# Cost Accounting

## A Data Analytics Approach

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# Dedications

**For Adam, Kate, Eloise, and James, with love.**

—Margaret Christ

**To Carolyn, who is and will ever be my favorite. Thank you for your unwavering love and support when I decide to do the impractical.**

—Kip Holderness

**To my most amazing son, Daniel, who has a zest for life and is the hardest worker I know. Love you, Danny!**

—Vern Richardson

# About the Authors

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**Margaret H. Christ** is the J. M. Tull Chair in Accounting in the Terry College of Business at the University of Georgia. Her research focuses on accounting innovation, including data analytics and other accounting technologies, and how they impact organizational risk, management control systems, and employee behavior. She has served as an editor for *The Accounting Review, The Journal of Management Accounting Research,* and *Accounting Horizons* and serves on several editorial boards. Dr. Christ teaches accounting analytics using a case-based curriculum that focuses on data analytics, visualization, and automation and their uses in a variety of accounting contexts. She also works with the Ernst and Young Academic Resource Center to develop and disseminate educational materials on the analytics mindset. Her teaching cases have won several awards from the AAA and Institute of Management Accounting, including the 2020 Innovation in Accounting Education Award.

Courtesy of Beth Ann Harper

**D. Kip Holderness Jr.** is Associate Professor of Accounting at West Virginia University. He teaches cost, management, and forensic accounting, and he works extensively with doctoral students conducting various research projects. Dr. Holderness's research focuses primarily on the impact of fraud and employee deviance on individuals and organizations and on improving detection methods. He also examines the effects of personality and generational differences in the workplace. He has published in practitioner and academic journals in the areas of fraud and forensics, auditing, managerial accounting, information systems, and accounting education. Dr. Holderness has received numerous research grants from the Institute for Fraud Prevention and the Institute of Management Accountants.

Vernon J. Richardson

**Vernon J. Richardson** is Distinguished Professor of Accounting and the G. William Glezen Chair in the Sam M. Walton College of Business at the University of Arkansas and Visiting Professor at Baruch College. He received his BS, Master of Accountancy, and MBA from Brigham Young University and his PhD in accounting from the University of Illinois at Urbana–Champaign. Dr. Richardson is a member of the American Accounting Association and has served as president of the American Accounting Association Information Systems section. He previously served as an editor of *The Accounting Review* and is currently an editor at *Accounting Horizons.* He is also a co-author of McGraw Hill's *Accounting Information Systems, Introduction to Data Analytics for Accounting, Introduction to Business Analytics, Data Analytics for Accounting,* and *Financial Statement Analysis* textbooks. His accounting analytics textbooks won the AAA's 2022 Innovation in Accounting Education Award.

# Data-Driven Insights: Guiding Students and Shaping Future Leaders

## From the Authors

The role of management accountants is to analyze data to help organizations make effective business decisions. Thanks to an ever-increasing amount of data generated by companies, the opportunities for management accountants to provide data-driven insights have never been greater. We believe that students can prepare for an accounting career not only by understanding the methods and procedures of cost accounting but also by learning how to examine and analyze data, interpret the results, and share insight with others in their organizations.

In addition to providing a strong foundation in cost accounting, *Cost Accounting: A Data Analytics Approach* offers a valuable framework that will help students use and analyze data and provide value to their organizations. This framework, which we call the AMPS model, is composed of four steps:

1. **A**sk the Question
2. **M**aster the Data
3. **P**erform the Analysis
4. **S**hare the Story

Throughout the text, the AMPS model helps students approach management accounting topics in a data-driven way. These topics include, but are not limited to, cost analysis, cost-volume-profit analysis, budgeting, variance analysis, and strategy maps. The model is reinforced as students complete labs in each chapter that require them to use common workplace tools (such as Excel®, Tableau®, and Power BI®) to analyze data, interpret results, and make effective business decisions.

The text explains important data analytics skills—such as sensitivity analysis, regression analysis, and goal-seek analysis—and asks students to apply these skills in a host of decision-making contexts. Students also learn how to create data visualizations to become effective communicators within their organizations.

