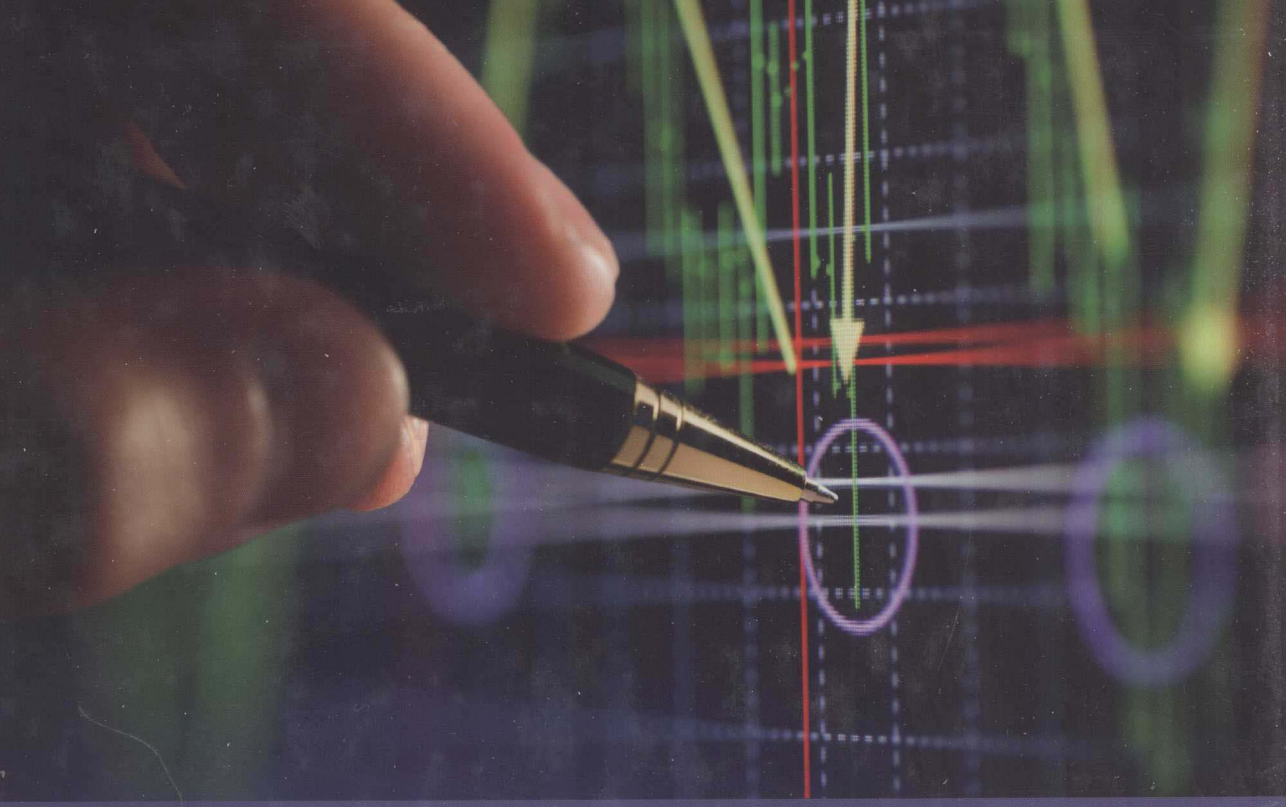

FORENSIC ANALYTICS

Methods and Techniques for Forensic Accounting Investigations

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Forensic Analytics

Methods and Techniques for Forensic Accounting Investigations

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WILEY
John Wiley & Sons, Inc.

Preface

THE BUSINESS OF OCCUPATIONAL and financial statement fraud is unfortunately alive and doing very well. There are regular reports of financial statement fraud in the financial press, and all types of financial fraud in the press releases section of the SEC's website. There are also regular reports of occupational fraud in the financial press. These reports might just be the tip of the iceberg. The 2010 *Report to the Nations on Occupational Fraud and Abuse* of the Association of Certified Fraud Examiners estimates that the typical organization loses 5 percent of its annual revenue to fraud. These statistics are confirmed in other fraud surveys such as *The Global Economic Crime Survey* of PriceWaterhourseCoopers (2009) and in reports published by the U.S. Government Accountability Office. Together with the losses from employee fraud, there are also other corporate and public sector losses from accounting errors such as underbilling or overpaying or duplicate payments.

