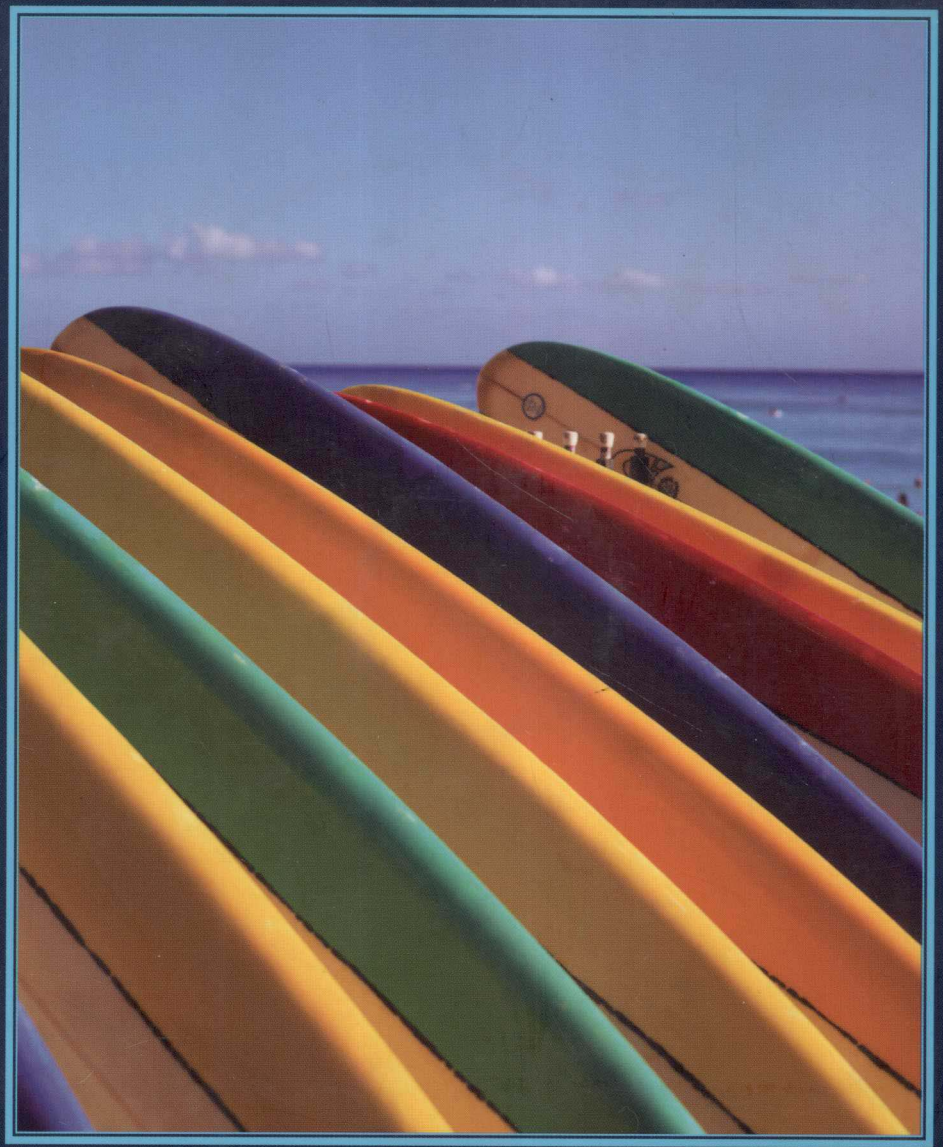
Modeling and Designing Accounting Systems

Using Access to Build a Database



C. Janie Chang • Laura R. Ingraham

MODELING AND DESIGNING ACCOUNTING SYSTEMS

Using Access to Build a Database

First Edition

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We dedicate this book to Robbie, Dan, Casey, and Paul
and to Ted, Theresa, and Brenda.
We are eternally grateful to them for all they have provided us in this endeavor: their hours of proofreading, their time sacrificed with us, their words of encouragement to persevere, and their belief in our ultimate success.

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TO THE STUDENT

More organizations today are turning from general ledger packages to database management systems to manage their accounting and other important operational data. In addition, increasingly, accounting systems are viewed in terms of enterprise-wide information systems which, by definition, are database management systems. These systems provide accountants and management with the information they need to make the important day-to-day decisions, control operations, and make strategic plans for the future.

