This case is included to provide you an opportunity to apply

the concepts and techniques you will learn in each chapter. The

case can also be used to support a semester-long database project

built throughout the term that results in a complete application.

We have selected a hospital for this case because it is a type

of organization that is at least somewhat familiar to most persons

and because health-care institutions are of such importance

in our society today. A segment of the case is included at

the end of each chapter in this text. Each segment includes a

brief description of the case as it relates to the material in the

chapter followed by questions and exercises related to the material.

Additional requirements, assignments, and project deliverables

are provided in support of a semester project.

Case Description

Mountain View Community Hospital (MVCH) is a not-for-profit,

short-term, acute care general hospital. It is a relatively small hospital,

with some 150 beds. Mountain View Community Hospital

strives to meet the needs of a community of about 60,000 with an

annual growth rate of 10 percent, a trend that is expected to continue

since the surrounding area is attracting many retirees. To

serve the health-care needs of this growing community, Mountain

View Community Hospital plans to expand its capacity by adding

another 50 beds over the next five years, and opening a managed

care retirement center with independent apartments and assisted

living facilities. The basic goal is to provide high-quality, costeffective

health-care services for the surrounding community in a

compassionate, caring, and personalized manner.

Within the last fiscal year, the hospital performed more

than one million laboratory procedures and over 110,000 radiology

procedures. During that time, the hospital had 9,192 admissions

and 112,230 outpatient visits, brought 1,127 babies into the

world, and performed 2,314 inpatient and 1,490 outpatient surgeries.

Patients who receive outpatient surgeries do not remain

in the hospital overnight. With an average of 2,340 patients a

month, the emergency department experienced approximately

28,200 visits throughout the year. Approximately 30 percent of

the patients admitted to the hospital were first treated in the

emergency room, and about 13 percent of emergency room visits

resulted in hospital admission. The hospital employs 740

full-time and 439 part-time personnel, among them 264 fulltime

and 176 part-time registered nurses, and 10 full-time and 6

part-time licensed practical nurses. The hospital’s active medical

staff includes over 250 primary physicians, specialists, and

subspecialists. Volunteers are an integral part of MVCH’s culture

and contribute greatly to the well-being of patients and

their families. Approximately 300 volunteers from different

backgrounds and of all ages devote their time, energy, and talents

to many areas of the hospital. They greet visitors and patients

and help them find their way through the hospital, deliver

mail and flowers to patient rooms, escort patients, aid staff

with clerical duties, work in the gift shop, assist at community

and fund-raising events, and help out in a host of other areas.

Mountain View Community Hospital provides a number

of key services, including general medical and surgical care,

general intensive care, a cardiology department, open-heart

surgery, a neurology department, pediatric medical and surgical

care, obstetrics, an orthopedics department, oncology, and a

24-hour emergency department. The hospital also offers a wide

range of diagnostic services. A specialty service within the neurology

department is the recently opened Multiple Sclerosis

(MS) Center, which provides comprehensive and expert care for

patients with multiple sclerosis in order to improve their quality

of life. Using an interdisciplinary team approach, the center

emphasizes all aspects of MS care from diagnosis and treatment

of MS symptoms and secondary complications, to individual

and family counseling, rehabilitation therapy, and social services.

Headed by Dr. Zequida, called Dr. “Z” by staff and patients,

the MS Center is a member of a consortium of MS centers.

The current organizational chart for Mountain View

Community Hospital is shown in MVCH Figure 1-1. Like most

other general hospitals, Mountain View Community is divided

into two primary organizational groups. The physicians,

headed by Dr. Browne (chief of staff), are responsible for the

quality of medical care provided to their patients. The group

headed by Ms. Baker (CEO and president) provides the nursing,

clinical, and administrative support the physicians need

to serve their patients. According to Ms. Baker, the most pressing

issues affecting the hospital within the last year have been

financial challenges such as bad debt, personnel shortages

(particularly registered nurses and imaging technicians), and

malpractice insurance. Other critical issues are the quality of

care, patient safety, compliance with HIPAA, and technological

innovation, which is seen as a major enabler for decreasing

costs and improving quality. The trend toward managed care

and the need to maintain costs while maintaining/improving

clinical outcomes requires the hospital to track and analyze

both clinical and financial data related to patient care services.

Goals and Critical Success Factors

In response to the steady growth and expansion plans at

Mountain View Community Hospital, a special study team including

Mr. Heller, Mr. Lopez, Dr. Jefferson, and a consultant

has been developing a long-term strategic plan, including an information

systems plan for the hospital. Their work is not complete,

but they have begun to identify many of the elements necessary

to build the plan. To meet the goals of high-quality health

care, cost containment, and expansion into new services, the

team concluded that the hospital has four critical success factors

(CSFs): quality of medical care, control of operating costs, control

of capital costs, and recruitment and retention of skilled

personnel. The development of improved information systems

is viewed as an enabler in dealing with each of these CSFs.

