES`)
- `$_SESSION`—An array of session variables

We come back to each of these superglobals throughout the book as they become relevant.

We cover scope in more detail when we discuss functions and classes later in this chapter. For the time being, all the variables we use are global by default.

Using Operators

Operators are symbols that you can use to manipulate values and variables by performing an operation on them. You need to use some of these operators to work out the totals and tax on the customer's order.

We've already mentioned two operators: the assignment operator (=) and the string concatenation operator (.). In the following sections, we describe the complete list.

In general, operators can take one, two, or three arguments, with the majority taking two. For example, the assignment operator takes two: the storage location on the left side of the = symbol and an expression on the right side. These arguments are called *operands*—that is, the things that are being operated upon.

Arithmetic Operators

Arithmetic operators are straightforward; they are just the normal mathematical operators. PHP's arithmetic operators are shown in Table 1.1.

Table 1.1 **PHP's Arithmetic Operators**

Operator	Name	Example
+	Addition	`$a + $b`
-	Subtraction	`$a - $b`
*	Multiplication	`$a * $b`
/	Division	`$a / $b`
%	Modulus	`$a % $b`

With each of these operators, you can store the result of the operation, as in this example:

```
$result = $a + $b;
```

Addition and subtraction work as you would expect. The result of these operators is to add or subtract, respectively, the values stored in the `$a` and `$b` variables.

You can also use the subtraction symbol (-) as a unary operator—that is, an operator that takes one argument or operand—to indicate negative numbers, as in this example:

```
$a = -1;
```

Multiplication and division also work much as you would expect. Note the use of the asterisk as the multiplication operator rather than the regular multiplication symbol, and the forward slash as the division operator rather than the regular division symbol.

The modulus operator returns the remainder calculated by dividing the `$a` variable by the `$b` variable. Consider this code fragment:

```
$a = 27;
$b = 10;
$result = $a%$b;
```

The value stored in the `$result` variable is the remainder when you divide 27 by 10—that is, 7.

You should note that arithmetic operators are usually applied to integers or doubles. If you apply them to strings, PHP will try to convert the string to a number. If it contains an `e` or an `E`, it will be read as being in scientific notation and converted to a float; otherwise, it will be converted to an integer. PHP will look for digits at the start of the string and use them as the value; if there are none, the value of the string will be zero.

String Operators

You've already seen and used the only string operator. You can use the string concatenation operator to add two strings and to generate and store a result much as you would use the addition operator to add two numbers:

```
$a = "Bob's ";
$b = "Auto Parts";
$result = $a.$b;
```

The `$result` variable now contains the string `"Bob's Auto Parts"`.

Assignment Operators

You've already seen the basic assignment operator (`=`). Always refer to this as the assignment operator and read it as "is set to." For example,

```
$totalqty = 0;
```

This line should be read as "`$totalqty` is set to zero." We explain why when we discuss the comparison operators later in this chapter, but if you call it equals, you will get confused.

Values Returned from Assignment

Using the assignment operator returns an overall value similar to other operators. If you write

```
$a + $b
```

the value of this expression is the result of adding the `$a` and `$b` variables together. Similarly, you can write

```
$a = 0;
```

The value of this whole expression is zero.

This technique enables you to form expressions such as

```
$b = 6 + ($a = 5);
```

This line sets the value of the `$b` variable to 11. This behavior is generally true of assignments: The value of the whole assignment statement is the value that is assigned to the left operand.

When working out the value of an expression, you can use parentheses to increase the precedence of a subexpression, as shown here. This technique works exactly the same way as in mathematics.

Combined Assignment Operators

In addition to the simple assignment, there is a set of combined assignment operators. Each of them is a shorthand way of performing another operation on a variable and assigning the result back to that variable. For example,

```
$a += 5;
```

This is equivalent to writing

```
$a = $a + 5;
```

Combined assignment operators exist for each of the arithmetic operators and for the string concatenation operator. A summary of all the combined assignment operators and their effects is shown in Table 1.2.

Table 1.2 **PHP's Combined Assignment Operators**

Operator	Use	Equivalent To
`+=`	`$a += $b`	`$a = $a + $b`
`-=`	`$a -= $b`	`$a = $a - $b`
`*=`	`$a *= $b`	`$a = $a * $b`
`/=`	`$a /= $b`	`$a = $a / $b`
`%=`	`$a %= $b`	`$a = $a % $b`
`.=`	`$a .= $b`	`$a = $a . $b`

Pre- and Post-Increment and Decrement

The pre- and post-increment (`++`) and decrement (`--`) operators are similar to the `+=` and `-=` operators, but with a couple of twists.

All the increment operators have two effects: They increment and assign a value. Consider the following:

```
$a=4;
echo ++$a;
```

The second line uses the pre-increment operator, so called because the `++` appears before the `$a`. This has the effect of first incrementing `$a` by 1 and second, returning the incremented value. In this case, `$a` is incremented to 5, and then the value 5 is returned and printed. The value of this whole expression is 5. (Notice that the actual value stored in `$a` is changed: It is not just returning `$a + 1`.)

