



<https://www.aisej.com>

**Volume 14**

**Number 1**

**2019**

ISSN: 1935-8156

# **IT General Controls Testing: Assessing the Effectiveness of User Access Management**

**Lorraine Lee**

University of North Carolina Wilmington

**Rebecca Sawyer**

University of North Carolina Wilmington

## *Author Acknowledgements*

We wish to thank Andrew Archibald for his assistance.

Published by the AIS Educator Association

[www.aiseducators.org](http://www.aiseducators.org)

© 2019 AIS Educator Association

# AIS Educator Journal



## Editor-in-Chief

**Chelley Vician**, University of St. Thomas

## Associate Editors

**Kim Church**, University of Missouri – Kansas City

**Del DeVries**, Belmont University

**Betsy Haywood-Sullivan**, Rider University

**Conni Lehmann**, University of Houston – Clear Lake

**Gary Schneider**, California State University – Monterey Bay

## **Senior Editorial Board**

Ronald J. Daigle, Sam Houston State University  
Kurt Fanning, Grand Valley State University  
David R. Fordham, James Madison University  
Cynthia Frownfelter-Lohrke, Samford University  
David C. Hayes, James Madison University  
Bonnie Klammer, North Dakota State University  
Brad Schafer, Kennesaw State University  
Joann Segovia, Winona State University  
Georgia Smedley, University of Missouri – Kansas City  
Marcia Watson, UNC Charlotte  
Skip White, University of Delaware

## **Editorial Board**

Daniel Boylan, Widener University  
Jean Ryberg Bradley, Texas State University  
Valrie Chambers, Stetson University  
Susan Cockrell, Austin Peay State University  
Dawna Drum, University of Western Washington  
Kevin Ennis, Mississippi State Univ – Meridian  
Kel-Ann Eyler, Georgia College & State University  
Sonia Gantman, Providence College  
Margaret (Peggy) Garnsey, Siena College  
Mike Garverick, Arizona State University  
David Henderson, University of Mary Washington  
Robert Hurt, Cal Poly Pomona  
Amy Igou, University of Northern Iowa  
Ethan Kinory, Rutgers Camden  
Greg Krippel, Coastal Carolina University  
Sherwood (Lane) Lambert, University of West Florida  
Lorraine Lee, UNC Wilmington  
Jie Li, Indiana University Bloomington

Cathleen McQuillen, Georgian Court University  
Monica Mendoza, Stetson University  
Kristian Mortenson, University of St. Thomas  
Pam Neely, The College at Brockport, SUNY  
Ann O'Brien, University of Wisconsin – Madison  
Russ O'Haver, Northeastern University  
Fernando Parra, California State University – Fresno  
Vasant Raval, Creighton University  
Rebecca Sawyer, UNCW  
Pamela Schmidt, Washburn University  
Poh-Sun Seow, Singapore Management University  
Seungjae Shin, Mississippi State University – Meridian  
Sean Stein Smith, Mississippi State Univ – Meridian  
Ryan Teeter, University of Pittsburgh  
Ting (TJ) Wang, Governors State University  
Leslie Weisenfeld, Winston-Salem State University  
Veronda Willis, University of Texas at Tyler  
Jack Winstead, Truman State University  
Joseph Woodside, Stetson University  
Jamey Worrell, University of Alabama at Birmingham (UAB)

## Past Editors-in-Chief

**Arlene Savage**, 2004-2007

**Stacy Kovar**, 2007-2009

**David R. Fordham**, 2009-2012

**William G. Heninger**, 2012-2015

**Ronald J. Daigle and David C. Hayes**, 2015-2018

*All materials contained herein are copyright AIS Educator Association, all rights reserved. Permission is hereby granted to reproduce any of the contents of the AIS Educator Journal for use in individual courses of instruction, as long as the source and AIS Educator Association copyright are indicated in any such reproductions. Written application must be made to the Editor for permission to reproduce any of the contents of the AIS Educator Journal for other uses, including publication in textbooks and books of readings for general distribution.*

## **Published by the AIS Educator Association**

**President:** Dawna Drum, Western Washington University

**President Elect:** Ann O'Brien, University of Wisconsin

**Conference Chair:** Sarah Bee, Seattle University

**Research Co-Chair:** Gary Schneider, California State University – Monterey Bay

**Research Co-Chair:** Kim Church, University of Missouri – Kansas City

# IT General Controls Testing: Assessing the Effectiveness of User Access Management



**Lorraine Lee**  
University of North Carolina Wilmington, leel@uncw.edu

*Volume 14,  
Number 1  
2019  
pages 15-34*

**Rebecca Sawyer**  
University of North Carolina Wilmington, sawyer@uncw.edu

## ABSTRACT

The verification of Information Technology (IT) controls is a core responsibility of IT auditors. This case places the student in the role of an IT auditor assigned to test the operating effectiveness of a specific IT general control: user access management. In addition to learning about IT controls, the case introduces several Excel functions such as VLOOKUP, MATCH, INDEX, and various text functions. The student documents the results of the IT controls tests by completing a testing matrix and writing a memo. General controls, user access management, and Excel applications are all topics taught in Accounting Information Systems (AIS) and Audit courses. As such, instructors can use this case at the undergraduate or graduate level in an IT Audit, Accounting Information Systems, or Audit class.

## Keywords

IT General Controls, User Access Management, Excel

*A teaching note and electronic files are available to faculty members for use with this case. If you are a member of the AIS Educator Association, please go to [www.aiseducators.org](http://www.aiseducators.org), sign in to your account, select the Journal menu option and the last item listed provides a secure link to Instructor-only materials.*

## INTRODUCTION

The Sarbanes-Oxley Act of 2002 (SOX) requires that the management of public companies implement, maintain, and test a system of internal controls to reduce the probability of material financial misstatements and requires evaluation of these internal controls by auditors. SOX requires a company to adopt a recognized framework of internal controls such as the framework developed by the Committee of Sponsoring Organizations of the Treadway Commission (COSO). SOX created the Public Company Accounting Oversight Board (PCAOB) to oversee the audits of public companies and to establish auditing and related professional practice standards. Specifically, as related to internal controls, the PCAOB established AS 2201, a standard for the audit of internal control over financial reporting.