The team is currently at work to generate two to four

short- or long-term objectives for each CSF. So far they have

developed the following four objectives related to the control of

the operating costs CSF:

1. Reduce costs for purchased items

2. More efficiently schedule staff

3. Lower cost of liability insurance

4. Expand volunteer services

The study team has developed a preliminary list of business

functions that describe the administrative and medical

activities within the hospital. These functions consider the organizational

goals and CSFs explained in the prior section. At

this point, the study team has identified five major business

functions that cut across all of the organizational units:

1. Patient care administration Manage the logistical and

record-keeping aspects of patient care

2. Clinical services Provide laboratory testing and procedures,

and patient monitoring and screening

3. Patient care services Provide patients with medical care

and support services

4. Financial management Manage the financial resources

and operations of the hospital

5. Administrative services Provide general management

and support services not directly related to patient care

The study team has been able to break each of these highlevel

business functions into lists of more detailed functions

(see MVCH Figure 1-2), but the team knows that these lists are

not complete nor well defined at this point.

Mountain View Community Hospital has computer

applications that support the following areas (among others):

patient care administration, clinical services, financial management,

and administrative services. Many of these applications

have been purchased from outside vendors, but a few have

been developed internally. Most of the computer applications

are implemented using relational database and client/server

technology. In the client/server environment, the client runs

the database applications that request the data. The server runs

the DBMS software, which fulfills the requests and handles the

functions required for concurrent, shared data access to the

database. Most of the databases (as well as the applications) are

two tier, using the classification introduced in this chapter.

Enterprise Modeling

The study team identified a preliminary set of 11 entity types

that describe the data required by the hospital in support of the

various business functions: FACILITY, PHYSICIAN, PATIENT,

DIAGNOSTIC UNIT, WARD, STAFF, ORDER, SERVICE/DRUG,

MEDICAL/SURGICAL ITEM, SUPPLY ITEM, and VENDOR.

From discussions with hospital staff, reviewing hospital documents,

and studying existing information systems, the study

team developed a list of business rules describing the policies of

the hospital and nature of the hospital’s operation that govern

the relationships between these entities. Some of these rules are:

1. AFACILITY maintains one or more DIAGNOSTIC UNITS

(radiology, clinical laboratory, cardiac diagnostic unit, etc.).

2. AFACILITY contains a number of WARDs (obstetrics, oncology,

geriatrics, etc.).

3. Each WARD is assigned a certain number of STAFF members

(nurses, secretaries, etc.); a STAFF member may be

assigned to multiple WARDs.

4. A FACILITY staffs its medical team with a number of

PHYSICIANs. APHYSICIAN may be on the staff of more

than one FACILITY.

5. A PHYSICIAN treats PATIENTs, and a PATIENT is treated

by any number of PHYSICIANs.

6. A PHYSICIAN diagnoses PATIENTs, and a PATIENT is

diagnosed by any number of PHYSICIANs.

7. A PATIENT may be assigned to a WARD (outpatients are

not assigned to a WARD). The hospital cares only about the

current WARD a patient is assigned to (if assigned at all).

8. A PATIENT uses MEDICAL/SURGICAL ITEMS, which

are supplied by VENDORs. A VENDOR also provides

SUPPLY ITEMs that are used for housekeeping and maintenance

purposes.

9. A PHYSICIAN writes one or more ORDERS for a PATIENT.

Each ORDER is for a given PATIENT, and a PATIENT

may have many ORDERs.

10. An ORDER can be for a diagnostic test (lab tests such as

lipid profile, CBC, liver function tests; diagnostic imaging

such as MRIs and X-rays) or a drug.

They recognized that certain business functions, such as

risk management and volunteering, were not adequately represented

in the set of data entities and business rules, but they decided

to deal with these and other areas later. The study team

stored descriptions of these data entities and the business rules

in the CASE repository for later analysis. Using the identified

entities and business rules, the study team developed a preliminary

enterprise data model (see MVCH Figure 1-3). Again, this

conceptual model is preliminary and does not follow all the

conventions used in the information systems department for

drawing data models, but the purpose of this enterprise model

is to give only a general overview of organizational data.

Case Questions

1. The goal of Mountain View Community Hospital is to provide

high-quality, cost-effective health-care services for the

surrounding community in a compassionate, caring, and

personalized manner. Give some examples of how the use

of databases in the hospital might improve health-care

quality or contain costs. How else could a well-managed

database help the hospital achieve its mission?