Good database design methodology follows two approaches: the normalization approach or the semantic database modeling approach, better known as REA data modeling. This text follows the REA data modeling approach to designing and building databases. While this approach is software-independent, we will utilize *Microsoft Access 2003* to implement the data models throughout the text.

This book will provide you with an understanding of the theory of data modeling, as well as a practical application of those concepts and their ultimate implementation in database design. You will begin in Chapters 1 and 2 with the concepts of data modeling. Chapter 3 introduces the application of those concepts to database design using *Access.* Finally, in Chapters 4 through 6, you begin to build an actual system.

In Chapter 4, the Sales/Collection Business Process, you will develop your skills in building tables, forms, simple queries, and a basic report. Chapter 5, the Acquisition/Payment Business Process, explores complex queries, forms, and reports. Finally, in Chapter 6 (Human Resource Business Process), you create simple macros, imbed internal controls in table designs, and develop even more complex queries.

By actively working through the step-by-step instructions in these chapters, you will gain the experience of actually building an accounting information system. In addition, we have provided multiple choice and discussion questions for you, as well as additional problems, at the end of each chapter to reinforce your learning.

TO THE INSTRUCTOR

Accounting information systems has proven to be one of the more challenging courses to teach in the curriculum. There are several reasons for this. One is that there is no agreement as to how many courses are ideal in terms of coverage of the topic. Many schools offer a single course, others have two courses, and very few others offer a full major in the area of accounting information systems.

This book is intended to be a supplement to any text that is utilized in either an introductory AIS course or a database modeling and design course. It provides you with both a conceptual and a practical approach to data modeling from a resource-event-agent (REA) perspective and database design using *Microsoft Access 2003* as a platform. The first two chapters provide the fundamental concepts and theory for data modeling. Later chapters provide step-by-step detailed instructions for students to follow as they begin to model and design three essential processes of an accounting information system: the sales/collection process, the acquisition/payment process, and the human resources/payroll process. Working through these processes, students will have the opportunity to build tables, forms, queries, and reports. In addition, there are end-of-chapter multiple choice questions, discussion questions, and additional problems for students to work through once they have completed the chapter exercises. A CD-ROM containing the additional data and forms students will need to complete each chapter is included.

An electronic Instructor's Manual includes:

- Solutions Manual for all chapters
- Detailed lecture suggestions
- PowerPoint slides for Chapters 1–3

ABOUT THE AUTHORS

C. Janie Chang is a Professor of Accounting Information Systems (AIS) at San Jose State University (SJSU). She received her Ph.D. from the University of California, Irvine. Before moving to the Silicon Valley, Dr. Chang taught at California State University San Marcos and was elected as the Accounting Faculty of the Year for three consecutive years (1995–98). Since joining the faculty at SJSU, Dr. Chang was responsible for developing the undergraduate AIS program at SJSU. In addition, she assisted SJSU students in establishing the student chapter of Information Systems Audit and Control Association (ISACA) in 2002. Dr. Chang's current teaching responsibilities include AIS, Advanced AIS, IS Audit, Issues in E-Business, and Business Networks and Controls. Dr. Chang is very active and productive in research. Her studies have been published in leading academic journals including *Abacus, Auditing: A Journal of Practice and Theory, Behavioral Research in Accounting, Data Base, Journal of Accounting Literature,* etc. In 2003, Dr. Chang received the SJSU College of Business Outstanding Academic/Theoretical Research Award.

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TRADEMARKS

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CHAPTER 1

BUSINESS PROCESSES, DATA MODELING, AND INFORMATION SYSTEMS

INTRODUCTION

Despite the rapid growth in networks and information technology, many companies today are still using separate subsystems in their daily operations to support such specialized functions as marketing information systems, accounting information systems, personnel information systems, and so forth. When management professionals make decisions based on information obtained within one functional area, those decisions, which are apt to be made from a narrow perspective, may not be in the best interest of the company. Given the current business environment, companies should carefully examine every step in their business processes and question the necessity of each step. It is critical for companies to use the power of modern information technology such as enterprise resource planning (ERP) applications to improve company performance.