In writing this book, we've incorporated input from hundreds of instructors through detailed development reviews, in-depth focus groups, and intensive panels to ensure that it includes the cost and management accounting topics that today's instructors and students need. Our focus on real-world applications, and on the integration of data analytics tools and decision making, sets our book apart while preparing today's students to become tomorrow's accounting leaders.

Margaret Christ
Kip Holderness
Vern Richardson

# Key Features

## Management Accounting and Data Analytics

Information is a strategic asset of any firm, and the way a business accesses, analyzes, and uses information to inform critical business decisions can give it a unique competitive advantage. Management accounting exists to address management's questions and to facilitate decision making. To this end, management accountants must be able to identify, transform, and analyze appropriate data, and then provide salient, real-time reporting and data visualizations to management. To help students develop these essential business skills, we integrate data analytics skills in every chapter of this text.

Chapter **2**

### An Introduction to Cost Data

#### A Look at This Chapter

To answer the management accounting questions introduced in Chapter 1, we must establish a common language, or vocabulary, and identify sources of relevant data. This chapter introduces the cost classifications and highlights relevant data sources used by management accountants. It also explains how and why data sources are combined to answer cost accounting questions (using VLOOKUP functions and data table linking). The chapter concludes with a discussion of relevant software tools (including Excel, Tableau, and Power BI) and their capabilities.

**Cost Accounting and Data Analytics**

| COST ACCOUNTING LEARNING OBJECTIVE | | RELATED DATA ANALYTICS LAB(S) | LAB ANALYTICS TYPE(S) |
|---|---|---|---|
| LO 2.1 | Define a cost object. | | |
| LO 2.2 | Differentiate between direct costs and indirect costs. | | |
| LO 2.3 | Compare and contrast fixed, variable, and mixed costs. | LAB 2.1 **Excel** Assessing Fixed, Variable, and Mixed Costs Using Scatterplots | Descriptive, Diagnostic |
| LO 2.4 | Define product costs and period costs. | | |
| LO 2.5 | Identify the sources of cost accounting data. | | |
| LO 2.6 | Describe different data attributes and data types, and explain how to use a relational database. | **Data Analytics Mini-Lab** Linking Tables Using VLOOKUP in Excel | Descriptive |
| | | LAB 2.2 **Excel** Linking Tables in Excel Using the VLOOKUP Command and Pivot Tables (Heartwood) | Descriptive |
| | | LAB 2.3 **Excel** Linking Tables in Excel Using an Internal Data Model (Heartwood) | Descriptive |
| LO 2.7 | Compare and contrast available data-analysis software tools and their specialties. | LAB 2.4 **Tableau** Linking Tables and Creating Visualizations (Heartwood) | Descriptive |
| | | LAB 2.5 **Power BI** Linking Tables and Performing Analysis (Heartwood) | Descriptive |

# Hands-on Learning with Labs and Mini-Labs

In *Cost Accounting: A Data Analytics Approach,* data analytics is not a footnote to the cost accounting curriculum. Instead, it is an integral part of every chapter, guiding students from accounting and data analytics concepts, to step-by-step practice and application, to independent analysis, interpretation, and data-driven decision making. To provide students with hands-on practice, each chapter provides not only an introductory Data Analytics Mini-Lab within the chapter but also full-length end-of-chapter labs that offer decision-making context, ask specific management questions, and walk students through the process of analyzing the data and presenting the results to decision makers. The labs are supported by an extensive library of author-created videos in Connect.

**DATA ANALYTICS MINI-LAB**
**Linking Tables Using VLOOKUP in Excel**

**Data Analytics Type: Descriptive Analytics**

**Lab Note**
The tools presented in this lab periodically change. Updated instructions, if applicable, can be found in the student and instructor support materials.

**Keywords**
Excel, Relational Databases

**Decision-Making Context**
Relational databases store data in multiple tables. When it comes time to do more extensive analysis, the tables are linked, and analysis is completed.

**DJI** is a company that produces and sells drones. We have a table that has (fictitious) sales for the month of October. We also have a second products (or SKU) table that provides product descriptions, along with the sales price and the cost of each product.

We'll use the product SKU to link the two tables together. Product SKU is the *primary key* for the products (SKU) table (Mini-Lab 2SKU Data.xlsx). Product SKU is the *foreign key* in the DJI Mavic Drone Sales Journal (Mini-Lab 2 Sales Journal Data.xlsx).

