COMP-6120 PROJECT

Database Design And Implementation On Hospital

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Problem Description

A new hospital is being constructed to service the needs of a rapidly growing retirement community. You have been contracted to develop the database system that will manage the primary care operation of the hospital, but not the financial operation.

Basic rules and operational procedures are described below:

- The hospital is staffed by many types of employees including doctors, nurses, technicians, and administrators.
- All doctors who work for the hospital have consulting privileges, which allow them to be assigned to patients, and order treatments for patients. Some, but not all, doctors also have admitting privileges, which allow them to admit patients to the hospital.
- The hospital provides both inpatient and outpatient services. Outpatient services must be ordered by a doctor with consulting privileges. Inpatient services require a hospital stay and are thus only available to patients who are admitted to the hospital.
- When a patient is admitted to the hospital by a doctor, he or she is given a unique patient identification number by an administrative employee. Each patient must provide an emergency contact and insurance policy information at the time of admission.

- The doctor who admits a patient is considered that patient's primary doctor. Only that doctor can order and perform treatments for that patient.

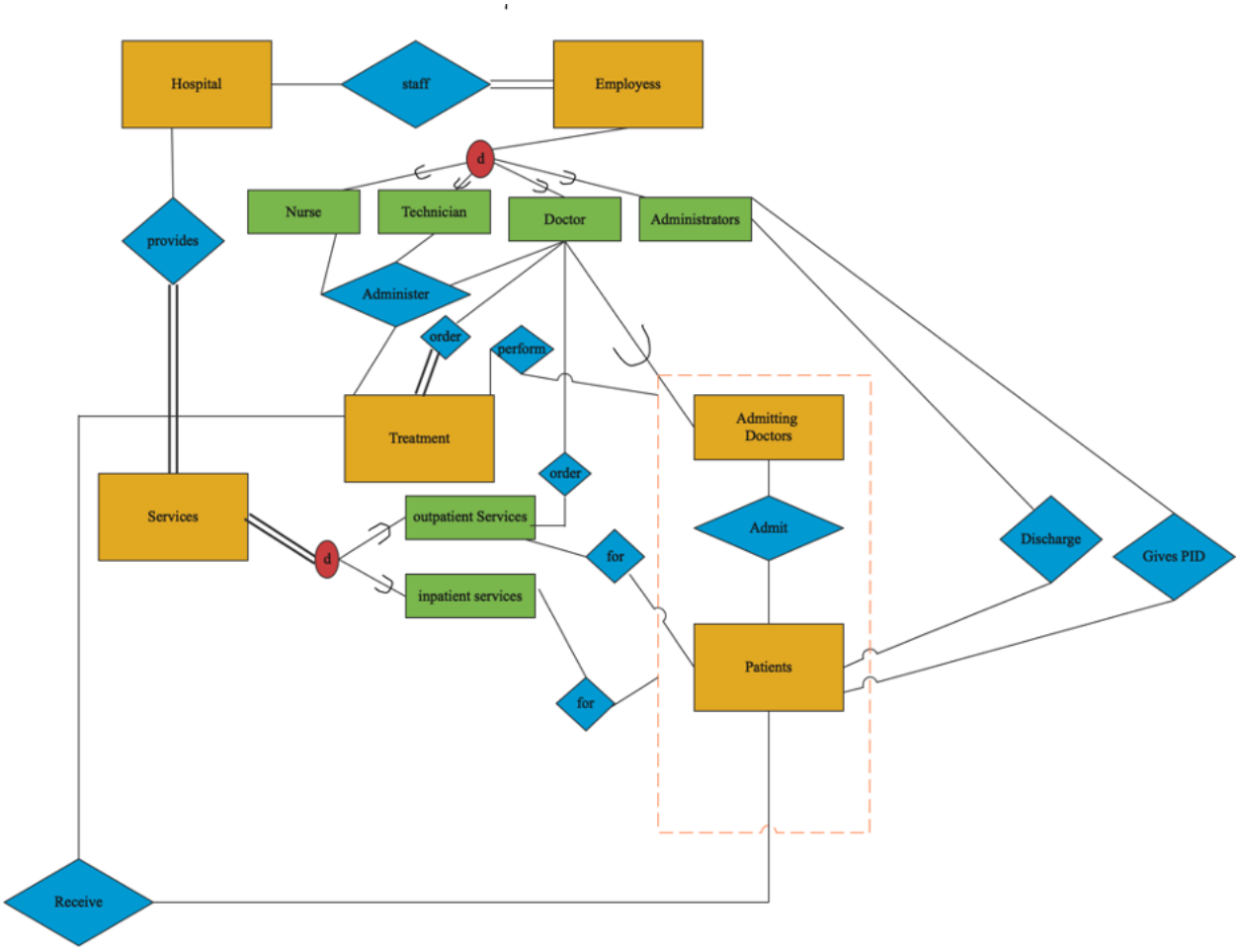
- Treatments include both procedures and medication. All treatments must be ordered by a doctor and administered by an appropriate hospital employee. Treatments may be ordered for patients on either an inpatient or outpatient basis. A timestamp is associated with the order and all administrations.