The database approach emphasizes the integration and sharing of data across major functional areas based on the company's business processes. This approach requires a fundamental reorientation or shift in business processes, starting with top management and affecting all employees. That is, the design of an information system is event-driven according to business processes. The purpose of this chapter is to start from the top and use data models to describe a company's business processes. Later chapters will use this business-process-based data modeling approach to assist you in learning how to design a relational database for a company. After completing this chapter, you should be able to:

- Identify resources, events, and agents (REA) in a data model
- Develop basic data models
- Recognize and evaluate the cardinalities in a data model
- Model a company's business processes using an REA diagram

BUSINESS PROCESSES AND DATA MODELING

Data modeling is the process of creating a logical representation of the structure of a database based on a company's business processes. Data modeling is the most important task in the development of an effective database that can provide useful information for decision making. A commonly used business data modeling technique is called the *entity-relationship diagram* (ERD). The ERD uses a graphical representation to identify and document various entities and the relationships between those entities. Three major components of an ERD are entity, relationship, and attribute. An entity is anything about

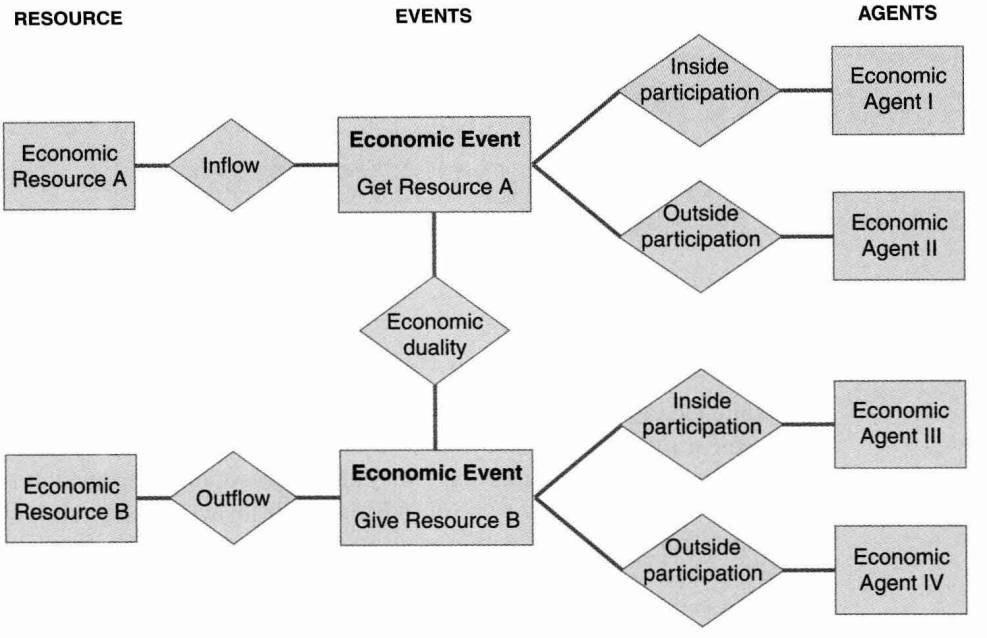

FIGURE 1-1 The REA Pattern
Adapted from McCarthy (1982).

which a company would like to collect and store information, such as "inventory," "purchase," and "vendor." A relationship is an association between entities, such as one or many inventory items included in each purchase transaction. An attribute is a characteristic of an entity, such as the inventory number and the description of each item in the entity of "inventory".[1] In an ERD, entities appear as rectangles, diamonds are used to represent relationships between entities, and small circles are used to show the attributes of each entity. Using ERD makes it relatively easy to understand a company's business processes and the relationships for those involved entities. ERD promotes communications between domain experts (such as accountants) and information technology (IT) professionals.

Based on the entity-relationship technique, the resource-event-agent (REA) data model is a framework specifically designed for building accounting information systems in a shared data environment.[2] First conceptualized by William E. McCarthy in 1982, it captures business processes by categorizing entities into economic resources, economic events, and economic agents. Resources are those things that have economic value to a company, such as cash and inventory. Events are the various business processes conducted in a company's daily operations, such as sales and purchases. Agents are the people and organizations, such as customers and salespeople, who participate in business events. Adapted from McCarthy (1982), Figure 1-1 shows the most basic REA pattern for modeling business processes. A general rule for creating REA diagrams is that each economic event should be linked to at least one economic resource and two economic agents.

[1]The concepts about attributes will be discussed in detail in the next chapter.

[2]McCarthy, W. E. 1982. The REA accounting model: A generalized framework for accounting systems in a shared data environment. *The Accounting Review* (July): 554–578.