Forensic analytics describes the act of obtaining and analyzing electronic data using formulas and statistical techniques to reconstruct, detect, or otherwise support a claim of financial fraud. In this book, forensic analytics is also used to detect accounting errors such as underbilling or overpayments. Forensic analytics also includes the detection of biases that come about when people aim for specific numbers or number ranges to circumvent actual or perceived internal control thresholds. The use of forensic analytics has been made easier with the continued increase in computing power available on laptop computers and access to inexpensive software capable of some rigorous data analysis on large data tables. The main steps in forensic analytics are (a) data collection, (b) data preparation, (c) the use of forensic analytics, and (d) evaluation, investigation, and reporting. The availability of computing power and the use of the Internet for many facets of forensic analytics have made all the steps in the process easier. All that is missing now is for forensic investigators, internal auditors, external auditors, and other data analysts to use the methods and techniques on their data.

The first three chapters in the book are an overview of using Microsoft Access, Excel, and PowerPoint for the analysis of data and the reporting of the forensic results. The next nine chapters describe forensic analytic methods and techniques that begin with high-level overviews and then drill deeper and deeper into the data to produce small sets of suspicious transactions. One high-level overview technique reviewed in depth is Benford's Law. Thereafter, two chapters show how correlation and time-series analysis can be used as detective or proactive continuous monitoring techniques. Chapters 15 and 16 discuss, with examples, a forensic risk-scoring technique that would work well in

a continuous monitoring application. Chapter 17 reviews the detection of financial statement fraud. The chapter shows how Benford's Law can be used to detect such frauds and also includes a scoring technique to score divisions for financial reporting fraud. The final chapter reviews the use of forensic analytics to detect purchasing card fraud and possible waste and abuse in a purchasing card environment.

The methods and techniques in the book are discussed and described with results from real-world data. The chapters also include a detailed demonstration of how to run the tests in Access 2007 and Excel 2007. These demonstrations are supported by about 300 screen shots showing the steps used to run the tests. In a few cases, either Access or Excel is demonstrated when that alternative is clearly the way to go. Forensic investigators should have no problem in running these tests in Access 2010 or Excel 2010 using the screenshots in the book.

The companion site for the book is www.nigrini.com/ForensicAnalytics.htm. The website includes the data tables used in the book. Users can then run the tests on the same data and can then check their results against the results shown in the book. The website also includes Excel templates that will make your results exactly match the results in the book. One template is the *NigriniCycle.xlsx* template for all the tests in the Nigrini cycle. The templates were prepared in Excel 2007. The companion site also includes PowerPoint 2007 slides for all 18 chapters. The website also has exercises and problems typical of those found at the end of college textbook chapters. These materials could be used by college professors using the book in a formal college course. With time, more sections will be added to the website and these might include links to useful resources and questions from forensic investigators and my answers to the end-of-chapter questions.

Forensic Analytics is the result of many years of work on forensic analytic projects, starting with my Ph.D. dissertation titled "The Detection of Income Tax Evasion through an Analysis of Digital Distributions." The book was written so that it would be understood by most financial professionals. Ideally, most users will have some experience in obtaining transactional data and some experience with the basic concepts of data analysis, such as working with tables, combining (appending) or selecting (extracting subsets) data, and performing calculations across rows or down columns. Users should understand the basics of either Excel or Access. There are many books covering these basics and also many free resources on the Microsoft website. In addition to the technical skills, the ideal user should have enough creativity and innovation to use the methods as described, or to add twists and tweaks to take into account some distinctive features of their environment. Besides innovation and creativity, the target user will also have a positive attitude and the disposition to, at times, accept that their past few hours of work have all been the equivalent of barking up the wrong tree and after taking a deep breath (and a few minutes to document what was done) to go back (perhaps with new data) and start again. Much of forensic analytics is more like an art than a science and forensic investigators need a personality that matches the iterative process of modifying and refining the tests.

To this day I am still thankful to my Ph.D. dissertation committee for their guidance and supervision of my forensic-based dissertation that was a move into uncharted

waters. I still remember the many Friday afternoon progress sessions with Martin Levy, a professor of Applied Statistics and Quantitative Analysis. A special thanks is also due to the first internal audit directors, Jim Adams, Bob Bagley, and Steve Proesel, that used my forensic analytic services in the mid-1990s. I needed their vote of confidence to keep going. I'd also like to thank the Wiley professionals, Timothy Burgard, Stacey Rivera, and Chris Gage, who turned my manuscript into a quality finished product.