The AS 2201 standard specifies that the auditor use a top-down approach to the audit of internal control over financial reporting. In a top-down approach, the audit starts at the top at the financial statement level, with the auditor obtaining an understanding of the overall risks to internal control over financial reporting. The auditor then focuses on entity-level controls and works downward towards significant accounts and disclosures (PCAOB, 2007). AS 2201 identifies entity-level controls and application-specific controls as internal controls.

Entity-level controls are those controls related to the overall control environment. Examples of entity-level controls include controls related to risk assessment, centralized processing, the monitoring of operations, and the monitoring of other controls (PCAOB, 2007). In contrast, application-level controls relate to controls in specific applications designed to prevent, detect, or correct errors and fraud within the application (Romney & Steinbart, 2018).

Information technology (IT) general controls are a subset of entity-level controls. According to the audit standard AU-C Section 315 (AICPA, 2018, p. 302), IT general controls are “policies and procedures that relate to many applications and support the effective functioning of application controls.” IT general controls include the IT control environment, the change management process, system software acquisition and development, user access management (both logical and physical access controls), and backup/recovery procedures. Without effective IT general controls, reliance on the systems related to the financial reports may not be possible.

The purpose of this paper is to describe an instructional case that focuses on the testing of a specific IT general control (user access management) and to review the use of specific Excel functions in testing the control. User access controls prevent unauthorized users from accessing, modifying, or deleting the organization’s information. A recent study by PwC determined that former employees are responsible for 26% of information security incidents in 2017 and 28% in 2016 (PwC, 2018). In addition to learning about IT controls, the case introduces several Excel functions such as VLOOKUP, MATCH, INDEX, and various text functions. The student documents the results of the IT controls tests by completing a testing matrix and writing a memo.

Internal controls including general controls, spreadsheets, systems auditing, and user security are all topics covered in Accounting Information Systems (AIS) textbooks and curriculums (Badua, Sharifi, & Watkins, 2011). IT Auditing and Auditing classes cover general controls including user access management. Proficiency in Excel is a necessary skill in all three classes as well as in the profession. The case presented in this paper is an interdisciplinary case that could be used in an AIS, Audit, or IT Audit class.

This paper is organized as follows. First, we perform a brief review of the accounting educational literature on cases involving internal controls and IT controls. Second, we identify the learning objectives associated with the case. Third, we provide background information on the two

primary concepts associated with the case: 1) user access management and 2) various intermediate Excel functions. Fourth, we describe the case and provide guidance associated with implementing the case. Finally, we provide evidence of efficacy in the classroom.

## **LITERATURE REVIEW**

Internal controls and internal controls testing are a key component of accounting information systems, audit, and IT audit and have been the subject of educational cases in the accounting literature. Table 1 provides examples of educational cases related to both internal controls and IT controls.

**Table 1: Literature Review of Instructional Cases Related to Internal Controls and IT Controls**

Year	Citation	Title	Primary Topics	Elements of article related to Internal Control / IT Control
2017	Davis, Ramamoorti, & Krull (2017)	"Understanding, evaluating, and monitoring internal control systems: A case and spreadsheet based pedagogical approach"	Internal controls / IT controls	Students document and evaluate computer controls
2014	Ragan, Puccio, & Talisesky (2014)	"Accounting control technology using SAP: A case-based approach"	Internal controls / IT controls	Uses SAP to teach Internal controls in a case scenario
2014	Daigle, Hayes, & Morris (2014)	"Dr. Phil and Montel help AIS students 'Get Real' with the fraud triangle"	Internal controls / Fraud Triangle	Case uses the fraud triangle to identify weaknesses in internal control that can lead to the possible misappropriation of assets
2014	Gainor, Blaine, & Zheng (2014)	"Teaching internal control through active learning"	Internal controls	Presents an in-class competition exercise involving the basics of internal control in an organization
2013	Dow, Watson, & Shea (2013)	"Understanding the links between audit risks and audit steps: The case of procurement cards"	Internal controls / generalized audit software	Case requires students to conduct an internal audit of a procurement card (PCard) program at a fictitious university. The case helps students understand the link between risks and controls and understand the link with the substantive and control tests
2012	Fordham (2012)	"Applying a real-world fraud to multiple learning objectives: Considerations and an example from the systems course"	Internal controls / IT controls	Case covers transaction cycles and internal controls under COSO ERM
2012	Borthick, Schneider, & Vance (2012)	"Using graphical representations of business processes in evaluating internal control"	Internal controls / IT controls	Students prepare business process diagrams to identify control weaknesses
2012	Dickins & Reisch (2012)	"Enhancing auditors' ability to identify opportunities to commit fraud: Instructional resource case"	Internal controls / IT controls	Students identify red flags related to fraud
2012	Premuroso & Houmes (2012)	"Financial statement risk assessment following the COSO framework: An instructional case study"	Internal controls	Students prepare a risk assessment worksheet
2012	Higgins (2012)	"Learning internal controls from a fraud case at Bank of China"	Internal controls / fraud	Case scenario; students answer questions about internal controls
2011	Ragan, Perrotto, & Risman (2011)	"Starsearch Technologies: In search of ways to enhance controls using SAP in the age of a risk based approach to auditing"	Internal controls / IT controls	Students use SAP screens to demonstrate internal controls in SAP