If the `++` is after the `$a`, however, you are using the post-increment operator. It has a different effect. Consider the following:

```
$a=4;
echo $a++;
```

In this case, the effects are reversed. That is, first, the value of `$a` is returned and printed, and second, it is incremented. The value of this whole expression is 4. This is the value that will be printed. However, the value of `$a` after this statement is executed is 5.

As you can probably guess, the behavior is similar for the `--` (decrement) operator. However, the value of `$a` is decremented instead of being incremented.

Reference Operator

The reference operator (`&`, an ampersand) can be used in conjunction with assignment. Normally, when one variable is assigned to another, a copy is made of the first variable and stored elsewhere in memory. For example,

```
$a = 5;
$b = $a;
```

These code lines make a second copy of the value in `$a` and store it in `$b`. If you subsequently change the value of `$a`, `$b` will not change:

```
$a = 7; // $b will still be 5
```

You can avoid making a copy by using the reference operator. For example,

```
$a = 5;
$b = &$a;
$a = 7; // $a and $b are now both 7
```

References can be a bit tricky. Remember that a reference is like an alias rather than like a pointer. Both `$a` and `$b` point to the same piece of memory. You can change this by unsetting one of them as follows:

```
unset($a);
```

Unsetting does not change the value of `$b` (7) but does break the link between `$a` and the value 7 stored in memory.

Comparison Operators

The comparison operators compare two values. Expressions using these operators return either of the logical values `true` or `false` depending on the result of the comparison.

The Equal Operator

The equal comparison operator (`==`, two equal signs) enables you to test whether two values are equal. For example, you might use the expression

```
$a == $b
```

to test whether the values stored in `$a` and `$b` are the same. The result returned by this expression is `true` if they are equal or `false` if they are not.

You might easily confuse == with =, the assignment operator. Using the wrong operator will work without giving an error but generally will not give you the result you wanted. In general,

nonzero values evaluate to `true` and zero values to `false`. Say that you have initialized two variables as follows:

```
$a = 5;
$b = 7;
```

If you then test `$a = $b`, the result will be `true`. Why? The value of `$a = $b` is the value assigned to the left side, which in this case is 7. Because 7 is a nonzero value, the expression evaluates to `true`. If you intended to test `$a == $b`, which evaluates to `false`, you have introduced a logic error in your code that can be extremely difficult to find. Always check your use of these two operators and check that you have used the one you intended to use.

Using the assignment operator rather than the equals comparison operator is an easy mistake to make, and you will probably make it many times in your programming career.

Other Comparison Operators

PHP also supports a number of other comparison operators. A summary of all the comparison operators is shown in Table 1.3. One to note is the identical operator (`===`), which returns `true` only if the two operands are both equal and of the same type. For example, `0=='0'` will be true, but `0==='0'` will not because one zero is an integer and the other zero is a string.

Table 1.3 **PHP's Comparison Operators**

Operator	Name	Use
`==`	Equals	`$a == $b`
`===`	Identical	`$a === $b`
`!=`	Not equal	`$a != $b`
`!==`	Not identical	`$a !== $b`
`<>`	Not equal (comparison operator)	`$a <> $b`
`<`	Less than	`$a < $b`
`>`	Greater than (comparison operator)	`$a > $b`
`<=`	Less than or equal to	`$a <= $b`
`>=`	Greater than or equal to	`$a >= $b`

Logical Operators

The logical operators combine the results of logical conditions. For example, you might be interested in a case in which the value of a variable, `$a`, is between 0 and 100. You would need to test both the conditions `$a >= 0` and `$a <= 100`, using the AND operator, as follows:

```
$a >= 0 && $a <=100
```

PHP supports logical AND, OR, XOR (exclusive or), and NOT.

The set of logical operators and their use is summarized in Table 1.4.

Table 1.4 **PHP's Logical Operators**

Operator	Name	Use	Result
`!`	NOT	`!$b`	Returns `true` if `$b` is `false` and vice versa
`&&`	AND	`$a && $b`	Returns `true` if both `$a` and `$b` are `true`; otherwise `false`
`||`	OR	`$a || $b`	Returns `true` if either `$a` or `$b` or both are `true`; otherwise `false`
`and`	AND	`$a and $b`	Same as `&&`, but with lower precedence
`or`	OR	`$a or $b`	Same as `||`, but with lower precedence
`xor`	XOR	`$a x or $b`	Returns true if either `$a` or `$b` is true, and false if they are both true or both false.

The `and` and `or` operators have lower precedence than the `&&` and `||` operators. We cover precedence in more detail later in this chapter.

Bitwise Operators

The bitwise operators enable you to treat an integer as the series of bits used to represent it. You probably will not find a lot of use for the bitwise operators in PHP, but a summary is shown in Table 1.5.

Table 1.5 **PHP's Bitwise Operators**

Operator	Name	Use	Result
`&`	Bitwise AND	`$a & $b`	Bits set in `$a` and `$b` are set in the result.
`|`	Bitwise OR	`$a | $b`	Bits set in `$a` or `$b` are set in the result.
`~`	Bitwise NOT	`~$a`	Bits set in `$a` are not set in the result and vice versa.
`^`	Bitwise XOR	`$a ^ $b`	Bits set in `$a` or `$b` but not in both are set in the result.
`<<`	Left shift	`$a << $b`	Shifts `$a` left `$b` bits.
`>>`	Right shift	`$a >> $b`	Shifts `$a` right `$b` bits.