### Ask the Question
What are the total sales of the Mavic 2 Drone, or SKU DJI-AIR?

### Master the Data
For this Mini-Lab we will use data in the Excel file titled **Mini-Lab 2 Sales Journal Data.xlsx.** The sales journal is a specialized accounting journal that keeps track of sales. In this case, it serves as a record of October sales at DJI Mavic.

Open Excel file **Mini-Lab 2 Sales Journal Data.xlsx.** Exhibit A shows a snippet of the sales journal spreadsheet and the data dictionary.

**Exhibit A**
**Data Dictionary for Mini-Lab 2 Sales Journal Data (also known as Sales Journal)**

| Field (Attribute) | Description | Data Type |
|---|---|---|
| **Date** | Date of sale | Date (MM/DD/YY) |
| **Invoice #** | Invoice number for sale of products | Number |
| **Customer #** | The customer number for each customer who purchased from DJI Mavic | Number |
| **SKU** | The product code or SKU (stock-keeping unit, which is a unique code for each product sold) | String |

# Contemporary Management Accounting Topics: Ethics, ESG, and Human Dimensions of Management Accounting

A variety of important new and emerging issues that organizations face today can impact management decision making. For example, many companies have prioritized sustainability efforts and sustainability reporting, using their management accounting system to accumulate, analyze, and report sustainability information for internal decision makers and external stakeholders. In addition, in performing their jobs, management accountants (and all other types of accountants) must exhibit a strong degree of integrity and adhere to a strict code of ethics. They must understand and respect customers', suppliers', and employees' right to privacy and make sure that they collect, use, and maintain data ethically. They must also be aware of, and work with, their companies' commitments to various ESG (environmental, social, and governance) goals. Finally, management accountants must understand the human dimensions of accounting decisions, ensuring that processes and procedures provide the right incentives to the workforce.

# From the Field

Accounting students need exposure to contemporary issues and should be prompted to think critically about how the traditional management accounting topics apply in the modern business environment. To this end, we include discussion of these topics throughout the text where appropriate, using engaging stories, anecdotes, and "From the Field" mini case studies.


**FROM THE FIELD**

**Tracing Costs to Remove the Need for Allocation**

Allocation always involves some element of guesswork. Traced costs are directly attributed to jobs or products, which removes the need for allocation. Therefore, one way to improve the accuracy of cost information is to increase the number of costs that are traced, which allows companies to reclassify indirect costs as direct costs.

Consider labor costs. In some industries such as accounting, legal services, and consulting, employees track their time in 15-minute increments, which are then traced to specific jobs. Tracing labor decreases indirect costs and provides more accurate cost information.

In many cases, tracing labor costs may not be practical, even though companies can do so. Consider a supervisor who oversees dozens of employees who work on separate projects. In this case, the cost of tracing supervisor labor may outweigh the benefits of more accurate cost data.

**Thinking Critically**

Companies have greatly increased tracing of the environmental costs of providing goods and services in the past several years. How might the specific identification of environmental costs have altered company behavior as it pertains to companies' ESG efforts? How will these efforts be impacted by ESG reporting regulations?

Jurisdictions that have relatively low corporate tax rates are known as *tax havens*. The British Virgin Islands, the Cayman Islands, and Bermuda are among the most popular international locations for multinational corporations looking to minimize their tax liability. In the United States, the state of Delaware is an attractive choice for incorporation because Delaware-based companies can avoid corporate taxes even while doing business across state lines.

Some question the ethical considerations of organizations relying heavily on tax havens to reduce their tax liability. Research shows that tax havens cost governments between $500 billion and $600 billion (per year) in lost corporate tax revenue. It is estimated that in 2021 U.S. Fortune 500 companies held $2.6 trillion in profits in offshore tax havens, allowing them to avoid over $700 billion in U.S. federal income taxes.

# Career-Readiness Focus

The introduction to each chapter shows how the chapter concepts relate to specific career skills. Markers throughout the text show where these career-readiness concepts are taught and reinforced. In addition, each chapter concludes with a recent job posting for a company looking to hire an accountant with the skills taught in that chapter. These materials help students see the direct connection between the skills learned in this course and the skills used in the real world of modern business.