Mark J. Nigrini, Ph.D.
Pennington, New Jersey, USA
February 18, 2011

About the Author

MARK NIGRINI, PH.D., IS an Associate Professor at The College of New Jersey in Ewing, New Jersey, where he teaches auditing and forensic accounting. He has also taught at other institutions, including Southern Methodist University in Dallas, Texas.

Mark is a Chartered Accountant and holds a B.Com. (Hons) from the University of Cape Town and an MBA from the University of Stellenbosch. His Ph.D. in Accounting is from the University of Cincinnati, where he discovered Benford's Law. His dissertation was titled "The Detection of Income Tax Evasion through an Analysis of Digital Distributions." His minor was in statistics and some of the advanced concepts studied in those statistics classes are used in this book.

It took a few years for his work to be noticed by corporate America. The breakthrough came in 1995 when his work was publicized in an article titled "He's got their number: Scholar uses math to foil financial fraud" in the *Wall Street Journal*. This was followed by several other articles on his work and on Benford's Law in the national and international media. A recent article on Benford's Law that discussed Mark's forensic work was published in Canada's *Globe and Mail* on December 22, 2010. Mark has also been interviewed on the radio and television. His radio interviews have included the BBC in London and NPR in the United States. His television interviews have included an appearance on NBC's *Extra*.

Mark has published papers on Benford's Law, auditing, and accounting in academic journals such as *The Journal of the American Taxation Association*, *Auditing: A Journal of Practice and Theory*, *The Journal of Accounting Education*, *The Review of Accounting and Finance*, *Journal of Forensic Accounting*, and *The Journal of Emerging Technologies in Accounting*. He has also published in scientific journals such as *Mathematical Geology* and pure mathematics journals such as the *International Journal of Mathematics and Mathematical Sciences*. Mark has also published articles in practitioner journals such as *Internal Auditor* and the *Journal of Accountancy*. Mark's current research addresses forensic and continuous monitoring techniques and advanced theoretical work on Benford's Law.

Mark has presented many academic and professional seminars for accountants in the United States and Canada with the audiences primarily comprising internal auditors, external auditors, and forensic accountants in the public and private sectors. Mark has presented a number of association conference plenary or keynote sessions with his talk titled "Benford's Law: The facts, the fun, and the future." The release date

of *Forensic Analytics* is planned to coincide with a plenary session to be delivered by Mark at NACVA's Annual Consultants' Conference in San Diego, CA, on June 9, 2011. Mark has also presented seminars overseas with professional presentations in the United Kingdom, The Netherlands, Germany, Luxembourg, Sweden, Thailand, Malaysia, Singapore, and New Zealand. Mark is available for seminars and presentations and he can be contacted at ForensicAnalytics@gmail.com. Other contact information is given on his website www.nigrini.com.

Contents

CHAPTER ONE

Using Access in Forensic Investigations

FORENSIC ANALYTICS IS THE procurement and analysis of electronic data to reconstruct, detect, or otherwise support a claim of financial fraud. The main steps in forensic analytics are (a) data collection, (b) data preparation, (c) data analysis, and (d) reporting. This book casts a wider net than simply the detection of financial fraud. Using computer-based analytic methods our goal is the detection of fraud, errors, and biases where biases involve people gravitating to specific numbers or number ranges to circumvent actual or perceived internal control thresholds. These analytic methods are directed at determining the likelihood or magnitude of fraud occurring. They would be a part of a fraud deterrence cycle that would include other steps such as employment screening procedures, including background checks. The techniques described in the book rely on the analysis of data, usually transactional data, but at times, other data such as statistical data or aggregated data of some sort.

The main workhorses for the preparation and analysis of data will be Microsoft Access and Microsoft Excel (or Access and Excel, for short). Other valuable and dependable and high-quality tools for data analysis include IDEA, Minitab, and SigmaPlot for preparing high-quality complex graphs. The reporting and presentation of the results is usually done using Microsoft Word and/or Microsoft PowerPoint. These results could include images cropped from various sources (including Access and Excel). Images can be copied and pasted into Word or PowerPoint by using a software tool called Snag-It.