- Treatments are administered to patients by one or more employees who are either doctors, nurses, or technicians.

- When an admitted patient's primary doctor decides that the necessary course of treatment has ended, that patient is discharged from the hospital by an administrative employee.

1. Specification of the Conceptual Model

a. Entity - Relationship Model



b. **Text annotations of assumptions & constraints.**

- Employee have subset to Admin, Doctor, Nurse, Technician and Administrator.
- All Doctors are consulting Doctors. We refer consulting doctors as doctors and doctors is superclass to AdminDoctor.
- Doctors can order any number of Treatments. Treatment has to be ordered by exactly one Doctor.
- Treatment is received by any number of Patient. A Patient can receive any number of Treatments.
- Treatment can be administered by one or more Nurses, Doctors or Technicians. Nurses, Doctors or Technicians can administer any number of Treatments.
- Outpatient and Inpatient treatments are specified by a patient attribute in Treatment.
- Medications and Procedures are specified by a description attribute in Treatment.
- The doctor who admits a patient is considered that patient's primary doctor.

- AdminDoctor can admit/discharge any number of Patients.
- AdminDoctor can update any number of DiagnosticHistory. A Patient has one DiagnosticHistory.
- A Patient can be admitted by any number of AdminDoctors.
- The patients that receive inpatient services stay in the hospital.
- Only admitted patients has patient's ID (pid).
- The Doctors that order treatment for inpatients, are their corresponding primary Doctors.
- Only admitted patients will treatment be ordered and performed for by the primary Doctor that admitted them.
- Each patient most provide an emergency contacts and insurance policy.
- Staff have an area attribute to determine the area of the Hospital they work in.

2. Specification of the Implementation Model.

a. **Relational Schemas**

Patients(

pid char(3),

name varchar(20),

insurance varchar(20),

Emergencycontact varchar(20),

patienttype char(3), – in, for Inpatient, out for Outpatient

admitteddate date,

dischargedate date,

outdate date,

PRIMARY KEY(pid)

);

Employees (

empid char(3),

name varchar(20),

datehire date,

emptype varchar(20),

PRIMARY KEY(empid)

);

Doctors(

empid char(3),

name varchar(20),

datehire date,

PRIMARY KEY (empid),

FOREIGN KEY (empid) REFERENCES employees(empid)

);

Treatment(

tid char(3), description varchar(20),

treattype char(3),

PRIMARY KEY (tid)

);

Nurses(

empid char(3),

name varchar(20),

date hire date,

PRIMARY KEY (empid),

FOREIGN KEY (empid) REFERENCES employees(empid)

);

Technicians(

empid char(3),

name varchar(20),

hiredate date,

PRIMARY KEY (empid),

FOREIGN KEY (empid) REFERENCES employees(empid)

);

Administrators(

empid char(3),

name varchar(20),

datedate,

PRIMARY KEY (empid),

FOREIGN KEY (empid) REFERENCES employees(empid)