**Chapter Concepts and Career Skills**

| Learning About . . . | Helps with These Career Skills |
|---|---|
| Cost objects | • Defining a company's costs |
| Direct vs. indirect costs | • Determining which costs are tracked directly and which costs are not tracked directly |
| Fixed, variable, and mixed costs | • Determining a firm's pricing and marketing strategies |
| Product vs. period costs, and prime vs. conversion costs | • Understanding the nature of costs and how they impact the accounting for costs overall |
| Cost accounting data sources | • Recognizing and using data from various sources to address management questions |
| Relational databases | • Understanding how databases link attributes of different customers, sales transactions, vendors, payroll, employees, and suppliers to each other using tables and primary and foreign keys |
| Analytics software tools, including Excel, Tableau, and Power BI | • Matching the most applicable software tool to the management accounting task |

# Tools and Resources

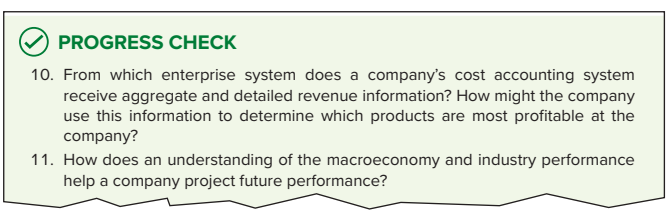
## AMPS Model

To help develop an analytics mindset, our textbook centers on the AMPS model of data analytics that serves as the framework for each chapter:

- **Ask the Question:** Management has questions that relate to the achievement of the organization's goals. Students learn how to ask the right questions that can be answered with data to improve decision making.
- **Master the Data:** The sources of management accounting data are described, and the basics of data preparation are considered.
- **Perform the Analysis:** Each chapter and lab emphasize the use of the appropriate data analytics techniques to answer management's specific questions. Four broad categories of data analytics are covered:
  - **Descriptive Analytics:** counts, summaries, totals, averages, cost breakdowns
  - **Diagnostic Analytics:** variances, cross-tabulations, conditional formatting
  - **Predictive Analytics:** correlation, regression, time series forecasting
  - **Prescriptive Analytics:** what-if analysis, goal-seek (break-even) analysis, cash flow analysis
- **Share the Story:** To make effective data-driven decisions, and to communicate results to key stakeholders, management must clearly understand accounting data and the results of data analysis. Each chapter emphasizes data reporting, creating visualizations, and developing dashboards that can help managers make effective decisions.

## Progress Checks

Progress Check questions posed following each major section of each chapter encourage students to consider and apply the concepts presented.

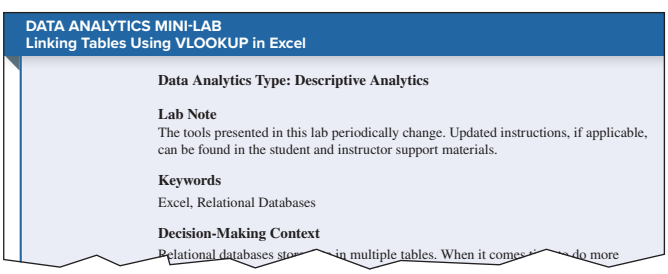


**PROGRESS CHECK**

10. From which enterprise system does a company's cost accounting system receive aggregate and detailed revenue information? How might the company use this information to determine which products are most profitable at the company?
11. How does an understanding of the macroeconomy and industry performance help a company project future performance?

## In-Chapter Data Analytics Mini-Labs

The in-chapter Data Analytics Mini-Labs illustrate how management accountants can answer managers' questions via the AMPS model. These labs move students from concepts to hands-on practice with the tools that modern businesses use to help them make profit-maximizing decisions. Each Mini-Lab serves as an introduction to the data analytics that students will work with in greater detail in the full-length labs at the end of each chapter.