**Table 1: Literature Review (Cont.)**

Year	Citation	Title	Primary Topics	Elements of article related to Internal Control / IT Control
2011	Cereola & Cereola (2011)	"Breach of data at TJX: An instructional case used to study COSO and COBIT, with a focus on computer controls, data security, and privacy legislation"	Internal controls / IT controls	COSO AND COBIT; students prepare a risk assessment matrix
2011	Michelman, Gorman, & Trompeter (2011)	"Accounting fraud at CIT Computer Leasing Group, Inc."	Internal controls / fraud	Case includes the override of segregation of duties; preventive and detective controls
2010	Lehmann (2010)	"Internal controls: A compendium of short cases"	Internal controls / IT controls	Cases address the following control issues: 1) hiring practices, 2) weaknesses in credit authorization procedures, 3) benefits and risks of new technology, 4) benefits and risks of remote access, 5) disaster recovery/business continuity plans, and 6) procedures for employee reimbursements
2010	Fleak, Harrison, & Turner (2010)	"Sunshine Center: An instructional case evaluating internal controls in a small organization"	Internal controls / IT controls	Students apply the COSO framework to evaluate internal controls. Also, students consider the fraud triangle to identify misappropriation of funds.
2010	Murthy (2010)	"Tampa Electronics: An instructional case in computer-assisted fraud examination"	Fraud / computer-assisted fraud examination	Computer assisted fraud examination, audit software. Case provides data so student can use software to identify the fraud
2010	Henry, Bitter, & Kubichan (2010)	"The Violet Bay School District deficit of 2005: Evaluating internal control and identifying risks"	Internal controls / fraud	Student answers questions to assess control environment, control activities, etc. Students also utilize the fraud triangle
2009	Norman, Payne, & Vondryk (2009)	"Assessing information technology general control risk: An instructional case"	Internal controls / IT controls	IT general controls review; students answer questions and prepare risk assessment matrix
2008	Savage, Norman, & Lancaster (2008)	"Using a movie to study the COSO internal control framework: An instructional case"	Internal controls	Presents COSO concepts; students identify examples of internal control failures from a movie
2008	Loraas & Mueller (2008)	"Bridging the gap between spreadsheet use and control: An instructional case"	Internal controls / IT controls	Students evaluate general controls and application controls over spreadsheet applications; detection of errors in a complex spreadsheet
2006	Bromley (2006)	"Assessing internal control over cash receipts at NADCo Communications: An instructional case"	Internal controls	Students assess the internal controls over cash receipts

In Table 1, several cases directly relate to COSO and internal controls. For example, Premuroso and Houmes (2012) use the COSO framework to perform a financial statement risk assessment, while Fleak, Harrison, and Turner (2010) use COSO to evaluate internal controls in a small organization. Savage, Norman, and Lancaster (2008) use a movie to introduce COSO concepts and to identify internal control failures.

Table 1 also highlights educational cases involving the identification and testing of application-level controls. For example, Ragan, Perrotto, and Rizman (2011) use SAP screens to identify internal controls within the SAP software, while Loraas and Mueller (2008) identify specific application controls in spreadsheets.

Finally, several cases in Table 1 relate to specific IT general controls. For example, Norman, Payne, and Vendirzyk (2009) provide a comprehensive discussion of IT general controls and provide an opportunity for students to perform a risk assessment related to the IT general controls. Lehmann (2010) presents a compendium of several short internal control cases, some of which relate to IT general controls (e.g. disaster recovery / business continuity and technology assessments). More recently, Davis, Ramamoorti, and Krull (2017) develop a case scenario to evaluate the internal control structure and conduct a control risk assessment.

Our case adds to the literature related to IT general controls by providing a hands-on application of testing one specific IT general control using Excel: user access management. Prior literature has not specifically addressed user access management. Additionally, as auditors recognize Excel as a widely-used tool, this case allows students to increase their understanding of Excel functions while performing an audit-related test. Students can bridge the gap between theory and application by learning about IT general controls concepts and then performing the detailed testing of IT controls through the use of Excel functions.

## LEARNING OBJECTIVES

The purpose of this case is to educate students about IT general controls and to provide an exercise where students can apply that knowledge and test the operating effectiveness of one particular type of IT general control: user access management. This case provides the opportunity to integrate theoretical concepts related to IT general controls and user access management with specific Excel technical functionality. With this case, students use Excel to assess IT general controls. Specifically, we have four learning objectives:

1. Educate the student on the concept of IT general controls as related to user access management
2. Introduce intermediate and advanced Excel functions
3. Demonstrate how Excel can be used in the assessment of IT general controls
4. Test and document the operating effectiveness of user access management controls

## CASE BACKGROUND

### User Access Management

User access management refers to controls related to the logical and physical access of systems and data. The processes and controls associated with user access management are of primary concern in audits (Schroeder and Singleton, 2010), with the most prevalent IT control weaknesses uncovered during SOX section 404 reviews related to user access management

(Worthen, 2005). In fact, CIO magazine reports that 57% of companies still assign local administration rights to ordinary users even in large corporations (Tynan, 2019).

User access controls are the first line of defense against unauthorized access to different parts of the accounting system. User access controls provide the foundation for implementing segregation of duties in a digital environment. A user logs in with a user ID and password, gaining access to subsets of the accounting information system (AIS). The assignment of the user ID to the different parts of the AIS should be based on segregating roles related to authorization, transaction, and recording. For example, different user IDs would have the right to set up a customer (authorizing), create a customer order (transacting), and enter an invoice (recording). In addition, user access controls can prevent a single employee from both entering a bogus purchase order or invoice and then authorizing a payment to the employee for the bogus transaction.

User access management continues to be a concern to information security, especially with the advent of cloud computing. With cloud computing, users no longer have to be physically on site to access the accounting information system. As such, the logical controls associated with user access management ensure that only the authorized users can access the protected resources.

The objectives of user access controls are to reduce the risk of unauthorized or inappropriate access to systems. A key part of testing user access management controls is performing periodic reviews of active users. A periodic review of users can uncover employees who have left the organization or who have transferred to another group but may still have access to the systems. Although unauthorized access is a risk, another issue is the lack of procedures or the ineffectiveness of the existing procedures in addressing employee change of status.

Auditing standard AU-C Section 315 (AICPA 2018) addresses the auditor's responsibility to identify and assess the risks of material misstatement in the financial statements through understanding the entity and its environment. AU-C Section 315.A64 (AICPA 2018, p. 292) specifically identifies several IT risks related to internal controls and user access management such as the "unauthorized access to data that may result in the destruction of data or improper changes to data, including the recording of unauthorized or nonexistent transactions or inaccurate recording of transactions."