2. How can database technology be used to help Mountain

View Community Hospital comply with the security standards

of the Health Insurance Portability and

Accountability Act of 1996 (HIPAA)? HIPAA requires

health-care providers to maintain reasonable and appropriate

administrative, technical, and physical safeguards to

ensure that the integrity, confidentiality, and availability of

electronic health information they collect, maintain, use, or

transmit is protected. (For more details on HIPAA, visit

www.hhs.gov/ocr/privacy.)

3. What are some of the costs and risks of using databases

that the hospital must manage carefully?

4. How critical are data quality requirements in the hospital

environment? For which applications might quality requirements

be more restrictive?

5. At present, Mountain View Community Hospital is using

relational database technology. Although this technology is

After completing a course in database management, you have

been hired as a summer intern by Mountain View Community

Hospital. Your first assignment is to work as part of a team of

three people to develop a high-level E-R diagram for the hospital.

You conduct interviews with a number of hospital administrators

and staff to identify the key entity types for the hospital.

You have also seen the preliminary enterprise-level diagram

shown in MVCH Figure 1-3 and subsequent revisions. As a

result, your team has identified the following entity types:

• Care Center—a treatment center within the hospital.

Examples of care centers are maternity, emergency care,

or multiple sclerosis center. Each care center has a care

center ID (identifier) and a care center name.

• Patient—a person who is either admitted to the hospital

or is registered as an outpatient. Each patient has an identifier,

the medical record number (MRN), and a name.

• Physician—a member of the hospital medical staff who

may admit patients to the hospital and who may administer

medical treatments. Each physician has a physician ID

(identifier) and name.

• Bed—a hospital bed that may be assigned to a patient

who is admitted to the hospital. Each bed has a bed number

(identifier), a room number, and a care center ID.

• Item—any medical or surgical item that may be used in

treating a patient. Each item has an item number (identifier),

description, and unit cost.

• Employee—any person employed as part of the hospital

staff. Each employee has an employee number (identifier)

and name.

• Diagnosis—a patient’s medical condition diagnosed by a

physician. Each diagnosis has a diagnosis ID/code and

diagnosis name. Mountain View Community Hospital is

using the HIPAA-mandated ICD-9-CM Volume 1 diagnosis

codes1 for patient conditions (e.g., 00.50, STAPH

FOOD POISONING, 173.3, BASAL CELL CARCINOMA,

200.2, MALIGNANT MELANOMA, BURKITT’S TYPE,

or 776.5. CONGENITAL ANEMIA).

• Treatment—any test or procedure ordered by and/or performed

by a physician for a patient. Each treatment has a

treatment ID/treatment code and treatment name using

standard codes. HIPAA-mandated ICD-9-CM Volume 3

Procedure Codes are used for diagnostic and therapeutic

procedures (e.g., 03.31, SPINAL TAP, 14.3, REPAIR OF

RETINAL TEAR, 87.44, ROUTINE CHEST X-RAY, or 90.5,

MICROSCOPIC EXAMINATION OF BLOOD).

• Order—any order issued by a physician for treatment

and/or services such as diagnostic tests (radiology, laboratory)

and therapeutic procedures (physical therapy, diet

orders), or drugs and devices (prescriptions). Each order

has an order ID, order date, and order time.

The team next recorded the following information concerning

relationships:

• Each hospital employee is assigned to work in one or

more care centers. Each care center has at least one

employee and may have any number of employees. The

hospital records the number of hours per week that a

given employee works in a particular care center.

• Each care center has exactly one employee who is designated

nurse-in-charge for that care center.

• A given patient may or may not be assigned to a bed

(since some patients are outpatients). Occupancy rates are

seldom at 100 percent, so a bed may or may not be

assigned to a patient.

• A patient may be referred to the hospital by exactly one

physician. A physician may refer any number of patients

or may not refer any patients.

• A patient must be admitted to the hospital by exactly one

physician. Aphysician may admit any number of patients

or may not admit any patients.

• Prior to a patient being seen by a physician, a nurse typically

obtains and records relevant information about the

patient. This includes the patient’s weight, blood pressure,

pulse, and temperature. The nurse who assesses the

vital signs also records the date and time. Finally, the reasons

for the visit and any symptoms the patient describes

are recorded.

• Physicians diagnose any number of conditions affecting a

patient, and a diagnosis may apply to many patients. The

hospital records the following information: date and time

of diagnosis, diagnosis code, and description.

• Physicians may order and perform any number of services/

treatments for a patient or may not perform any

treatment. A treatment or service may be performed on

any number of patients, and a patient may have treatments

performed or ordered by any number of physicians.

For each treatment or service rendered, the hospital

records the following information: physician ordering the

treatment, treatment date, treatment time, and results.

• A patient may also consume any number of items. A

given item may be consumed by one or more patients, or

may not be consumed. For each item consumed by a

patient, the hospital records the following: date, time,

quantity, and total cost (which can be computed by multiplying

quantity times unit cost).