**DATA ANALYTICS MINI-LAB**
**Linking Tables Using VLOOKUP in Excel**

**Data Analytics Type: Descriptive Analytics**

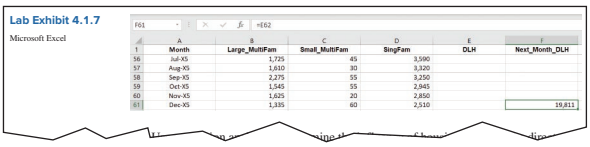
**Lab Note**
The tools presented in this lab periodically change. Updated instructions, if applicable, can be found in the student and instructor support materials.

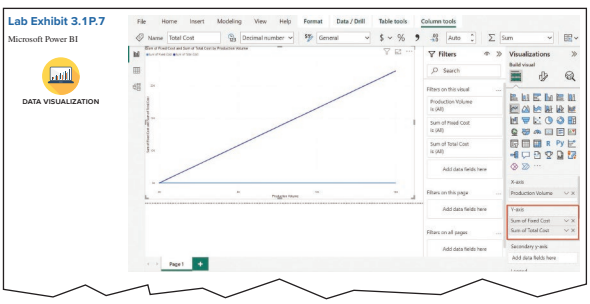
**Keywords**
Excel, Relational Databases

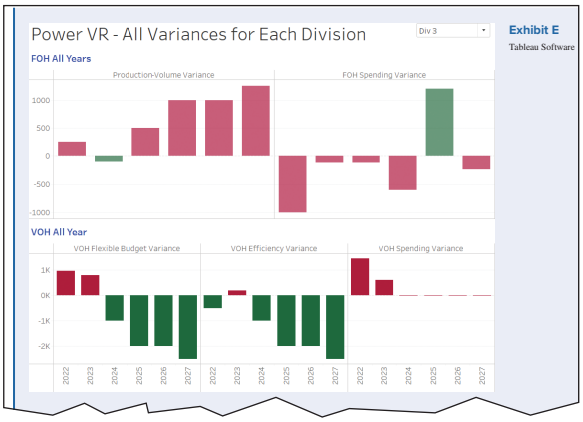
**Decision-Making Context**
Relational databases stor[illegible] in multiple tables. When it comes t[illegible] do more

# Focus on Building Skills with Excel®, Tableau®, and Power BI®

Students learn how to conduct business analytics using three software tools that are widely used by businesses today: Excel, Tableau, and Power BI.




## Data Analytics Labs

To provide students with hands-on experience in data analysis techniques and skills, each chapter includes approximately *five* detailed labs that require them to use Excel, Tableau, and/or Power BI. Each lab asks students to bring together their knowledge of cost accounting and data analytics to ask and answer questions, and to present their findings to decision makers. Each lab has two versions. The first provides step-by-step instructions to help students learn the relevant techniques, while the second assesses students on the skills learned. Each lab allows students to choose their path through the AMPS model: They can use written instructions with screenshots from the relevant software package, or they can follow along with video tutorials created by the authors. Lab assessment is conducted primarily in Connect through the use of auto-graded questions, including multiple-choice questions, algorithmic questions, and other objective questions.

**CHAPTER 2 LABS**

- **LAB 2.1** **Excel** Assessing Fixed, Variable, and Mixed Costs Using Scatterplots
- **LAB 2.2** **Excel** Linking Tables in Excel Using the VLOOKUP Command and Pivot Tables
- **LAB 2.3** **Excel** Linking Tables in Excel Using an Internal Data Model
- **LAB 2.4** **Tableau** Linking Tables and Creating Visualizations
- **LAB 2.5** **Power BI** Linking Tables and Performing Analysis

### Lab 2.1 Excel

#### Assessing Fixed, Variable, and Mixed Costs Using Scatterplots

**Data Analytics Types: Descriptive Analytics, Diagnostic Analytics**

**Lab Note:** The tools presented in this lab periodically change. Updated instructions, if applicable, can be found in the student and instructor support materials.

**Keywords**

Scatterplot, Visualization, Cost Behavior

**Decision-Making Context**

Cheap Drones is trying to determine its cost behavior to make sure its products are profitable.

It is important for managers to understand their cost behavior, which is the relationship between cost and behavior. Variable cost changes in proportion to the change in cost drivers, but variable cost per unit is constant within the relevant range. Fixed cost does not change in total, but fixed cost per unit decreases within the relevant range. Mixed cost increases as activity increases but not to proportion.

