

# **Beginning Databases with PostgreSQL**

From Novice to Professional, Second Edition

NEIL MATTHEW AND RICHARD STONES

**Apress®**

## **Beginning Databases with PostgreSQL: From Novice to Professional, Second Edition**

**Copyright © 2005 by Neil Matthew and Richard Stones**

All rights reserved. No part of this work may be reproduced or transmitted in any form or by any means, electronic or mechanical, including photocopying, recording, or by any information storage or retrieval system, without the prior written permission of the copyright owner and the publisher.

ISBN (pbk): 1-59059-478-9

Printed and bound in the United States of America 9 8 7 6 5 4 3 2 1

Trademarked names may appear in this book. Rather than use a trademark symbol with every occurrence of a trademarked name, we use the names only in an editorial fashion and to the benefit of the trademark owner, with no intention of infringement of the trademark.

Lead Editor: Jason Gilmore

Contributing Author: Jon Parise

Technical Reviewer: Robert Treat

Editorial Board: Steve Anglin, Dan Appleman, Ewan Buckingham, Gary Cornell, Tony Davis, Jason Gilmore, Jonathan Hassell, Chris Mills, Dominic Shakeshaft, Jim Sumser

Assistant Publisher: Grace Wong

Project Manager: Sofia Marchant

Copy Manager: Nicole LeClerc

Copy Editor: Marilyn Smith

Production Manager: Kari Brooks-Copony

Production Editor: Katie Stence

Compositor: Susan Glinert

Proofreader: Elizabeth Berry

Indexer: John Collin

Artist: Kinetic Publishing Services, LLC

Cover Designer: Kurt Krames

Manufacturing Manager: Tom Debolski

Distributed to the book trade in the United States by Springer-Verlag New York, Inc., 233 Spring Street, 6th Floor, New York, NY 10013, and outside the United States by Springer-Verlag GmbH & Co. KG, Tiergartenstr. 17, 69112 Heidelberg, Germany.

In the United States: phone 1-800-SPRINGER, fax 201-348-4505, e-mail [orders@springer-ny.com](mailto:orders@springer-ny.com), or visit <http://www.springer-ny.com>. Outside the United States: fax +49 6221 345229, e-mail [orders@springer.de](mailto:orders@springer.de), or visit <http://www.springer.de>.

For information on translations, please contact Apress directly at 2560 Ninth Street, Suite 219, Berkeley, CA 94710. Phone 510-549-5930, fax 510-549-5939, e-mail [info@apress.com](mailto:info@apress.com), or visit <http://www.apress.com>.

The information in this book is distributed on an “as is” basis, without warranty. Although every precaution has been taken in the preparation of this work, neither the author(s) nor Apress shall have any liability to any person or entity with respect to any loss or damage caused or alleged to be caused directly or indirectly by the information contained in this work.

The source code for this book is available to readers at <http://www.apress.com> in the Downloads section.

# Contents at a Glance

About the Authors . . . . .	xvii
About the Technical Reviewer . . . . .	xix
Acknowledgments . . . . .	xxi
Introduction . . . . .	xxiii
<b>CHAPTER 1</b>	<b>Introduction to PostgreSQL . . . . . 1</b>
<b>CHAPTER 2</b>	<b>Relational Database Principles . . . . . 17</b>
<b>CHAPTER 3</b>	<b>Getting Started with PostgreSQL . . . . . 43</b>
<b>CHAPTER 4</b>	<b>Accessing Your Data . . . . . 73</b>
<b>CHAPTER 5</b>	<b>PostgreSQL Command-Line and Graphical Tools . . . . . 113</b>
<b>CHAPTER 6</b>	<b>Data Interfacing . . . . . 149</b>
<b>CHAPTER 7</b>	<b>Advanced Data Selection . . . . . 173</b>
<b>CHAPTER 8</b>	<b>Data Definition and Manipulation . . . . . 201</b>
<b>CHAPTER 9</b>	<b>Transactions and Locking . . . . . 243</b>
<b>CHAPTER 10</b>	<b>Functions, Stored Procedures, and Triggers . . . . . 267</b>
<b>CHAPTER 11</b>	<b>PostgreSQL Administration . . . . . 309</b>
<b>CHAPTER 12</b>	<b>Database Design . . . . . 357</b>
<b>CHAPTER 13</b>	<b>Accessing PostgreSQL from C Using libpq . . . . . 385</b>
<b>CHAPTER 14</b>	<b>Accessing PostgreSQL from C Using Embedded SQL . . . . . 419</b>
<b>CHAPTER 15</b>	<b>Accessing PostgreSQL from PHP . . . . . 445</b>
<b>CHAPTER 16</b>	<b>Accessing PostgreSQL from Perl . . . . . 465</b>
<b>CHAPTER 17</b>	<b>Accessing PostgreSQL from Java . . . . . 491</b>
<b>CHAPTER 18</b>	<b>Accessing PostgreSQL from C# . . . . . 517</b>
<b>APPENDIX A</b>	<b>PostgreSQL Database Limits . . . . . 543</b>
<b>APPENDIX B</b>	<b>PostgreSQL Data Types . . . . . 545</b>

**APPENDIX C**      PostgreSQL SQL Syntax Reference ..... 551

**APPENDIX D**      psql Reference ..... 573

**APPENDIX E**      Database Schema and Tables ..... 577

**APPENDIX F**      Large Objects Support in PostgreSQL ..... 581

  

**INDEX** ..... 589