Other Operators

In addition to the operators we have covered so far, you can use several others.

The comma operator (`,`) separates function arguments and other lists of items. It is normally used incidentally.

Two special operators, `new` and `->`, are used to instantiate a class and access class members, respectively. They are covered in detail in Chapter 6.

There are a few others that we discuss briefly here.

The Ternary Operator

The ternary operator (`?:`) takes the following form:

```
condition ? value if true : value if false
```

This operator is similar to the expression version of an `if-else` statement, which is covered later in this chapter.

A simple example is

```
($grade >= 50 ? 'Passed' : 'Failed')
```

This expression evaluates student grades to `'Passed'` or `'Failed'`.

The Error Suppression Operator

The error suppression operator (`@`) can be used in front of any expression—that is, anything that generates or has a value. For example,

```
$a = @(57/0);
```

Without the `@` operator, this line generates a divide-by-zero warning. With the operator included, the error is suppressed.

If you are suppressing warnings in this way, you need to write some error handling code to check when a warning has occurred. If you have PHP set up with the `track_errors` feature enabled in `php.ini`, the error message will be stored in the global variable `$php_errormsg`.

The Execution Operator

The execution operator is really a pair of operators—a pair of backticks (``` `` ```) in fact. The backtick is not a single quotation mark; it is usually located on the same key as the ~ (tilde) symbol on your keyboard.

PHP attempts to execute whatever is contained between the backticks as a command at the server's command line. The value of the expression is the output of the command.

For example, under Unix-like operating systems, you can use

```
$out = `ls -la`;
echo '<pre>'.$out.'</pre>';
```

Or, equivalently on a Windows server, you can use

```
$out = `dir c:`;
echo '<pre>'.$out.'</pre>';
```

Either version obtains a directory listing and stores it in `$out`. It can then be echoed to the browser or dealt with in any other way.

There are other ways of executing commands on the server. We cover them in Chapter 17, "Interacting with the File System and the Server."

Array Operators

There are a number of array operators. The array element operators (`[]`) enable you to access array elements. You can also use the `=>` operator in some array contexts. These operators are covered in Chapter 3.

You also have access to a number of other array operators. We cover them in detail in Chapter 3 as well, but we included them here in Table 1.6 for completeness.

Table 1.6 **PHP's Array Operators**

Operator	Name	Use	Result
`+`	Union	`$a + $b`	Returns an array containing everything in `$a` and `$b`
`==`	Equality	`$a == $b`	Returns `true` if `$a` and `$b` have the same key and value pairs
`===`	Identity	`$a === $b`	Returns `true` if `$a` and `$b` have the same key and value pairs in the same order `and of the same type.`
`!=`	Inequality	`$a != $b`	Returns `true` if `$a` and `$b` are not equal
`<>`	Inequality	`$a <> $b`	Returns `true` if `$a` and `$b` are not equal
`!==`	Non-identity	`$a !== $b`	Returns `true` if `$a` and `$b` are not identical

You will notice that the array operators in Table 1.6 all have equivalent operators that work on scalar variables. As long as you remember that `+` performs addition on scalar types and union on arrays—even if you have no interest in the set arithmetic behind that behavior—the behaviors should make sense. You cannot usefully compare arrays to scalar types.

The Type Operator

There is one type operator: `instanceof`. This operator is used in object-oriented programming, but we mention it here for completeness. (Object-oriented programming is covered in Chapter 6.)

The `instanceof` operator allows you to check whether an object is an instance of a particular class, as in this example:

```
class sampleClass{};
$myObject = new sampleClass();
if ($myObject instanceof sampleClass)
  echo  "myObject is an instance of sampleClass";
```

Working Out the Form Totals

Now that you know how to use PHP's operators, you are ready to work out the totals and tax on Bob's order form. To do this, add the following code to the bottom of your PHP script:

```
$totalqty = 0;
$totalqty = $tireqty + $oilqty + $sparkqty;
echo "<p>Items ordered: ".$totalqty."<br />";
$totalamount = 0.00;

define('TIREPRICE', 100);
define('OILPRICE', 10);
define('SPARKPRICE', 4);

$totalamount = $tireqty * TIREPRICE
             + $oilqty * OILPRICE
             + $sparkqty * SPARKPRICE;

echo "Subtotal: $".number_format($totalamount,2)."<br />";

$taxrate = 0.10;  // local sales tax is 10%
$totalamount = $totalamount * (1 + $taxrate);
echo "Total including tax: $".number_format($totalamount,2)."</p>";
```

If you refresh the page in your browser window, you should see output similar to Figure 1.5.

As you can see, this piece of code uses several operators. It uses the addition (`+`) and multiplication (`*`) operators to work out the amounts and the string concatenation operator (`.`) to set up the output to the browser.