);

AdminDoctors(

empid char(3),

name varchar(20),

datehire date,

PRIMARY KEY (empid),

FOREIGN KEY (empid) REFERENCES Doctors(empid)

);

OrderedTreatment(

orderid char(3),

tid char(3),

pid char(3),

empid char(3),

timeorder date,

PRIMARY KEY (orderid,tid, empid, pid),

FOREIGN KEY (tid) REFERENCES Treatment(tid),

FOREIGN KEY (empid) REFERENCES Doctors(empid),

FOREIGN KEY (pid) REFERENCES Patients(pid)

);

AdministeredTreatment(

orderid char(3),

tid char(3),

pid char(3),

empid char(3),

patienttype char(3),

treatdate date,

PRIMARY KEY (tid,empid, pid),

FOREIGN KEY (tid) REFERENCES Treatment(tid),

FOREIGN KEY (empid) REFERENCES employees(empid),

FOREIGN KEY (pid) REFERENCES Patients(pid)

);

AdmittedPatients(

pid char(3), empid char(3),

admitted date NOT NULL,

discharged date,

FOREIGN KEY (pid) REFERENCES Patients(pid),

FOREIGN KEY (empid) REFERENCES AdminDoctors(empid)

);

b. **Description of how the ER model was translated into the listed schema:**

- employees has empid as primary key. It's other attributes are name, emp_type and date_hire.
- Admit relation between AdminDoctor and Patient are put as a new entity AdmittedPatients. Specifically, AdmittedPatients has foreign keys, pid from Patient and empid from AdminDoctor. pid and empid make up the primary key.
- Order relation between Doctors and Treatment becomes attributes within Order Treatment. Specifically, orderTreatment will have a foreign key, empid which will be a foreign key for Doctor's empid.
- Administer relation between Nurse, Technician, Doctor and Treatment will be an attribute in Administerredtreatment. Specifically, AdminsiterredTreatment will have a foreign key tid, empid which will be a foreign key for Nurse,Technician, Doctor empid attribute.
- Receives relation between Patient and Treatment will be an attribute in Treatment. Specifically, Treatment will have a foreign key, pid, which will be a foreign key for Patients pid attribute.
- Treatment will have a timestamp (treatdate) to account for when it was administered.

- Patient will have attributes insurance, contact, admitted, discharged and primary key pid.
- Service Entity unnecessary, we have an attribute called 'patienttype' in Patient's table and administerredtreatment table which is defined as 'in' for inpatients and 'out' for outpatients.

c. **Text description of normalization to BCNF.**

Employee:

- (empid → name , date_hire)

Patients:

- (pid → name, insurance, conatct, Patient_type, admited_date, discharge_date)

Doctors:

- (empid → name, date_hire)

Nurses:

- (empid → name, date_hire)

Technicians:

- (empid → name,date_hire)

Administrators:

- (empid → name, date_hire)

AdminDoctors:

- (empid → name, date_hire)

Treatment:

- (tid → description, treat_ type)

OrderTreatment:

- ((orderid,empid, pid, tid) → orderid, time_order)

AdmittedPatients

- ((empid, pid) → admitted, discharge)

d. **Text annotations of assumptions, constraints, decisions on 3NF.**

- patient_type attribute in Treatment implies inpatient treatment or outpatient treatment.
- 'Description' attribute in Treatment implies medication and procedures.
- Patients and Treatment has many-many relationship.
- There is many to many relationship between Treatment and (Nurses, Technicians, Doctors), i.e., Treatment can be administered by one or more Nurses, Doctors or Technicians. Nurses, Doctors or Technicians can administer any number of Treatments.
- Employee is a superclass Nurses, Technicians, and Doctors.
- Doctors contains AdminDoctors.
- A patient can be admitted by any number of AdminDoctors.
- Doctors has one-many relationship with treatment.
- Only AdminDoctors could admit patients and are the primary doctors.
- There could be any number of Nurses and Technicians involved in a patient's treatment, but there will be only one Doctor.