In order to provide guidance in this area, the AICPA developed the 2017 Trust Services Criteria for evaluating and reporting on controls as related to security, availability, processing integrity, confidentiality, and privacy (AICPA, 2017). With respect to user access management, Common Criteria (CC) 5.2 from the Trust Services Criteria (AICPA, 2017, p. 202) states:

*CC5.2 New internal and external system users are registered and authorized prior to being issued system credentials and granted the ability to access the system. User system credentials are removed when user access is no longer authorized.*

Additionally, the Trust Services Criteria reiterates the importance of separation of duties with respect to user access management. For example, a user's manager approves a user's request for a specific role, and the manager submits the approved request to the security group via a formal change management system. In this example, separation of duties exists among individuals who request access, authorize access, grant access, and review access (AICPA, 2017).

From a software application perspective, user access management generally encompasses the processes associated with creating, changing, and deleting user accounts for the associated applications. When user accounts have access to the systems associated with financial reporting, the IT controls should be formal and documented. The IT controls associated with user access management include the following:

- Document account creation and change requests.

- Require formal approval from different areas of management for account creation and change requests. For example, HR should initiate account creation for new employees, and the IT department should implement the request.
- Create a process to ensure that account administrators are notified in a timely manner when an employee is terminated.
- Remove access by terminated employees in a timely manner.
- Review access privileges for existing users and verify that those privileges are appropriate for each user's role.

## Excel

Various studies have frequently identified Excel as an important tool for accountants. For example, Ragland and Ramachandran (2014) confirm that public accounting firms are seeking graduates proficient in Excel and identify specific topics and functions of Excel particularly applicable to new graduates. From the perspective of accounting faculty, Rackliffe and Ragland (2016) explore Excel in the accounting curriculum and find that faculty understand the importance of Excel in public accounting and the need to improve students' overall proficiency in Excel. Finally, in an exploratory study, Lee, Kerler, and Ivancevich (2018) identified Excel as the most frequently utilized software or tool used by accounting practitioners, as well as the most important software tool for new hires.

Excel skills are clearly valued by the accounting profession, but they are sometimes under-emphasized in accounting curriculums. For example, instructors may teach Excel skills in a general business course and then perhaps review Excel again in an introductory AIS class. A potential problem is that students only learn basic competency in Excel without an opportunity to focus on more advanced, in-depth Excel skills in the accounting context.

## CASE DESCRIPTION AND IMPLEMENTATION GUIDANCE

### Description of Case

In this case scenario, the student takes the role of an IT auditor assigned the task of testing the IT controls related to user access management. The student tests the following two control assertions: 1) new employees receive timely access to the system; and 2) after an employee leaves the organization, the employee's account is closed in a timely manner. To test the effectiveness of these control assertions, the IT auditor at the end of each quarter requests a list of new and terminated personnel from Human Resources and a list of active system users from the IT department. The IT auditor validates that the new employees are on the list of active users and that the terminated employees are no longer on the list of active users. In this case scenario, the IT auditor is verifying that the account is opened/closed within the same quarter of the hire/termination.<sup>1</sup> Appendix A provides the full case scenario.

In order to complete this case, students will have the opportunity to use several intermediate Excel features (Table 2) to accomplish the testing, most notably text functions and lookup functions. Ragland and Ramachandran (2014) identified text and lookup functions as particularly important to accountants. With respect to text functions, new hires in accounting ranked formatting as 4<sup>th</sup> in overall importance from a list of 15 Excel functions, while supervisors ranked formatting as 3<sup>rd</sup>. New hires ranked concatenation, another text-oriented function, 8<sup>th</sup>, and supervisors ranked it 11<sup>th</sup>. For lookup functions, new hires in accounting ranked lookup functions 3<sup>rd</sup> in overall importance, and supervisors ranked lookup functions 5<sup>th</sup> (Ragland & Ramachandran 2014).

In this case, the student has two data files. The first file is from the Human Resources department, which contains the employee's first name and last name as two separate fields, along with the employee's hire date and termination date (if applicable). From the IT department, the student receives the employee's system user name and the employee name, but with the employee name as one field.<sup>2</sup> This inconsistency in format requires the student to perform a process known as "data cleansing" or "data scrubbing."

Data cleansing or scrubbing is the process of maintaining consistent and accurate data through the removal of any inaccurate or dirty data. In this case, the data from the client is assumed to be accurate, but the format of the employee name between the two files must match before the student can properly test the controls. Excel text functions can address the data preparation step to resolve the formatting differences.

The trim function in Excel removes spaces from a text string. Spaces in a text string may prevent the lookup function from correctly identifying a match. It is a good practice to use the trim function on both sets of data (source and destination) to ensure correct matching of what may be perceived as identical data. The concatenate function joins text together so that a new string can be created from various input strings, such as creating a "last name, first name" string or a "first name space last name" string.

By reviewing the Excel features in Table 2, the instructor provides general guidance on potential Excel features that could be useful in accomplishing the task. However, this task is fairly unstructured in that there are various ways to accomplish the goal. The student independently determines the required Excel functions to use and the specific steps to accomplish the controls testing.

**Table 2: Summary of Excel Functions Applicable to Case**

Feature	Description
Text functions (e.g. Trim, Concatenate)	Excel has several functions to edit a text element, such as: <ul style="list-style-type: none"> <li>• TRIM: Removing extra characters from a text string</li> <li>• CONCATENATE: Joining together 2 or more text strings</li> <li>• LEFT: Returning a specified number of characters from the left of a text string</li> </ul>
VLOOKUP()	<ul style="list-style-type: none"> <li>• Allows searching by row for a specific value in a spreadsheet. A restriction in VLOOKUP() is that the value to be looked up must be in the first (left-most) column in the table array.</li> </ul>
INDEX + MATCH	<ul style="list-style-type: none"> <li>• A combination of the INDEX() and the MATCH() functions to perform a search similar to VLOOKUP() but without the "first column" restriction.</li> </ul>
FLASH FILL	<ul style="list-style-type: none"> <li>• Excel automatically completes an adjacent column by recognizing a pattern from a few manual entries</li> </ul>

### Implementation Guidance

A graduate-level IT Audit class has implemented this case three times, in Fall 2016 (44 students), Fall 2017 (55 students), and Fall 2018 (58 students). This class is a required class in a Master of Science in Accounting program at a southeastern U.S. university. The class is a 7-week, two credit hour class and meets face-to-face twice a week for 100 minutes per class session. The course typically uses the case midway into the term, with students already exposed to initial concepts of IT controls and basic Excel skills.