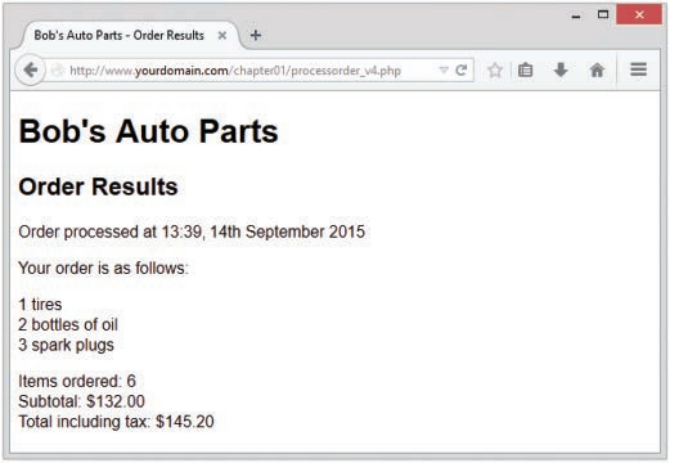

Figure 1.5 The totals of the customer's order have been calculated, formatted, and displayed

It also uses the `number_format()` function to format the totals as strings with two decimal places. This is a function from PHP's Math library.

If you look closely at the calculations, you might ask why the calculations were performed in the order they were. For example, consider this statement:

```
$totalamount = $tireqty * TIREPRICE
             + $oilqty * OILPRICE
             + $sparkqty * SPARKPRICE;
```

The total amount seems to be correct, but why were the multiplications performed before the additions? The answer lies in the precedence of the operators—that is, the order in which they are evaluated.

Understanding Precedence and Associativity

In general, operators have a set precedence, or order, in which they are evaluated. Operators also have associativity, which is the order in which operators of the same precedence are evaluated. This order is generally left to right (called *left* for short), right to left (called *right* for short), or *not relevant*.

Table 1.7 shows operator precedence and associativity in PHP. In this table, operators with the lowest precedence are at the top, and precedence increases as you go down the table.

Table 1.7 **Operator Precedence in PHP**

Associativity	Operators
left	`,`
left	`Or`
left	`Xor`
left	`And`
right	Print
left	`= += -= *= /= .= %= &= |= ^= ~= <<= >>=`
left	`? :`
left	`||`
left	`&&`
left	`|`
left	`^`
left	`&`
n/a	`== != === !==`

Associativity	Operators
n/a	`< <= > >=`
left	`<< >>`
left	`+ - .`
left	`* / %`
right	`!`
n/a	`Instanceof`
right	`~ (int) (float) (string) (array) (object) (bool) @`
n/a	`++ --`
right	`[]`
n/a	clone `new`
n/a	`()`

Notice that we haven't yet covered the operator with the highest precedence: plain old parentheses. The effect of using parentheses is to raise the precedence of whatever is contained within them. This is how you can deliberately manipulate or work around the precedence rules when you need to.

Remember this part of the preceding example:

```
$totalamount = $totalamount * (1 + $taxrate);
```

If you had written

```
$totalamount = $totalamount * 1 + $taxrate;
```

the multiplication operation, having higher precedence than the addition operation, would be performed first, giving an incorrect result. By using the parentheses, you can force the subexpression `1 + $taxrate` to be evaluated first.

You can use as many sets of parentheses as you like in an expression. The innermost set of parentheses is evaluated first.

Also note one other operator in this table we have not yet covered: the `print` language construct, which is equivalent to `echo`. Both constructs generate output.

We generally use `echo` in this book, but you can use `print` if you find it more readable. Neither `print` nor `echo` is really a function, but both can be called as a function with parameters in parentheses. Both can also be treated as an operator: You simply place the string to work with after the keyword `echo` or `print`.

Calling `print` as a function causes it to return a value (`1`). This capability might be useful if you want to generate output inside a more complex expression but does mean that `print` is marginally slower than `echo`.

Using Variable Handling Functions

Before we leave the world of variables and operators, let's look at PHP's variable handling functions. PHP provides a library of functions that enable you to manipulate and test variables in different ways.

Testing and Setting Variable Types

Most of the variable functions are related to testing the type of function. The two most general are `gettype()` and `settype()`. They have the following function prototypes; that is, this is what arguments expect and what they return:

```
string gettype(mixed var);
bool settype(mixed var, string type);
```

To use `gettype()`, you pass it a variable. It determines the type and returns a string containing the type name: `bool`, `int`, `double` (for floats, confusingly, for historical reasons), `string`, `array`, `object`, `resource`, or `NULL`. It returns `unknown type` if it is not one of the standard types.

To use `settype()`, you pass it a variable for which you want to change the type and a string containing the new type for that variable from the previous list.

> **Note**
>
> This book and the php.net documentation refer to the data type "mixed." There is no such data type, but because PHP is so flexible with type handling, many functions can take many (or any) data types as an argument. Arguments for which many types are permitted are shown with the pseudo-type "mixed."

You can use these functions as follows:

```
$a = 56;
echo gettype($a).'<br />';
settype($a, 'float');
echo gettype($a).'<br />';
```

When `gettype()` is called the first time, the type of `$a` is integer. After the call to `settype()`, the type is changed to `float`, which is reported as `double`. (Be aware of this difference.)