Later chapters will use more sophisticated methods to explain cost behavior. This lab focuses on developing a basic understanding of cost behavior with scatterplots, a common type of data visualization.

**Required**

Determine the cost behavior for each input cost and the total cost of each drone produced.

# Practical Examples from Real-World Companies

Throughout the text, management accounting concepts are introduced via examples from a host of real-world companies and industries. In addition, each chapter includes at least one lab using data from **Heartwood Cabinets**, a fictional business adapted from a real manufacturing company, to provide continuity and to allow students to work with the cost accounting aspects of the many operations of a single company.

## PRODUCT COSTS AND PERIOD COSTS

Companies also classify costs as either product costs or period costs. **Product costs** are all costs that are incurred to produce goods and services for customers. What gets categorized as product costs differs substantially between companies. For service companies, such as the **Boston Consulting Group**, product costs may include the materials used to provide consulting services, but many service companies have no product costs. For retailers such as **TJ Maxx** and **Target**, product costs consist of inventory purchased for resale in their stores. For manufacturing companies such as **Tesla** and **Apple**, product costs consist of all costs incurred to produce goods: namely, direct materials, direct labor, and manufacturing overhead. Companies often use the terms **prime costs** to refer to direct materials and direct labor and **conversion costs** to refer to direct labor and manufacturing overhead.

**Period costs** are recorded as expenses on the income statement when they occur. Any cost that is not a product cost is a period cost. In contrast, product costs are recorded as part of an asset in inventory. Exhibit 2.4 provides some examples of product costs and period costs at Tesla and **Heartwood Cabinets**

# End-of-Chapter Exercises and Problems

In-chapter and end-of-chapter progress checks, exercises, and problems are essential to each chapter. The end-of-chapter assessments include real-world application questions with a special emphasis on data analytics skills and tools. Each chapter also provides multiple-choice and discussion questions as well as exercises and problems to reinforce learning. Adapted CMA exam questions are also included and called out with an icon.

CMA

## Problems

1. (LO4.4) Web Bytes allocates manufacturing overhead on the basis of direct labor hours. Web Bytes had the following cost information:

   Estimated direct labor hours: 10,000 hours

   Actual direct labor hours: 12,000 hours

   Estimated manufacturing overhead costs: $18,000

   Actual manufacturing overhead costs: $24,000

   **Required**

   a. What is Web Bytes' predetermined overhead rate?

   b. What is Web Bytes' applied overhead for the year?

   c. What is the amount of overapplied or underapplied overhead for the year?

2. (LO4.1, 4.3, 4.6) Dashing Diva has the following costs for April.

| | |
|---|---|
| Direct labor | $20,000.00 |
| Direct materials | $15,000.00 |
| Factory utilities | $8,000.00 |
| Accounting services | $12,000.00 |
| Direct marketing | $17,000.00 |
| Production supervisor salaries | $6,000.00 |
| Factory equipment depreciation | $13,000.00 |

   **Required**

   a. What are the total production costs?

   b. What are the total manufacturing overhead costs?

   c. Dashing Diva produced Job #123 with the following actual costs: $1,500 of direct materials, $1,800 of direct labor, and $1,000 of manufacturing overhead. Dashing Diva allocates manufacturing overhead at a rate of 80% of direct labor costs. Under a normal costing system, what was Dashing Diva's recorded cost for Job #123?

3. (LO4.4, 4.6) Jackson Mills has the f[illegible] cost information:

CMA

21. (LO5.2) When using activity-based costing techniques, which one of the following departmental activities would be expected to use machine hours as a cost driver to allocate overhead costs to production?
    a. Plant cafeteria
    b. Machine setups
    c. Material handling
    d. Robotics painting

CMA

22. (LO5.2) A company is considering the implementation of an activity-based costing and management program. The company:
    a. should focus on manufacturing activities and avoid implementation with service-type functions.
    b. will probably find a lack of software in the marketplace to assist with the related recordkeeping.
    c. will likely gain added insights into causes of cost.
    d. will likely use fewer cost pools than it did under more traditional accounting methods.
23. (LO5.2, 5.3) The Chocol[illegible]er specializes in chocolate baked g[illegible]