This chapter introduces Access and the components and features of Access that are used in a forensic analytics environment. The next two chapters do the same for Excel and PowerPoint. In summary, Access has almost everything that is needed for a forensic analytics application with reasonably sized data sets, where there is not a high

requirement for high security. Forensic-related applications can be created in Access and other users with little or no knowledge of Access could use the system. The chapter reviews the Access components and features that make it useful for forensic analytics.

AN INTRODUCTION TO ACCESS

Access is Windows-based and so, fortunately, all the basic Windows operations work in Access. Your trusted mouse works just like before with right clicks, left clicks, and double clicks. Access is launched just like any other program using a shortcut or the **Start** button. Copying, moving, naming, and deleting files are done as usual. There are some differences that are mainly related to the fact that Access is a database program that expects the data tables to be continually changed and updated.

Access differs from Word and Excel in that for most users there was no migration from other products. Microsoft did an excellent job in showing people how to do task *x* in Word given that you used to do task *x* following a set of procedures using perhaps WordPerfect or Wordstar. Microsoft also showed people how to do task *y* in Excel given that you used to do task *y* using a series of steps in perhaps Quattro Pro or Lotus 1-2-3. For example, you can still enter *@sum(B1..B5)* in cell **B6** in Excel (2007) and not only will it calculate the sum correctly, but it will convert the formula to = SUM(B1:B5) for you. There is no help in Access geared to making you more familiar with the program, because there was not a preceding product that users were used to. This makes the logic of Access a little tricky to follow at first. With practice comes familiarity, and it will not be too long before you will prefer to use Access for those projects that are more suited to Access than to Excel.

One reason for favoring Access over Excel for forensic analytics work is that Access forces some discipline onto the data analysis project. Excel is basically a large free-form rectangle divided into smaller rectangles (called cells). In these cells you can (a) paste images, (b) enter numbers, (c) enter formulas, or (d) display a graph (called a chart in Excel). When you view a number in Excel, unless you click on the cell itself, you are never really sure if this is a data point or the result of a formula (a calculation). Excel is (unfortunately) very forgiving in that a column heading can be repeated (you can call both columns A and B, *People*), Excel does not mind if you call a column *Dollars* and immediately below the field name you enter the word *Rambo*. Excel has some built-in documenting capabilities (including the ability to Insert Comment) but most of the structure and the integrity are left up to the user. Without clear documentation it is easy for another user to have no clue as to what is happening in a complex spreadsheet, and even the original developer might have trouble figuring out what is happening if they look at a complex spreadsheet six months later. The opening screen for Access 2007 is shown in Figure 1.1.

In contrast to Access, most computer programs will at least do something once opened. For example, in PowerPoint you can immediately click on the blank slide and type a title or some text. This is not the case with Access. To get Access to start working

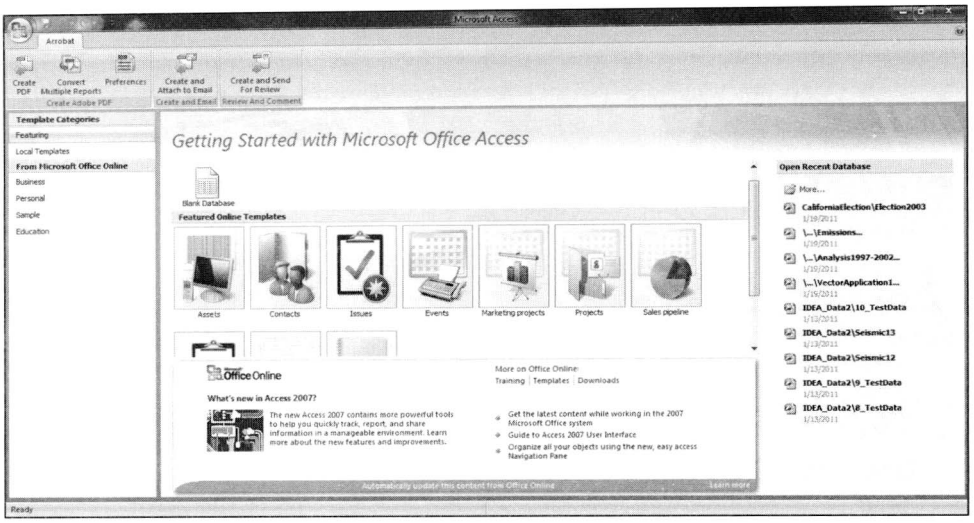

FIGURE 1.1 Opening Screen for Microsoft Access 2007

you either need to open an existing file or you need to create a new blank database. For a new forensic analytics project, the ***New Blank Database*** is the starting point. Clicking on ***Blank Database*** will start the series of dialog boxes creating a new Access database. The next step is shown in Figure 1.2.