PHP also provides some specific type-testing functions. Each takes a variable as an argument and returns either `true` or `false`. The functions are

- `is_array()`—Checks whether the variable is an array
- `is_double()`, `is_float()`, `is_real()` (All the same function)—Checks whether the variable is a float
- `is_long()`, `is_int()`, `is_integer()` (All the same function)—Checks whether the variable is an integer

- `is_string()`—Checks whether the variable is a string
- `is_bool()`—Checks whether the variable is a boolean
- `is_object()`—Checks whether the variable is an object
- `is_resource()`—Checks whether the variable is a resource
- `is_null()`—Checks whether the variable is null
- `is_scalar()`—Checks whether the variable is a scalar—that is, an integer, boolean, string, or float
- `is_numeric()`—Checks whether the variable is any kind of number or a numeric string
- `is_callable()`—Checks whether the variable is the name of a valid function

Testing Variable Status

PHP has several functions for testing the status of a variable. The first is `isset()`, which has the following prototype:

```
bool isset(mixed var[, mixed var[,...]])
```

This function takes a variable name as an argument and returns `true` if it exists and `false` otherwise. You can also pass in a comma-separated list of variables, and `isset()` will return `true` if all the variables are set.

You can wipe a variable out of existence by using its companion function, `unset()`, which has the following prototype:

```
void unset(mixed var[, mixed var[,...]])
```

This function gets rid of the variable it is passed.

The `empty()` function checks to see whether a variable exists and has a nonempty, nonzero value; it returns `true` or `false` accordingly. It has the following prototype:

```
bool empty(mixed var)
```

Let's look at an example using these three functions.

Try adding the following code to your script temporarily:

```
echo 'isset($tireqty): '.isset($tireqty).'<br />';
echo 'isset($nothere): '.isset($nothere).'<br />';
echo 'empty($tireqty): '.empty($tireqty).'<br />';
echo 'empty($nothere): '.empty($nothere).'<br />';
```

Refresh the page to see the results.

The variable `$tireqty` should return 1 (`true`) from `isset()` regardless of what value you entered in that form field and regardless of whether you entered a value at all. Whether it is `empty()` depends on what you entered in it.

The variable `$nothere` does not exist, so it generates a blank (`false`) result from `isset()` and a 1 (`true`) result from `empty()`.

These functions are handy when you need to make sure that the user filled out the appropriate fields in the form.

Reinterpreting Variables

You can achieve the equivalent of casting a variable by calling a function. The following three functions can be useful for this task:

```
int intval(mixed var[, int base=10])
float floatval(mixed var)
string strval(mixed var)
```

Each accepts a variable as input and returns the variable's value converted to the appropriate type. The `intval()` function also allows you to specify the base for conversion when the variable to be converted is a string. (This way, you can convert, for example, hexadecimal strings to integers.)

Making Decisions with Conditionals

Control structures are the structures within a language that allow you to control the flow of execution through a program or script. You can group them into conditional (or branching) structures and repetition structures (or loops).

If you want to sensibly respond to your users' input, your code needs to be able to make decisions. The constructs that tell your program to make decisions are called *conditionals*.

`if` Statements

You can use an `if` statement to make a decision. You should give the `if` statement a condition to use. If the condition is `true`, the following block of code will be executed. Conditions in `if` statements must be surrounded by parentheses `()`.

For example, if a visitor orders no tires, no bottles of oil, and no spark plugs from Bob, it is probably because she accidentally clicked the Submit Order button before she had finished filling out the form. Rather than telling the visitor "Order processed," the page could give her a more useful message.

When the visitor orders no items, you might like to say, "You did not order anything on the previous page!" You can do this easily by using the following `if` statement:

```
if ($totalqty == 0)
  echo 'You did not order anything on the previous page!<br />';
```

The condition you are using here is `$totalqty == 0`. Remember that the equals operator (==) behaves differently from the assignment operator (=).

The condition `$totalqty == 0` will be `true` if `$totalqty` is equal to zero. If `$totalqty` is not equal to zero, the condition will be `false`. When the condition is `true`, the `echo` statement will be executed.

Code Blocks

Often you may have more than one statement you want executed according to the actions of a conditional statement such as `if`. You can group a number of statements together as a *block*. To declare a block, you enclose it in curly braces:

```
if ($totalqty == 0) {
  echo '<p style="color:red">';
  echo 'You did not order anything on the previous page!';
  echo '</p>';
}
```

The three lines enclosed in curly braces are now a block of code. When the condition is `true`, all three lines are executed. When the condition is `false`, all three lines are ignored.

> **Note**
>
> As already mentioned, PHP does not care how you lay out your code. However, you should indent your code for readability purposes. Indenting is used to enable you to see at a glance which lines will be executed only if conditions are met, which statements are grouped into blocks, and which statements are parts of loops or functions. In the previous examples, you can see that the statement depending on the `if` statement and the statements making up the block are indented.

`else` Statements

You may often need to decide not only whether you want an action performed, but also which of a set of possible actions you want performed.

An `else` statement allows you to define an alternative action to be taken when the condition in an `if` statement is `false`. Say you want to warn Bob's customers when they do not order anything. On the other hand, if they do make an order, instead of a warning, you want to show them what they ordered.