The relationship shown between the two economic events in Figure 1-1 is referred to as an *economic duality relationship*. This is the causal relationship that occurs as a result of a give event (an economic decrement or an outflow) and a take event (an economic increment or an inflow). For example, in a revenue cycle, the give event could be sales (an outflow of inventory) and the take event could be cash receipts (an inflow of cash). In an expenditure cycle, the give event could be cash disbursements (an outflow of cash) and the take event could be purchases (an inflow of inventory).

REA MODELS AND TRANSACTION CYCLES

The database development process begins with enterprise modeling to set the range and general contents of organizational databases. This can be done effectively and efficiently by organizing an organization's subsystems around certain types of repetitive transactions. These groups of related transactions are called transaction cycles. Although different companies have different transactions, most companies have some transaction cycles in common: revenue, expenditure, human resource/payroll, and financing cycle. For manufacturing companies, the conversion/production cycle is another important component of their information systems.

Figure 1-2 shows the most basic economic events in the five transaction cycles. The revenue cycle includes the sale and cash receipt events. The expenditure cycle includes the

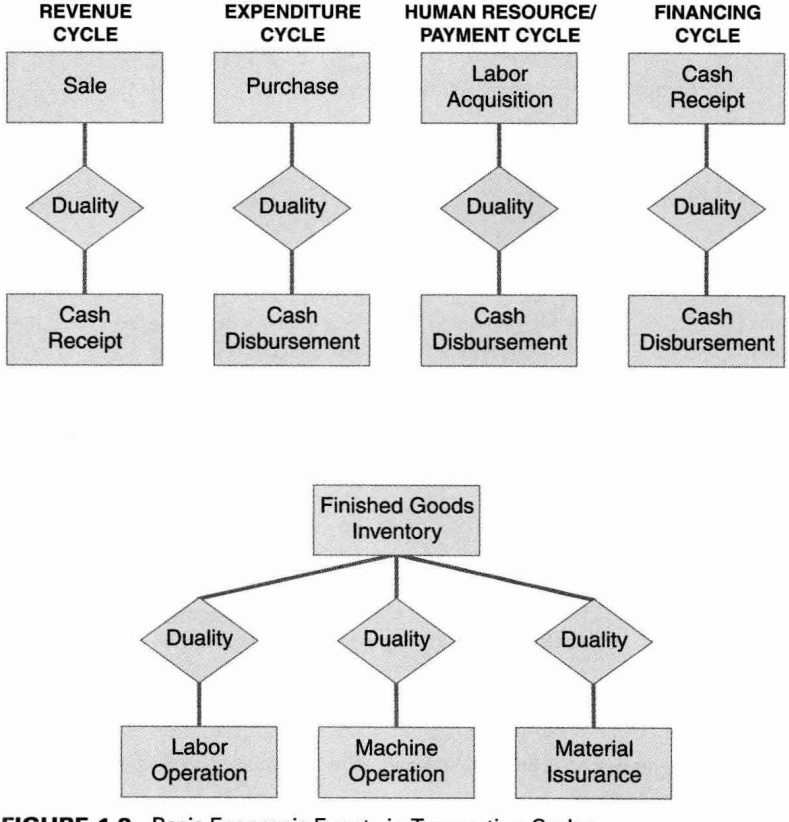

FIGURE 1-2 Basic Economic Events in Transaction Cycles

purchase and cash disbursement events. In addition, a company must acquire labor and pay wages/salaries through the human resources/payroll cycle. The financing cycle includes the events of obtaining funds from investors and/or creditors and paying them back. The conversion/production cycle includes events of using labor and machines to transform materials into finished goods.

The transaction cycles in Figure 1-2 are combined in Figure 1-3 into an REA model to create the entire accounting information system. This high-level conceptual model indicates how the transaction cycles interact with each other and with the financial reporting system.