Figure 1.2 shows the step needed to create an Access database named *Chapter1a.accdb* in a folder named *DataDrivenForensics*. Clicking the **Create** button will give the result in Figure 1.3.

The opening screen of the new database named *Chapter1a* is shown in Figure 1.3. *Table 1* is shown in the open objects panel and this is there so that the spot does not look empty. The table disappears once a new table is created and *Table 1* is closed. The navigation pane on the left lists all the Access objects and the details can be shortened or extended by selecting the drop down arrow and selecting ***Object Type*** or ***All Access Objects***. The architecture of Access and the components of a database are discussed in the next section.

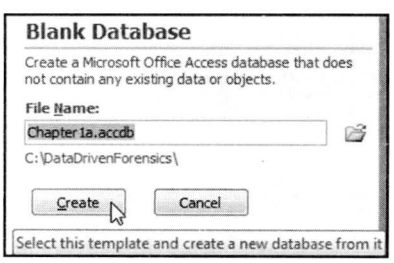

FIGURE 1.2 Creation of a New Blank Database in the *DataDrivenForensics* Folder

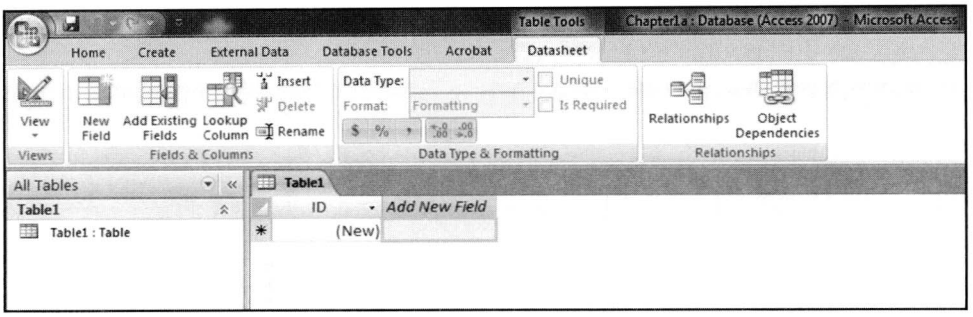

FIGURE 1.3 Opening Screen of a New Access Database Named *Chapter1a*

THE ARCHITECTURE OF ACCESS

The Microsoft Access homepage at http://office.microsoft.com/en-us/access-help/ has lots of useful and reliable information on Access 2003, 2007, and 2010. The website's opening screen with Access 2007 selected is shown in Figure 1.4.

Extensive Microsoft Access information and help is available as can be seen in Figure 1.4. After selecting the appropriate version on the right (see the arrow in Figure 1.4) the site provides information and help related to using Access. A good starting place, irrespective of your Access version, is the Access Basics section in Access 2010. The *basics* are basically the same for each version except that Access 2007 and Access 2010 use the ribbon for the selection of tasks. There are also other websites with Access information and several of these are listed on the companion site for this book.

An Access database is a tool for collecting, storing, and analyzing data, and reporting information. A database consists of unprocessed data and other objects associated with collecting, editing, adding, deleting, processing, organizing, reporting on, and sharing the data. The objects listed below are of most interest from a forensic analytics perspective:

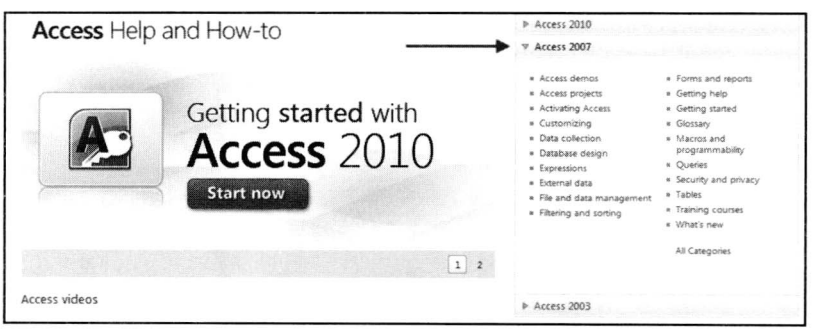

FIGURE 1.4 Microsoft Website with Access Information and Help