If you rearrange the code and add an `else` statement, you can display either a warning or a summary:

```
if ($totalqty == 0) {
    echo "You did not order anything on the previous page!<br />";
} else {
    echo htmlspecialchars($tireqty).' tires<br />';
    echo htmlspecialchars($oilqty).' bottles of oil<br />';
    echo htmlspecialchars($sparkqty).' spark plugs<br />';
  }
```

You can build more complicated logical processes by nesting `if` statements within each other. In the following code, the summary will be displayed only if the condition `$totalqty == 0` is true, and each line in the summary will be displayed only if its own condition is met:

```
if ($totalqty == 0) {
    echo "You did not order anything on the previous page!<br />";
} else {
    if ($tireqty > 0)
      echo htmlspecialchars($tireqty).' tires<br />';
    if ($oilqty > 0)
      echo htmlspecialchars($oilqty).' bottles of oil<br />';
    if ($sparkqty > 0)
      echo htmlspecialchars($sparkqty).' spark plugs<br />';
}
```

`elseif` Statements

For many of the decisions you make, you have more than two options. You can create a sequence of many options using the `elseif` statement, which is a combination of an `else` and an `if` statement. When you provide a sequence of conditions, the program can check each until it finds one that is true.

Bob provides a discount for large orders of tires. The discount scheme works like this:

- Fewer than 10 tires purchased—No discount
- 10–49 tires purchased—5% discount
- 50–99 tires purchased—10% discount
- 100 or more tires purchased—15% discount

You can create code to calculate the discount using conditions and `if` and `elseif` statements. In this case, you need to use the AND operator (`&&`) to combine two conditions into one:

```
if ($tireqty < 10) {
  $discount = 0;
} elseif (($tireqty >= 10) && ($tireqty <= 49)) {
  $discount = 5;
} elseif (($tireqty >= 50) && ($tireqty <= 99)) {
  $discount = 10;
} elseif ($tireqty >= 100) {
  $discount = 15;
}
```

Note that you are free to type `elseif` or `else if`—versions with or without a space are both correct.

If you are going to write a cascading set of `elseif` statements, you should be aware that only one of the blocks or statements will be executed. It did not matter in this example because

all the conditions were mutually exclusive; only one can be true at a time. If you write conditions in a way that more than one could be true at the same time, only the block or statement following the first true condition will be executed.

`switch` Statements

The `switch` statement works in a similar way to the `if` statement, but it allows the condition to take more than two values. In an `if` statement, the condition can be either `true` or `false`. In a `switch` statement, the condition can take any number of different values, as long as it evaluates to a simple type (integer, string, or float). You need to provide a `case` statement to handle each value you want to react to and, optionally, a default case to handle any that you do not provide a specific `case` statement for.

Bob wants to know what forms of advertising are working for him, so you can add a question to the order form. Insert this HTML into the order form, and the form will resemble Figure 1.6:

```
<tr>
  <td>How did you find Bob's?</td>
  <td><select name="find">
  <option value = "a">I'm a regular customer</option>
  <option value = "b">TV advertising</option>
  <option value = "c">Phone directory</option>
  <option value = "d">Word of mouth</option>
  </select>
  </td>
</tr>
```

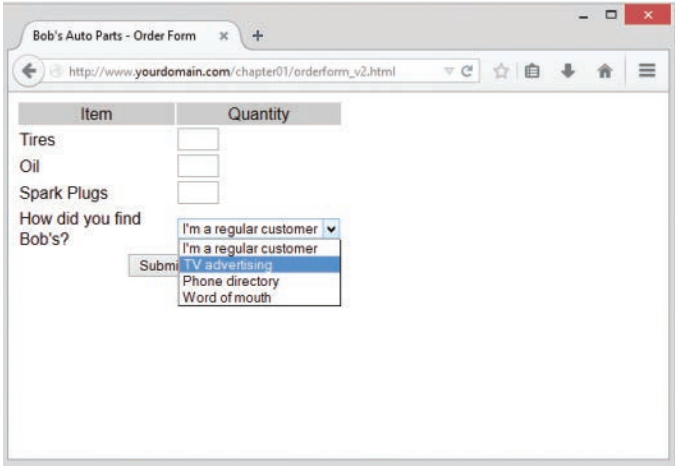

Figure 1.6 The order form now asks visitors how they found Bob's Auto Parts

This HTML code adds a new form variable (called `find`) whose value will be `'a'`, `'b'`, `'c'`, or `'d'`. You could handle this new variable with a series of `if` and `elseif` statements like this:

```
if ($find == "a") {
  echo "<p>Regular customer.</p>";
} elseif ($find == "b") {
  echo "<p>Customer referred by TV advert.</p>";
} elseif ($find == "c") {
  echo "<p>Customer referred by phone directory.</p>";
} elseif ($find == "d") {
  echo "<p>Customer referred by word of mouth.</p>";
} else {
  echo "<p>We do not know how this customer found us.</p>";
}
```

Alternatively, you could write a `switch` statement:

```
switch($find) {
  case "a" :
    echo "<p>Regular customer.</p>";
    break;
  case "b" :
    echo "<p>Customer referred by TV advert.</p>";
    break;
  case "c" :
    echo "<p>Customer referred by phone directory.</p>";
    break;
  case "d" :
    echo "<p>Customer referred by word of mouth.</p>";
    break;
  default :
    echo "<p>We do not know how this customer found us.</p>";
    break;
}
```

(Note that both of these examples assume you have extracted `$find` from the `$_POST` array.)