Figure 1-4 provides sample REA diagrams for a revenue cycle and an expenditure cycle. In the expenditure cycle, a purchase transaction is made between a purchasing agent

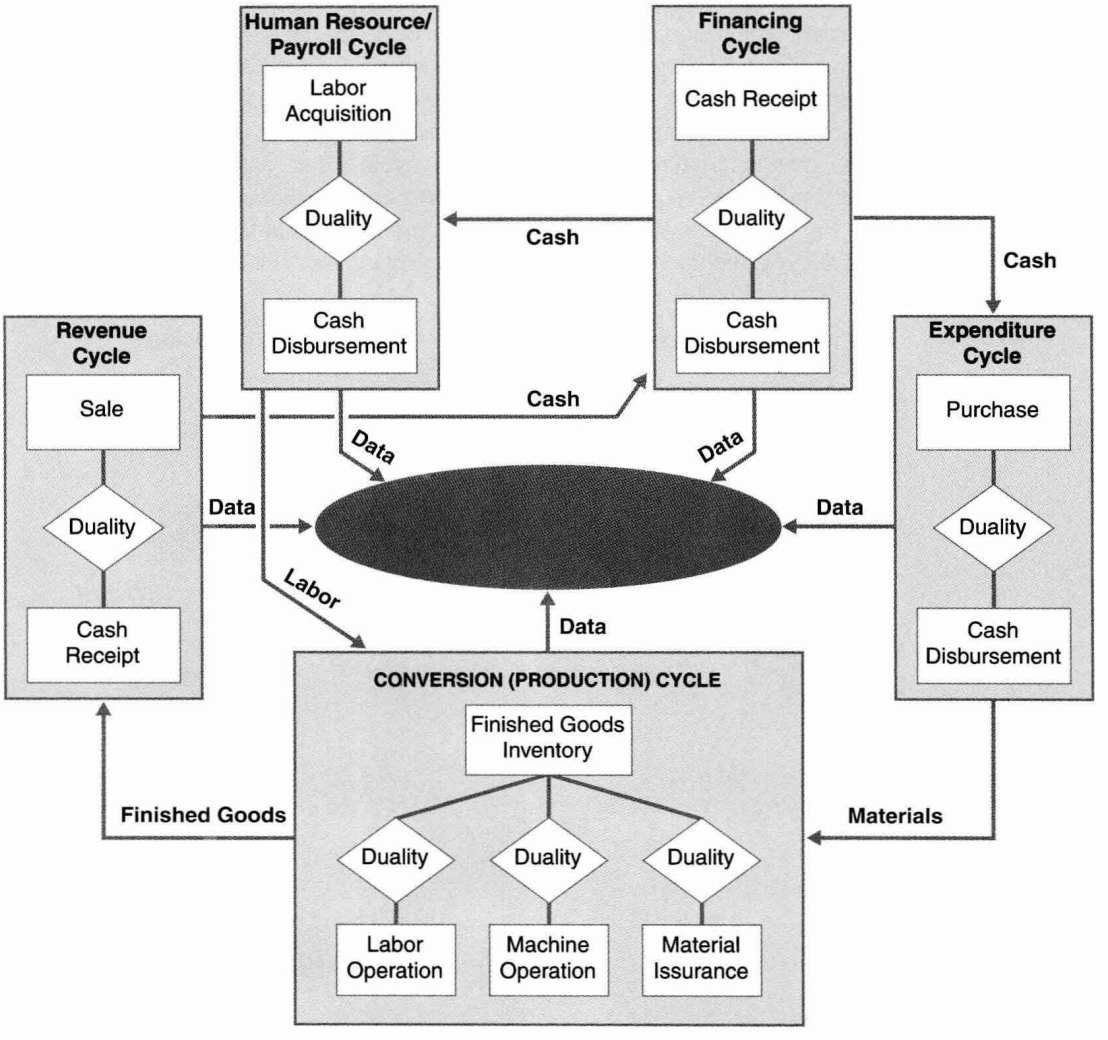

FIGURE 1-3 Overall REA Model for an Accounting Information System

Adapted from Romney, M. B. and P. J. Steinbart. 2006. *Accounting Information Systems.* 9th ed. Englewood Cliffs, N. J.: Prentice Hall, p. 30.