This case is intended as an individual case for undergraduate or graduate accounting students. The student should be able to complete the case outside of class in 1-2 hours. Courses that could incorporate the case include Audit, IT Audit, and Accounting Information Systems.

The instructor should spend about 45 minutes to 1 hour of class time preparing the students for the case. First, the instructor can assess students' existing knowledge of IT general controls, application controls, and various Excel features used in the case by administering a pre-test, which is included in the Instructor Resources. Second, the instructor can review the concepts associated with IT general controls, including excerpts from the AS 2201 and AU-C Section 315 standards.<sup>3</sup> Third, the instructor can discuss the Excel features of VLOOKUP and INDEX/MATCH in more detail and provide examples of the applicability of those features. After reviewing these three steps, the instructor can introduce the actual case scenario, the assignment, and the files (spreadsheets) required to complete the case. The students should complete the actual work on the case individually and outside of class.

After completing the case, the student submits the following files: 1) a memo documenting the results; 2) an Excel worksheet representing a work paper with the completed testing matrix; and 3) a merged Excel workbook that demonstrates how the student combined the two input spreadsheet files and performed the matching task. In a subsequent class, the instructor can review the correct solution and the sample memo, as well as generate classroom discussions on the variety of approaches used by students to perform the testing. It might be especially interesting to note the number of students using VLOOKUP versus "INDEX/MATCH" and again discuss the differences in the two approaches. Additionally, the instructor could assess retention of the knowledge from this case by having the students re-take the same pre-test or by creating a new post-test.

The following teaching materials are available to instructors: 1) a set of teaching slides to guide the instructor through the steps described above; 2) two versions of a pre-test that include questions on IT controls and the applicable Excel features in the case; 3) a suggested solution spreadsheet; 4) a spreadsheet with the intermediate steps to derive the solution; 5) a sample memo documenting the results of the controls testing; and 6) a suggested grading rubric.

The student materials include: 1) a case scenario in Appendix A; 2) a testing matrix for students to report test results ("Case Testing Matrix.xlsx"); 3) a list of new and terminated employees ("New and Terminated Employees.xlsx"); and 4) a list of authorized computer users ("System Usernames.xlsx").

### **Case Extension**

A possible extension of this case is to work it with a database such as Microsoft Access. By using Access, students would need to be familiar with database concepts related to primary keys, table organization, and database querying. Instructors teaching AIS classes using both Access and Excel can work this case first with Excel and then later with Access. Another more unstructured approach would be for the student to have the option to use either software to complete the IT controls testing.

**Table 3: Assessment Questions**

ID	Question	Version		
		A only	B only	Both
	<b>IT General Controls</b>			
1	The objectives of IT General controls are to ensure the proper development and implementation of applications, as well as the integrity of programs, data files, and computer operations. (T/F)		X	
2	Deficiencies in IT General controls always leads to misstatements in the financial statements. (T/F)		X	
3	Common IT General controls include all of the following EXCEPT: a) Controls related to data center and network operations b) Controls related to system software acquisition, change, and maintenance c) Controls related to the physical security of the data center d) Controls related to assigning administrator privileges within the ERP system		X	
4	The input, processing, and output controls associated with a specific software are examples of a) Application controls b) General controls		X	
5	User access management refers to controls related to the logical and physical access of IT systems and data. (T/F)		X	
6	Policies associated with user access management include the following EXCEPT: a) Account creation and change requests should be documented. b) Account creation and change requests should require formal approval from different areas of management. c) When an employee is terminated, a process should exist to ensure that account administrators are notified in a timely manner. d) The arithmetical accuracies of calculated values should be checked before a transaction is complete.		X	
7	The possibility of IT personnel gaining access privileges beyond those necessary to perform their necessary duties would break down what concept? a) Matching principle b) Segregation of duties c) Materiality d) Audit independence		X	
8	The objective of user access management controls is to <b>increase</b> the risk of unauthorized users having access to the relevant systems. (T/F)		X	

**Table 3: Assessment Questions (Cont.)**

ID	Question	Version		
		A only	B only	Both
	<b>Excel Text Functions</b>			
9	What is the result of this TRIM function? =TRIM("John Doe")			X
10	Using the Excel sheet in the example, what is the result of this CONCATENATE function? =CONCATENATE(A2, B2)			X
11	Using the Excel sheet in the example, what would the following function return? =LEFT(A3, 3)			X
12	Using the Excel sheet in the example, what would the following function return? =B2 & "," & A2			X
13	Using the Excel in the example, what would the following function return? =right(B2, 5)			X
14	Using the Excel sheet in the example, you want to create an email address consisting of the user's <u>firstname.lastname@uncw.edu</u> . For example, Richard Newell's email address would be: <u>Richard.Newell@uncw.edu</u> What Excel formula / function would you use?			X
	<b>Excel INDEX and MATCH</b>			
15	The following is the formula view of an Excel spreadsheet. What is the value that will be displayed in cell E2 from the MATCH function?	X		
16	The following is the formula view of an Excel spreadsheet. What is the value that will be displayed in cell E3 from the INDEX function?	X		
17	Cell D3 contains the following formula. What will be displayed in cell D3? =INDEX(\$A\$3:\$B\$5, 3, 2)	X		
18	Cell E3 contains the following formula. What will be displayed in cell E3? =INDEX(A3:C5, MATCH (D3, A3:A5, 0),3)	X		
19	Based on the spreadsheet below, what formula using INDEX + MATCH would you write in cell x to determine whose favorite color is yellow?	X		
20	You want to look up the "Title / Description" and return the Artist. How would you have to modify the below Excel data in order to use VLOOKUP?	X		

## Case Efficacy

We assessed the efficacy of the case in two ways: 1) knowledge related to Excel skills and IT controls, and 2) student perception of the case.