The `switch` statement behaves somewhat differently from an `if` or `elseif` statement. An `if` statement affects only one statement unless you deliberately use curly braces to create a block of statements. A `switch` statement behaves in the opposite way. When a `case` statement in a `switch` is activated, PHP executes statements until it reaches a `break` statement. Without `break` statements, a `switch` would execute all the code following the `case` that was true. When a `break` statement is reached, the next line of code after the `switch` statement is executed.

Comparing the Different Conditionals

If you are not familiar with the statements described in the preceding sections, you might be asking, “Which one is the best?”

That is not really a question we can answer. There is nothing that you can do with one or more `else`, `elseif`, or `switch` statements that you cannot do with a set of `if` statements. You should try to use whichever conditional will be most readable in your situation. You will acquire a feel for which suits different situations as you gain experience.

Repeating Actions Through Iteration

One thing that computers have always been very good at is automating repetitive tasks. If you need something done the same way a number of times, you can use a loop to repeat some parts of your program.

Bob wants a table displaying the freight cost that will be added to a customer's order. With the courier Bob uses, the cost of freight depends on the distance the parcel is being shipped. This cost can be worked out with a simple formula.

You want the freight table to resemble the table in Figure 1.7.

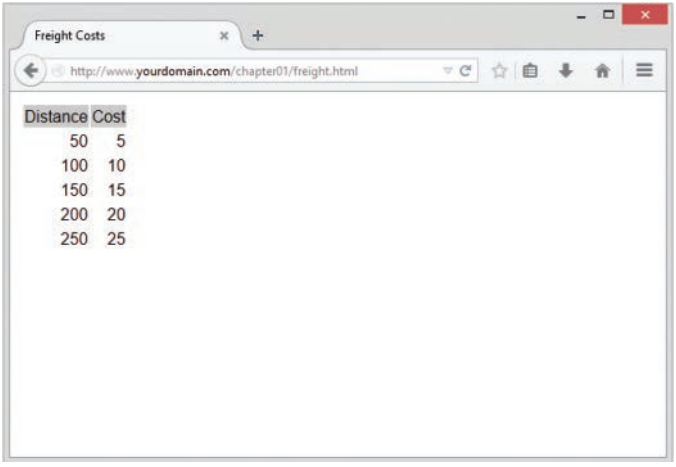

Figure 1.7 This table shows the cost of freight as distance increases

Listing 1.2 shows the HTML that displays this table. You can see that it is long and repetitive.

Listing 1.2 **`freight.html`—HTML for Bob's Freight Table**

```
<!DOCTYPE html>
<html>
  <head>
   <title>Bob's Auto Parts - Freight Costs</title>
  </head>
  <body>
```

```
    <table style="border: 0px; padding: 3px">
    <tr>
     <td style="background: #cccccc; text-align: center;">Distance</td>
     <td style="background: #cccccc; text-align: center;">Cost</td>
    </tr>
    <tr>
     <td style="text-align: right;">50</td>
     <td style="text-align: right;">5</td>
    </tr>
    <tr>
     <td style="text-align: right;">100</td>
     <td style="text-align: right;">10</td>
    </tr>
    <tr>
     <td style="text-align: right;">150</td>
     <td style="text-align: right;">15</td>
    </tr>
    <tr>
     <td style="text-align: right;">200</td>
     <td style="text-align: right;">20</td>
    </tr>
    <tr>
     <td style="text-align: right;">250</td>
     <td style="text-align: right;">25</td>
    </tr>
    </table>
  </body>
</html>
```

Rather than requiring an easily bored human—who must be paid for his time—to type the HTML, having a cheap and tireless computer do it would be helpful.

Loop statements tell PHP to execute a statement or block repeatedly.

`while` Loops

The simplest kind of loop in PHP is the `while` loop. Like an `if` statement, it relies on a condition. The difference between a `while` loop and an `if` statement is that an `if` statement executes the code that follows it only once if the condition is `true`. A `while` loop executes the block repeatedly for as long as the condition is `true`.

You generally use a `while` loop when you don't know how many iterations will be required to make the condition true. If you require a fixed number of iterations, consider using a `for` loop.

The basic structure of a `while` loop is

```
while( condition ) expression;
```

The following `while` loop will display the numbers from 1 to 5:

```
$num = 1;
while ($num <= 5 ){
  echo $num."<br />";
  $num++;
}
```

At the beginning of each iteration, the condition is tested. If the condition is `false`, the block will not be executed and the loop will end. The next statement after the loop will then be executed.

You can use a `while` loop to do something more useful, such as display the repetitive freight table in Figure 1.7. Listing 1.3 uses a `while` loop to generate the freight table.

Listing 1.3 **`freight.php`—Generating Bob's Freight Table with PHP**

```
<!DOCTYPE html>
<html>
  <head>
   <title>Bob's Auto Parts - Freight Costs</title>
  </head>
  <body>
    <table style="border: 0px; padding: 3px">
    <tr>
     <td style="background: #cccccc; text-align: center;">Distance</td>
     <td style="background: #cccccc; text-align: center;">Cost</td>
    </tr>

    <?php
    $distance = 50;
    while ($distance <= 250) {
      echo "<tr>
            <td style=\"text-align: right;\">".$distance."</td>
            <td style=\"text-align: right;\">".($distance / 10)."</td>
            </tr>\n";
      $distance += 50;
    }
    ?>

    </table>
  </body>
</html>
```

To make the HTML generated by the script readable, you need to include newlines and spaces. As already mentioned, browsers ignore this whitespace, but it is important for human readers. You often need to look at the HTML if your output is not what you were seeking.