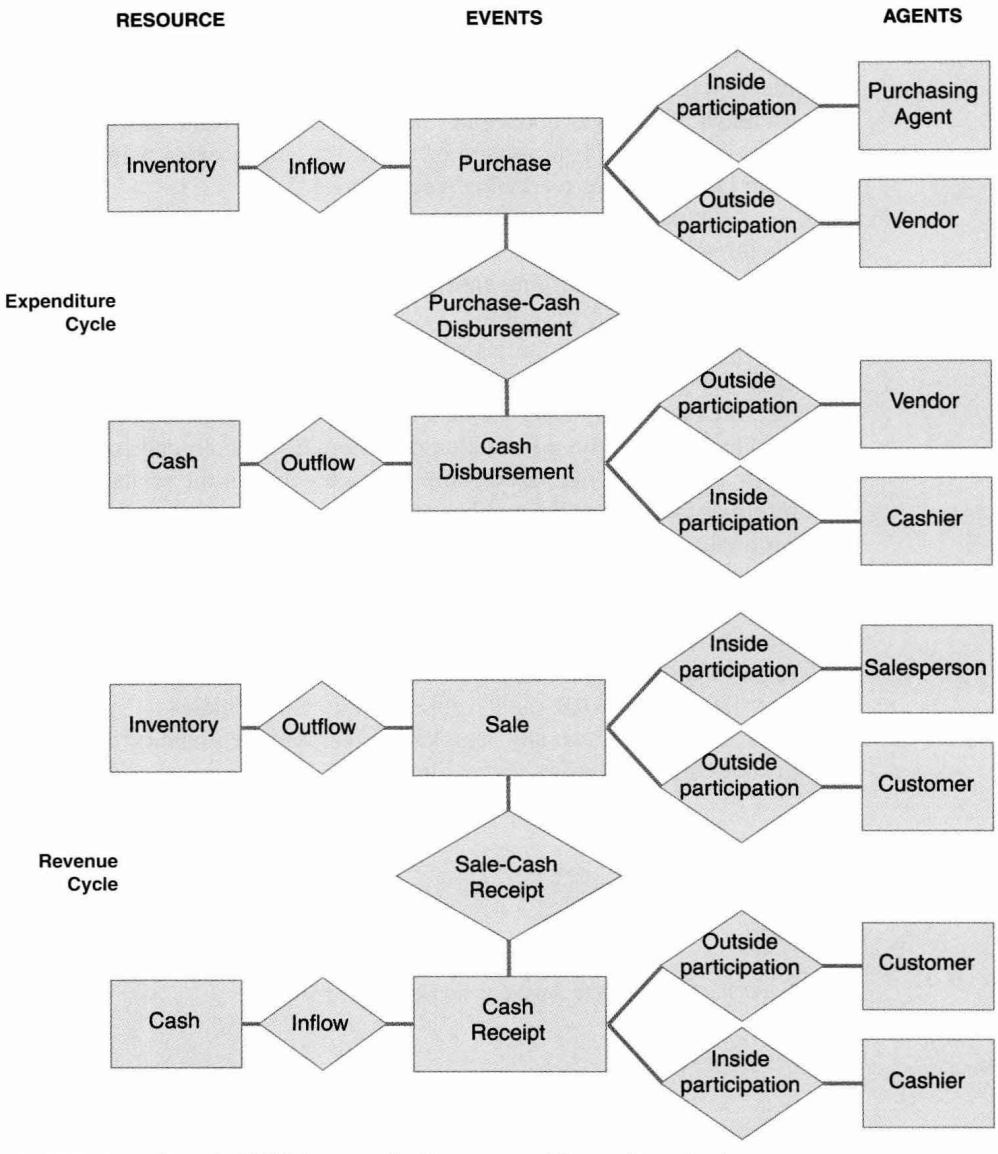

FIGURE 1-4 Sample REA Diagrams for Revenue and Expenditure Cycles

and a vendor and will increase inventory stocks. The purchase transaction will be paid by using cash involving the vendor and cashier in a cash disbursement event. In the revenue cycle, each sale transaction will decrease inventory, and a salesperson and a customer will participate in the transaction. Note that as we design the system that models these transactions, each entity needs to be shown only once. That is, there is just one "vendor" entity and one "customer" entity shown on Figure 1-4 despite the fact that the company has many vendors and customers. The sales transaction will be paid by receiving cash involving the participation of the customer and the cashier in a cash receipt event.

CARDINALITIES OF RELATIONSHIPS

Identification of relationships is a very important step in data modeling. A relationship establishes a logical connection between entities. Relationship examples in generic settings include: (1) Eric majors in finance; (2) Ben owns vehicle#104; and (3) Professor John Lewis teaches marketing (see Figure 1-5).

For data modeling purposes, Figure 1-6 provides corresponding diagrams to describe the three relationships.