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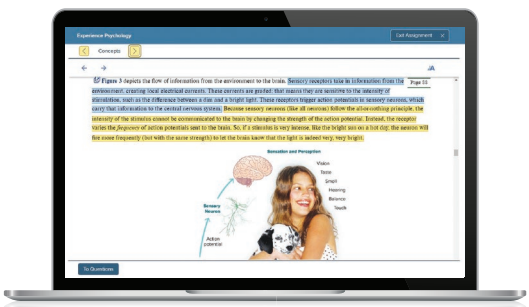

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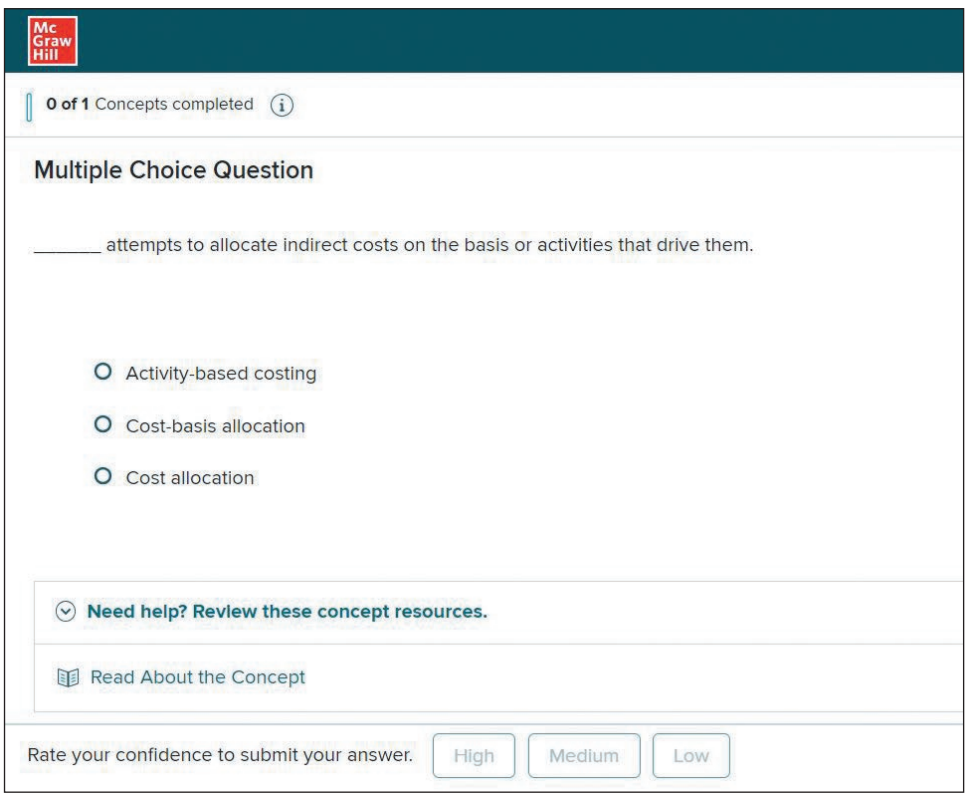
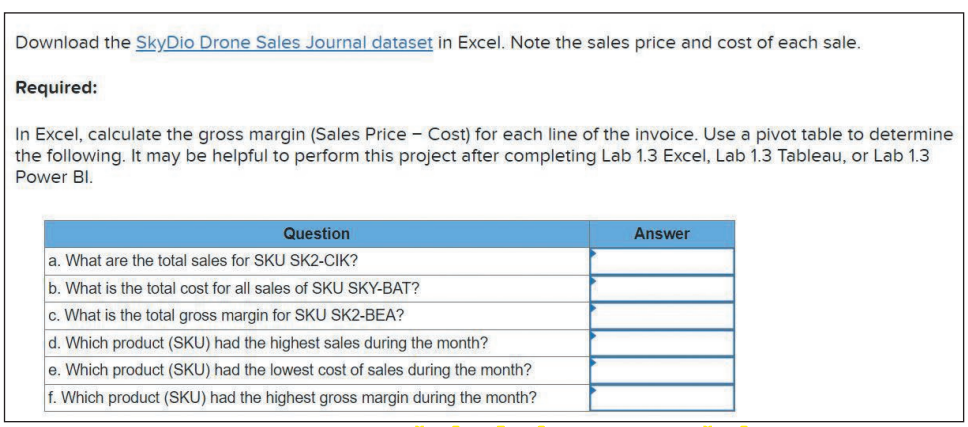



**Exercises/Problems:** Selected exercises and problems from the text are available for assignment in Connect to ensure students are building an analytical skill set.