In Listing 1.3, you can see `\n` inside some of the strings. When inside a double-quoted string, this character sequence represents a newline character.

`for` and `foreach` Loops

The way that you used the `while` loops in the preceding section is very common. You set a counter to begin with. Before each iteration, you test the counter in a condition. And at the end of each iteration, you modify the counter.

You can write this style of loop in a more compact form by using a `for` loop. The basic structure of a `for` loop is

```
for( expression1; condition; expression2)
  expression3;
```

- *`expression1`* is executed once at the start. Here, you usually set the initial value of a counter.
- The *`condition`* expression is tested before each iteration. If the expression returns `false`, iteration stops. Here, you usually test the counter against a limit.
- *`expression2`* is executed at the end of each iteration. Here, you usually adjust the value of the counter.
- *`expression3`* is executed once per iteration. This expression is usually a block of code and contains the bulk of the loop code.

You can rewrite the `while` loop example in Listing 1.3 as a `for` loop. In this case, the PHP code becomes

```
<?php
for ($distance = 50; $distance <= 250; $distance += 50) {
  echo "<tr>
        <td style=\"text-align: right;\">".$distance."</td>
        <td style=\"text-align: right;\">".($distance / 10)."</td>
        </tr>\n";}
?>
```

Both the `while` and `for` versions are functionally identical. The `for` loop is somewhat more compact, saving two lines.

Both these loop types are equivalent; neither is better or worse than the other. In a given situation, you can use whichever you find more intuitive.

As a side note, you can combine variable variables with a `for` loop to iterate through a series of repetitive form fields. If, for example, you have form fields with names such as `name1`, `name2`, `name3`, and so on, you can process them like this:

```
for ($i=1; $i <= $numnames; $i++){
  $temp= "name$i";
  echo htmlspecialchars($$temp).'<br />'; // or whatever processing you want to do
}
```

By dynamically creating the names of the variables, you can access each of the fields in turn.

As well as the `for` loop, there is a `foreach` loop, designed specifically for use with arrays. We discuss how to use it in Chapter 3.

`do...while` Loops

The final loop type we describe behaves slightly differently. The general structure of a `do...while` statement is

```
do
  expression;
while( condition );
```

A `do...while` loop differs from a `while` loop because the condition is tested at the end. This means that in a `do...while` loop, the statement or block within the loop is always executed at least once.

Even if you consider this example in which the condition will be `false` at the start and can never become `true`, the loop will be executed once before checking the condition and ending:

```
$num = 100;
do{
  echo $num."<br />";
}while ($num < 1 ) ;
```

Breaking Out of a Control Structure or Script

If you want to stop executing a piece of code, you can choose from three approaches, depending on the effect you are trying to achieve.

If you want to stop executing a loop, you can use the `break` statement as previously discussed in the section on `switch`. If you use the `break` statement in a loop, execution of the script will continue at the next line of the script after the loop.

If you want to jump to the next loop iteration, you can instead use the `continue` statement.

If you want to finish executing the entire PHP script, you can use `exit`. This approach is typically useful when you are performing error checking. For example, you could modify the earlier example as follows:

```
if($totalqty == 0){
  echo "You did not order anything on the previous page!<br />";
  exit;
}
```

The call to `exit` stops PHP from executing the remainder of the script.

Employing Alternative Control Structure Syntax

For all the control structures we have looked at, there is an alternative form of syntax. It consists of replacing the opening brace ({) with a colon (:) and the closing brace with a new keyword, which will be `endif`, `endswitch`, `endwhile`, `endfor`, or `endforeach`, depending on which control structure is being used. No alternative syntax is available for `do...while` loops.

For example, the code

```
if ($totalqty == 0) {
  echo "You did not order anything on the previous page!<br />";
  exit;
}
```

could be converted to this alternative syntax using the keywords `if` and `endif`:

```
if ($totalqty == 0) :
  echo "You did not order anything on the previous page!<br />";
  exit;
endif;
```

Using `declare`

One other control structure in PHP, the `declare` structure, is not used as frequently in day-to-day coding as the other constructs. The general form of this control structure is as follows:

```
declare (directive)
{
// block
}
```

This structure is used to set *execution directives* for the block of code—that is, rules about how the following code is to be run. Currently, only two execution directives, `ticks and encoding`, have been implemented.

You use ticks by inserting the directive `ticks=`*`n`*. It allows you to run a specific function every *`n`* lines of code inside the code block, which is principally useful for profiling and debugging.

The encoding directive is used to set encoding for a particular script, as follows:

```
declare(encoding='UTF-8');
```

In this case, the declare statement may not be followed by a code block if you are using namespaces. We'll talk about namespaces more later.

The `declare` control structure is mentioned here only for completeness. We consider some examples showing how to use `tick` functions in Chapters 25, "Using PHP and MySQL for Large Projects," and 26, "Debugging and Logging."

Next

Now you know how to receive and manipulate the customer's order. In the next chapter, you'll learn how to store the order so that it can be retrieved and fulfilled later.

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