Note that identifying entities and adding relationships to the diagrams are still insufficient in terms of describing how an entity participates in a specific relationship. For example, we should indicate that each student may major in one or more fields. One person may own zero vehicles, one vehicle, or many vehicles. The number of instances one entity can be linked to one specific instance of another entity is defined as a cardinality. With the information of cardinality at both ends of each relationship, we can easily understand the participation of each entity in the relationships. That is, cardinality information restricts the number of participation constraints in a relationship. In this book, cardinality is denoted as (*min,max*) where *min* is the minimum number and *max* is the maximum number that can participate in a relationship. What is the correct set of cardinalities in each relationship? Does each entity have a fixed set of cardinalities for all the relationships? The answer depends on the problem domain that you need to model. Regarding the person-vehicle example above, assume that Ben, Emily, and Tina own vehicle#104, vehicle#101 and vehicle#105, and vehicle#107, respectively. In addition, Michael does not own any vehicles. We can use the graphical representation in Figure 1-7 to show the relationship and cardinalities.

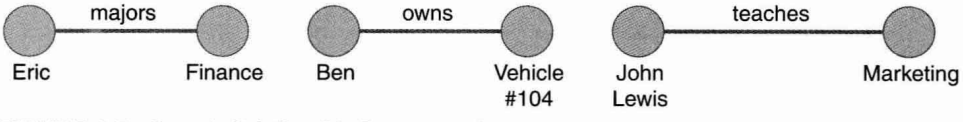

FIGURE 1-5 Sample Relationship Representation

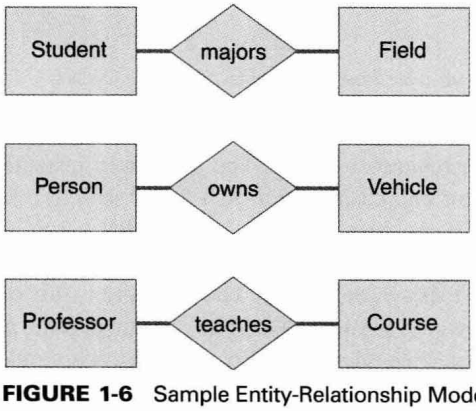

FIGURE 1-6 Sample Entity-Relationship Models

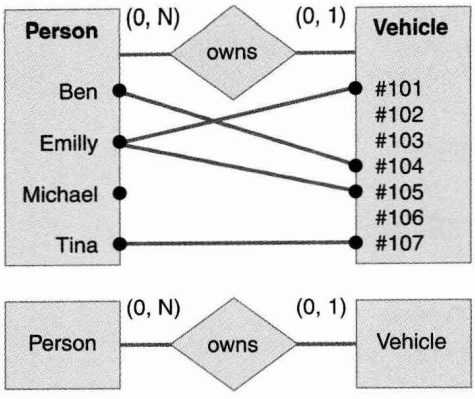

FIGURE 1-7 Person-Vehicle Example

In Figure 1-7, Emily owns two vehicles. Michael does not own any vehicles. Each of the other two people owns one vehicle. Thus, the cardinalities in this specific "person owns vehicle" relationship is (0,N) near the person entity, which means each person can own at least zero vehicles and at most many vehicles. "N" here means many. The cardinalities of (0,1) near the vehicle entity indicate that each vehicle may not be owned by a person yet. In addition, at most, each vehicle can be owned by one person only.[3]

Another example is the professor-course relationship. Figure 1-8 indicates that each professor teaches at least one course and may teach many courses. Different professors can

[3]This book uses Chen's notation for cardinalities. There are other commonly used notations: Crow's Foot and HDC. The following comparison is adapted from Dunn, C. L., J. W. Cherrington, and A. S. Hollander, 2005, *Enterprise Information Systems*, New York: McGraw-Hill, p. 59.

	Notation for each cardinality	Diagram format to the person-vehicle example
Chen (used in this textbook)	Min zero = (0, Min one = (1, Max one = ,1) Max many = ,N)	Person (0, N) owns (0, 1) Vehicle
Crow's Foot	Min zero = Min one = Max one = Max many =	Person Vehicle
HDC	Min zero = (0, Min one = (1, Max one = ,1) Max many = ,*)	Person (0, 1) (0, *) Vehicle