To assess the knowledge related to Excel skills and IT general controls, we administered a pre-test and a post-test (Table 3). Version A of the test instrument was used in 2016 and 2017, while version B was used in 2018. Table 3 describes the differences between the two versions. Although Table 3 provides the general questions, the full tests are available in the instructor resources.

In assessing improvements in knowledge relevant to the case, we first gave the pre-test to students to develop a baseline number. Students then completed the case to develop their proficiency with the functions and features of the assignment. After completion, we gave the students a post-test with the same questions as the pre-test. We analyzed the results using a paired-sample t-test. This analysis revealed a significant difference between the mean number of correct responses between the pre-test and the post-test for all three years. Table 4 presents the results for the pre-test and post-test, showing an overall improvement in the scores of 60.07% (Fall 2016), 35.04% (Fall 2017), and 6.12% (Fall 2018).

**Table 4: Pre-test and Post-test**

	<b>Fall 2016</b> (N = 44)	<b>Fall 2017</b> (N = 55)	<b>Fall 2018</b> (N = 58)
<b>Assessment Version</b>	A	A	B
<b>Number of Questions</b>	12	12	14
<b>Pre-Test (Mean)</b>	5.61	6.38	10.62
<b>Post-Test (Mean)</b>	9.02	8.62	11.27
<b>Percentage Improvement</b>	60.07%	35.10%	6.12%
<b>T-value</b>	11.77	8.07	2.52
<b>Pr &gt;  t </b>	< 0.0001	< 0.0001	.0145

To assess student perceptions of the case, we surveyed students at the end of the semester for the three years (Table 5). From Table 5, students from each of the three years responded positively to the case, agreeing that the case improved their understanding of IT controls (Q1) and improved their knowledge of Excel functions (Q2-Q4). Notably, the respondents agreed that the case will be useful to future accounting graduate students (Q8) and recommended continual usage of the case (Q9). Additionally, we compared the mean differences among the years using an independent-samples t-test. We compared the mean values for Q1-Q9 between 2017 and 2018 and found no significant differences ( $p < .05$ ) in the means between the two years. Similarly, there were no significant differences ( $p < .05$ ) in the mean values for Q1-Q9 for 2016 versus 2017. However, in comparing the means for 2016 versus 2018, we found that Q1 ( $p = .0289$ ) and Q8 ( $p$

= .0036) were significantly different between 2016 and 2018, which provides limited evidence on improvements in the case as it was implemented during the three-year period.

**Table 5: Student Perceptions**

	<b>Question</b> (Scale: 1 = Strongly Disagree; 2 = Disagree; 3 = Slightly Disagree; 4= Neither Agree nor Disagree; 5 = Slightly Agree; 6 = Agree; 7 = Strongly Agree)	<b>Fall 2016</b> <b>N=44</b>	<b>Fall 2017</b> <b>N=55</b>	<b>Fall 2018</b> <b>N=57</b>
Q1	As a result of the case, I have a better understanding of how to test IT controls related to user access management.	5.50	5.65	5.88
Q2	As a result of the case, I can better apply Excel text functions such as LEFT, RIGHT, TRIM, and CONCATENATE.	5.81	5.85	5.81
Q3	As a result of the case, I have improved my ability to use VLOOKUP.	5.93	5.85	5.74
Q4	As a result of the case, I have improved my ability to use EXCEL INDEX + MATCH.	5.59	5.69	5.98
Q5a	I understood the steps in how to complete the case.	5.79	n/a	n/a
Q5b	The steps for completing the case were clear and understandable.	n/a	6.03	5.67
Q6	The case was a positive learning experience.	5.65	5.85	6.00
Q7	The case was an interesting case assignment.	5.27	5.65	5.56
Q8	The case will be useful to future graduate accounting students.	5.89	6.09	6.33
Q9	I recommend continuing to use the case with graduate accounting students.	n/a	6.02	6.28

A potential limitation of this case is that it has only been formally implemented with graduate students in the Master of Accounting program as part of an IT Audit class. However, with the core focus of the case related to IT general controls, we believe that the case is also appropriate at the undergraduate level in an AIS or Audit class.

### CONCLUDING REMARKS

Overall, this case provides students the opportunity to perform IT general controls testing related to user access management and to use specific Excel features and functions in this testing. As this case is based on the experiences of actual interns through their internship work experience in public accounting, it provides a real-world task that future audit / advisory interns may encounter. In addition, this case provides an accounting-based scenario for students to use and improve their Excel skills, as well as an opportunity for instructors to emphasize the accounting standards related to internal controls and IT controls.

## REFERENCES

Editor's Note: This article contains hyperlinks to World Wide Web pages. Readers who have the ability to access the Web directly from their devices and applications may be able to gain direct access to these linked pages. Readers are warned of the following caveats regarding these links.

1. The links existed as of the date of publication but are not guaranteed to be working thereafter.
2. The contents of web pages may change over time. Where version information is provided in the AISEJ published article, different versions may not contain the information or the conclusions referenced.
3. The author(s) of the web pages, not *AIS Educator Journal* nor *AIS Educator Association*, is (are) responsible for the accuracy of their content.
4. The author(s) of this article, not *AIS Educator Journal* nor *AIS Educator Association*, is (are) responsible for the accuracy of the URL and version information.

American Institute of Certified Public Accountants (AICPA). (2017). Trust services criteria.

Retrieved from

<https://www.aicpa.org/content/dam/aicpa/interestareas/frc/assuranceadvisoryservices/downloadabledocuments/trust-services-criteria.pdf>. Accessed 21 April 2019.

American Institute of Certified Public Accountants (AICPA). (2018). AU-C Section 315.

Understanding the entity and its environment and assessing the risks of material misstatement. Retrieved from

<https://www.aicpa.org/content/dam/aicpa/research/standards/auditattest/downloadabledocuments/au-c-00315.pdf>. Accessed 21 April 2019.