**Labs with Lab Assessments:** While the labs require students to work outside of Connect in Excel, Tableau, and/or Power BI, Connect allows students to upload their results and answer analytical questions designed to reinforce the concepts and techniques taught in each chapter.

**Lab 1-3 (Static) Excel: Assessment Questions**

Answer the following questions based on the details provided.

| Question | Answer |
|---|---|
| 1. Which of these products has the highest gross margin percentage? | |
| 2. What word do we use to describe the different groupings in a histogram? | |
| 3. Which gross margin percentage bin does the Goji Berry SKU fit in? | |
| 4. Which gross margin percentage bin does the FRT-COU SKU fit in? | |
| 5. How many products (SKUs) have gross margin percentages in the 0.325 - 0.35 range? | |

**Required**

1. Create a histogram of the gross margin percentages using bins of 0.025 size.
2. Create a list of SKUs in the highest 0.025 bin (from 0.40 to 0.425).
3. Create a histogram visualization.

**SKU:** Stock-keeping unit, a unique code for each product sold.

**Ask the Question**

Which products (SKUs) are the most profitable to sell?

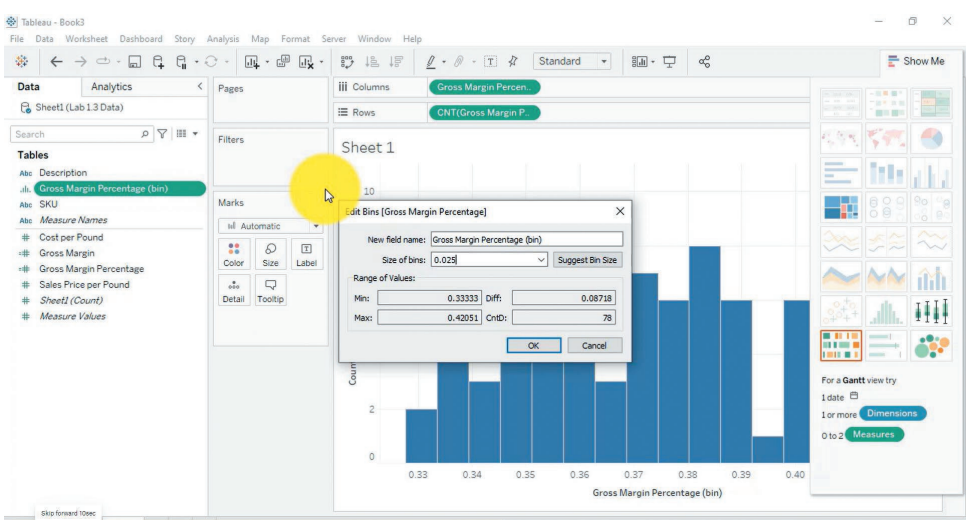
**Master the Data**

Fancy Fruits is a fictitious mail-order business that sells exotic fruit from around the world to customers throughout the United States. The company keeps a price list for each product. We will work from this price list to find the items that are most profitable per dollar of sales. This is the data dictionary:

| | |
|---|---|
| SKU | Fancy Fruits' SKU (unique code for each fruit product sold) |
| Description | Description of each fruit sold |
| Sales price per pound | Total sales price per pound of product |
| Cost per pound | Total cost of product sold per pound of product |

Open Excel file Lab 1.3 Data.xlsx, which includes the Fancy Fruits price list. A snippet of the spreadsheet appears in Lab Exhibit 1.3E.1.

**Lab Help Videos:** Help videos for each lab provide step-by-step tutorials that walk students through the assigned analysis tasks in Excel, Tableau, and Power BI.



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