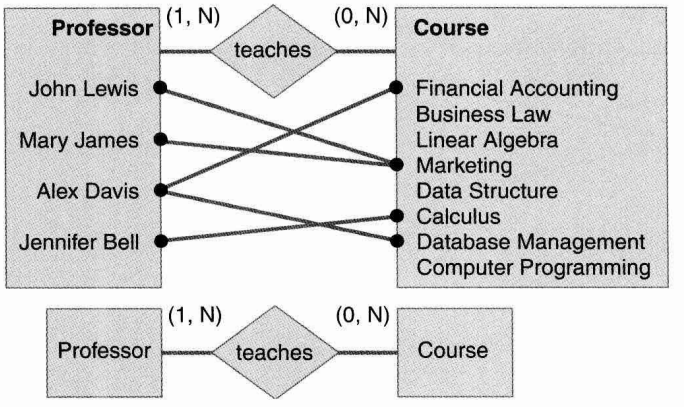

FIGURE 1-8 Professor-Course Example

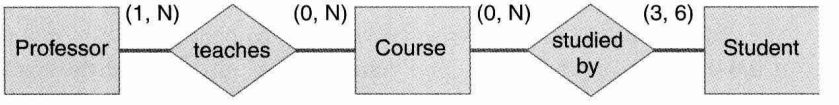

FIGURE 1-9 Professor-Course-Student Example

teach the same course for different sessions. In addition, not all courses are taught every semester. In this example, professors John Lewis and Mary James both teach the marketing course, and business law is not taught by any professor in the current semester. For this type of relationship, we employ (1,N) near the "Professor" entity to represent that each professor teaches at least one and at most many courses. We employ (0,N) near the "Course" entity to show that each course can be taught by at least zero or at most many professors.

We may also add another entity called "Student," as well as its relationship, "Course is studied by Student," to the diagram (see Figure 1-9). This time, we will assume all students are full-time. We want to impose the restriction that each student must take at least 3 courses but no more than 6 courses in a semester. Accordingly, the cardinalities (0,N) and (3,6) are added to the diagram.

USING REA TO MODEL BUSINESS PROCESSES

There are three basic steps to construct an REA diagram to depict a company's business processes. After the business processes are modeled, the REA diagram should be validated by the company's experts who are knowledgeable about the details and objectives of the business processes. The three steps in developing an REA diagram are as follows:

1. Identify economic exchange events.
2. Identify the resources affected by each economic event and the agents who participate in those events.
3. Determine the cardinalities of each relationship.

The following section provides an example that demonstrates how to use the REA to model a small company's business processes.

Cherokee Art and Antique Store

Background The Cherokee Art and Antique Store sells original art and antique pieces. Its owner, Jesse Lewis, started the store in 1990 in a small town with a rich Native-American culture. Jesse carries original paintings, crafts, jewelry, and special antiques from local Native-American artists and antique sellers. Jesse runs his business as a consignment store. First, he and the artists/sellers agree on a minimum price for the art/antique item. Then, Jesse sets a sale price and he takes a percentage of the sale price as his commission. He displays all the available pieces in the store. So far, Jesse has carried only original pieces of art and craft and antiques—no two are the same. Jesse has no employees to help him. Jesse takes care of all the selecting, buying, and selling himself.

Cherokee's Revenue Cycle All sales occur in the store. Sales to customers consist of one or more pieces of art and/or the antiques displayed in the store. Other than cash and checks, Jesse accepts credit cards for sales. However, he requires that all customers pay in full for each transaction. Jesse goes to the bank every day to deposit daily cash receipts. Although Jesse has a couple of bank accounts for the Cherokee Art and Antique Store, he always deposits his daily revenue into the general checking account.

Model the Revenue Cycle Using REA **To model business processes in the revenue cycle for the Cherokee Art and Antique Store (Cherokee), we first need to identify economic exchange events in the cycle.** Recall that in Figure 1-2 there are two basic events for any revenue cycle: "Sales" and "Cash Receipt." According to the descriptions stated in the previous paragraph, we can determine that these two events are proper for Cherokee. Therefore, the partial REA diagram in Figure 1-10 can be drawn.

The second step is to identify the resources affected by each economic event and the agents who participate in those events. For the "Sales" event, inventories of art and antiques are reduced and the participating agents are a customer and Jesse. For the "Cash Receipt" event, Jesse receives cash/checks from the customer. Accordingly, the REA in Figure 1-11 provides the basic business model for Cherokee's revenue cycle.

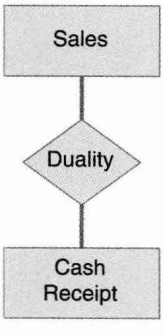

FIGURE 1-10 Sales-Cash Receipt Relationship