Badua, F.A., Sharifi, M., & Watkins, A.L. (2011). The topics, they are a-changing: The state of the accounting information systems curriculum and the case for a second course. *The Accounting Educators Journal*, 21, 89-106.

Borthick, A. F., Schneider, G.P., & Vance, A. (2012). Using graphical representations of business processes in evaluating internal control. *Issues in Accounting Education*, 27(1), 123-140.

Bromley, R. (2006). Assessing internal control over cash receipts at NADCo Communications: An instructional case. *AIS Educator Journal*, 1(1), 39-43, <https://doi.org/10.3194/aise.2006.1.1.39>.

Cereola, S.J. & Cereola, R.J. (2011). Breach of data at TJX: An instructional case used to study COSO and COBIT, with a focus on computer controls, data security, and privacy legislation. *Issues in Accounting Education*, 26(3), 521-45.

Daigle, R., Hayes, D.C, & Morris, P.W. (2014). Dr. Phil and Montel help AIS students "Get Real" with the fraud triangle. *Journal of Accounting Education*, 32(2), 146-159.

Davis, J. T., Ramamoorti, S., & Krull Jr, G.W. (2017). Understanding, evaluating, and monitoring internal control systems: A case and spreadsheet based pedagogical approach. *AIS Educator Journal*, 12(1), 59-68, <https://doi.org/10.3194/1935-8156-12.1.59>.

- Dickins, D., & Reisch, J.T. (2012). Enhancing auditors' ability to identify opportunities to commit fraud: Instructional resource cases. *Issues in Accounting Education*, 27(4), 1153-1169.
- Dow, K.E., Watson, M.W., & Shea, V.J. (2013). Understanding the links between audit risks and audit steps: The case of procurement cards. *Issues in Accounting Education*, 28(4), 913-921.
- Fleak, S. K., Harrison, K.E., & Turner, L.A. (2010). Sunshine center: An instructional case evaluating internal controls in a small organization. *Issues in Accounting Education*, 25(4), 709-720.
- Fordham, D. R. (2012). Applying a real-world fraud to multiple learning objectives: Considerations and an example from a systems course. *Journal of Accounting Education*, 30(3/4), 325-354.
- Gainor, M.E., Blin, D., & Zheng, X. (2014). Teaching internal control through active learning. *Journal of Accounting Education*, 32(2), 200-221.
- Henry, L. J., Bitter, M.E. & Kubichan, T. (2010). The Violet Bay school district deficit of 2005: Evaluating internal control and identifying risks. *Issues in Accounting Education*, 25(1), 119-153.
- Higgins, H.N. (2012). Learning internal controls from a fraud case at Bank of China. *Issues in Accounting Education*, 27(4), 1171-1192.
- Lee, L, Kerler, W., & Ivancevich, D. (2018). Beyond Excel: Software tools and the accounting curriculum. *AIS Educator Journal*, 13(1), 44-61, <https://doi.org/10.3194/1935-8156-13.1.44>.
- Lehmann, C. M. (2010). Internal controls: A compendium of short cases. *Issues in Accounting Education*, 25(4), 741-754.
- Loraas, T.M., & Mueller, J.M. (2008). Bridging the gap between spreadsheet use and control: An instructional case. *Journal of Information Systems*, 22(1), 161-172.
- Michelman, J. E., Gorman, V. & Trompeter, G.M. (2011). Accounting fraud at CIT Computer Leasing Group, Inc. *Issues in Accounting Education*, 26(3), 569-591.
- Murthy, U. S. (2010). Tampa Electronics: An instructional case in computer-assisted fraud examination. *Issues in Accounting Education*, 25(3), 547-552.
- Norman, C.S., Payne M.D. & Vandrzyk, V.P. (2009). Assessing information technology general control risk: An instructional case. *Issues in Accounting Education*, 24(1), 63-76.

- Public Accounting Oversight Board (PCAOB). (2007). AS 2201: An audit of internal control over financial reporting that is integrated with an audit of financial statements. Retrieved from: <https://pcaobus.org/Standards/Auditing/Pages/AS2201.aspx>. Accessed 21 April 2019.
- PwC. (2018). Information security survey 2018. Retrieved from <https://www.pwc.com/us/en/services/consulting/cybersecurity/library/information-security-survey.html>. Accessed 21 April 2019.
- Premuroso, R.F. & Houmes, R. (2012). Financial statement risk assessment following the COSO framework. *International Journal of Accounting & Information Management*, 20(1), 26-48.
- Rackliffe, U. R. & Ragland L. (2016). Excel in the accounting curriculum: Perceptions from accounting professors. *Accounting Education*, 25(2), 139-166.
- Ragan, J.M., Perrotto, B., & Rizman, B. (2011). Starsearch Technologies: In search of ways to enhance controls using SAP in the age of a risk-based approach to auditing. *Journal of Business Case Studies*, 7(1), 11-22.
- Ragan, J.M., Puccio, C., & Talisesky, B. (2014). Accounting control technology using SAP: A case-based approach. *American Journal of Business Education-Fourth Quarter 2014*, 7(4), 349-360.
- Ragland, L. & Ramachandran, U. (2014). Towards an understanding of Excel functional skills needed for a career in public accounting: Perceptions from public accountants and accounting students. *Journal of Accounting Education*, 32(2), 113-129.
- Romney, M.B. & Steinbart, P.J. (2018). *Accounting Information Systems*, 14<sup>th</sup> edition, New York: Pearson.
- Savage, A., Norman, C.S. & Lancaster, K.A.S. (2008). Using a movie to study the COSO internal control framework: An instructional case. *Journal of Information Systems*, 22(1), 63-76.
- Schroeder, D., & Singleton, T. (2010, July). Implementing the IT-related aspects of risk-based auditing standards. *The CPA Journal*, 66-70.
- Tynan, D. (2019, January 2). 15 IT Resolutions for 2019. *CIO Magazine*. Retrieved from <https://www.cio.com/article/3328790/15-it-resolutions-for-2019.html>. Accessed 21 April 2019.
- Worthen, B. (2005, July 1). How to dig out from under Sarbanes-Oxley. *CIO Magazine*. Retrieved from [https://www.cio.com.au/article/181075/how\\_dig\\_from\\_under\\_sarbanes-oxley/?pp=5&fp=4&fpid=1](https://www.cio.com.au/article/181075/how_dig_from_under_sarbanes-oxley/?pp=5&fp=4&fpid=1). Accessed 21 April 2019.

## APPENDIX A

### The Case

You are an IT auditor and have been assigned by your senior (Max Rogers) to test IT controls at a large data center. One of the controls you are testing is management's review over authorized user accounts for one of their database systems. Due to the confidential nature of this database, management is required to review and update the authorized users list periodically and to issue quarterly reports on the authorized users.

As the IT auditor, you must test the quarterly reports of authorized users maintained by management against both the new employee lists and the terminated employee lists received from Human Resources. Specifically, you must verify the following assertions:

- 1) All new hires have an account created with access to the database within the same quarter they are hired.
- 2) All terminated employees are removed from the authorized users list within the same quarter they are terminated.

Emily Hanover is the regional manager over the data center and your main point of contact. She has sent you management's quarterly reports regarding authorized user accounts ("System Usernames.xlsx").

Sam November is head of the HR department and has sent the lists of new employees and terminated employees for each quarter of 2014 ("New and Terminated Employees.xlsx").

**Step 1:** Examine the files received from Emily and Sam. Develop a way to test the names from the lists received from Sam against the list received from Emily.

**Step 2:** Test the lists for Q1-Q4 to determine if there are any exceptions. An exception would be a new hire without an account or a terminated employee with an account.

In this assignment, you are testing two assertions for each quarter:

Assertion A: Newly hired employees have authorized user accounts created within the quarter of hire

Assertion B: Terminated employees have their authorized user accounts deleted within the quarter of termination

Please be sure to consider the following:

- If a new hire does not have an authorized account in the quarter of hire, you must check if the new hire was granted access in a subsequent quarter.
- If an employee was terminated in a particular quarter and still had access in that same quarter, you must continue to check if he or she has access in subsequent quarters. If the employee still has access in subsequent quarters, it would continue to be considered a test failure for that quarter until the employee's account was properly deleted. For example, if John Doe was fired in Quarter 2 and still had a user account in Q2, Q3, and Q4, Assertion B would be considered a "Fail" for those three quarters (Q2, Q3, Q4).
- If an employee is hired and terminated in the same quarter, the employee is expected to be on both the hired list and the terminated list but not on the "authorized users" list. For example, if John Doe was hired in Q2 and fired in Q2, he would be listed in the Q2 report (6/30/2014) as a new hire and a terminated employee. Additionally, it would be expected for him to NOT be listed as an authorized user since the authorized user list represents the authorized users at a particular point in time.

**Step 3:** Fill in the testing matrix (“Case Testing Matrix.xlsx”) with the test results. In the testing matrix spreadsheet, you will complete the shaded cells in the following table:

Q	Sample Date	Assertion A	Assertion B
1	3/31/2014		
2	6/30/2014		
3	9/30/2014		
4	12/31/2014		

For example, for Q1 (3/31/2014), if Assertion A is verified as correct in that all newly hired employees during Q1 have been added as authorized users, then you would put a check mark in the appropriate cell.

Q	Sample Date	Assertion A	Assertion B
1	3/31/2014	✓	
2	6/30/2014		
3	9/30/2014		
4	12/31/2014		

To use a check mark in the table, go to Insert>Symbol>Font: Wingdings and select the checkmark symbol.

If exceptions are noted, put an alphabetic footnote and explain the exception in the text box at the bottom of the matrix. For example, if John Doe was hired on 3/1/2014 and was not on the authorized user’s list as of 3/31/2014, an exception would be noted in the testing matrix and indicated by Footnote A and documented in the Exceptions box.

Q	Sample Date	Assertion A	Assertion B
1	3/31/2014	A	
2	6/30/2014		
3	9/30/2014		
4	12/31/2014		

**EXCEPTIONS**

A: John Doe was hired on 3/1/2014 but did not have a user account as of 3/31/2014.

Complete the testing matrix based on your test results for the four quarters.

**Step 4:** Prepare a one-page memo to your senior documenting the testing objectives, detailed procedures, results, and recommendations.

### Memo Guidelines

Include the WHO, WHAT, WHY, WHEN, WHERE, and HOW

One-page (single-spaced; single space between paragraphs; no indentation on first paragraph; 11-point font)

Memo Segment	Description	
Heading Segment	TO: Reader's name and job title FROM: Your name and job title DATE: Current date SUBJECT: What the memo is about	WHO, WHAT, WHEN
Opening Segment / Task Segment	Brief identification of what you did, for which client, where the work was performed, and why you did it.	WHAT, WHO, WHY, WHERE
Discussion Segment	<ul style="list-style-type: none"> <li>Document the specific assertions tested</li> <li>Document how you tested the assertions</li> <li>Document the results of the testing</li> </ul>	HOW
Summary Segment	Restatement of the results, location of any supporting documentation, and recommendations of next steps	

<sup>1</sup> The quarterly timeframe is used in this case as part of the audit verification process. In practice, the client is likely to have more stringent requirements on the timing of account provisioning and closures, e.g. the client would likely have a terminated employee immediately removed as an authorized user on the employee's last day of work. This timing on actual account provisioning and closure versus the timing of audit verification can be included as a part of the overall classroom discussion.

<sup>2</sup> In practice, employers would likely have an Employee ID as a primary key that would be used as part of the matching process. For this case, an Employee ID is not provided in order to provide additional practice with Excel text functions.

<sup>3</sup> Information on AS 2201 can be found at: <https://pcaobus.org/Standards/Auditing/Pages/AS2201.aspx>. Accessed 21 April 2019.

Information on AU-C Section 315 can be found at: <https://www.aicpa.org/content/dam/aicpa/research/standards/auditattest/downloadabledocuments/au-c-00315.pdf>. Accessed 21 April 2019.