Database Management Systems

Database Design Example

Topics

- Hospital Database
- E-R Design
  - Entities
  - Relationships
- Converting E-R Model to Relational Model
  - Tables
  - Queries
- Summary

Hospital Database (1)

- The database for a hospital or a clinic.
- It contains information about ***people*** who have been admitted at least once to the hospital. A person can be admitted several times to the same or different ***wards***. People are identified by a Code.
- The database should describes all the hospital wards, showing for each ward the name and the respective ***consultant***.

Hospital Database (2)

- The database should contain information about all ***doctors*** in the hospital, giving their surnames, first names, wards, and so on.
- For each ***patient*** the given ***treatment*** at each date is stored in the database.

E-R Model

- Entities:
  - Patient
  - Doctor
  - Ward
- Relationships:
  - A doctor ***works*** in a ward
  - A patient ***is admitted*** to a ward at a given date.
  - A doctor ***gives treatment*** to a patient on a given date.
  - A ward ***has*** a consultant who is a doctor

Patient Entity and its Attributes

- A patient is identified by a Patient Code. The attributes are:
  - PatientCode
  - Name
  - Surname
  - Date of Birth
  - Place of Birth
  - Sex
  - Address
  - Phone

Doctor Entity and its Attributes

- For each doctor a code is assigned. The attributes are:
  - DoctorID
  - Name
  - Surname
  - Expertise
  - Address
  - Phone

Ward Entity

- Ward has the following attributes:
  - WardID
  - Name
  - Building (location)
  - Phone

Relationships(1)

- Each doctor works in a ward
- A ward has many doctors
- The relationship between ward and doctor is a one to many relationship. This relationship is defined using a foreign key in doctor entity.

Relationships(2)

- Admission:
  - A patient is admitted to a ward.
  - A patient may be admitted to different wards at different dates
  - A ward admits many patients
  - Admission is a many to many relationship

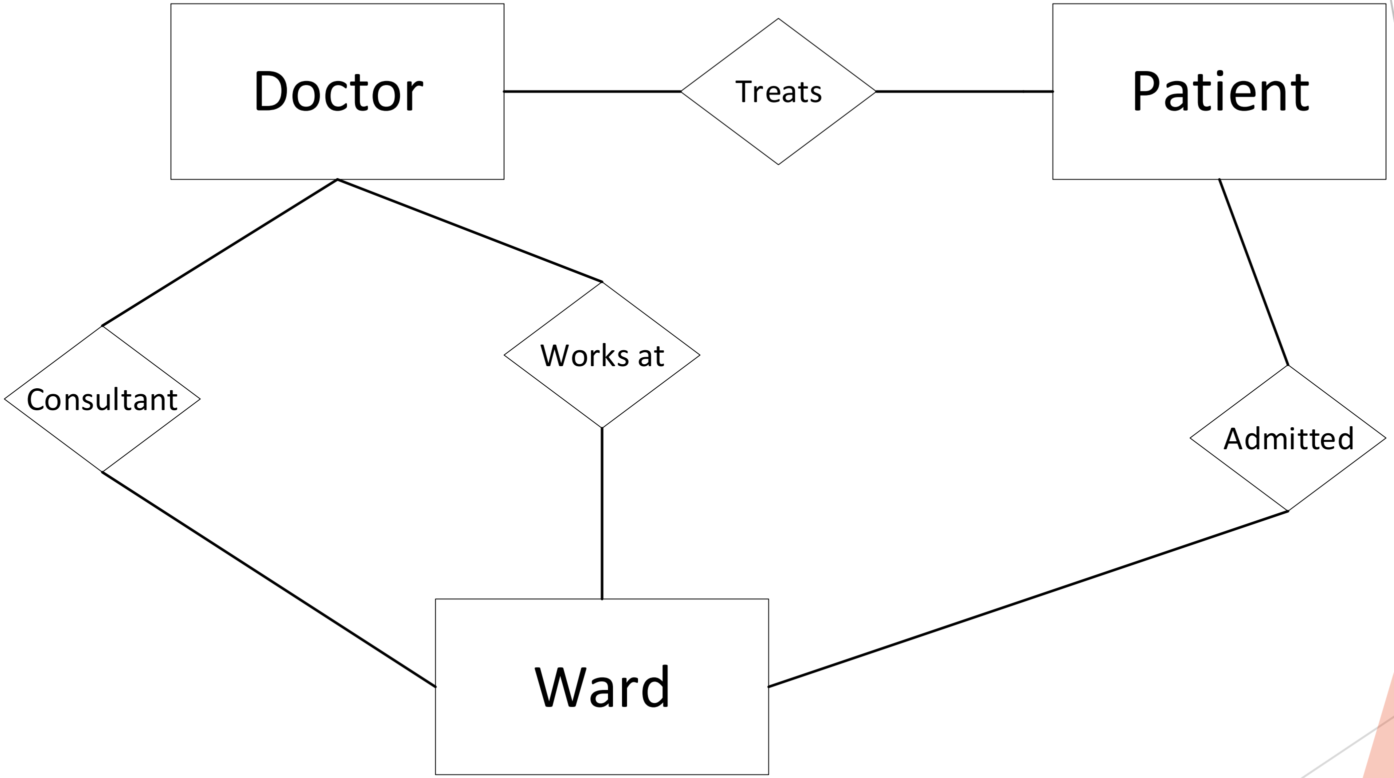
Relationships(3)

- Treatment
  - A doctor gives treatment to a patient
  - A doctor can give treatment to many patients
  - A patient gets treatment from many doctors (on different dates)
  - The treatment is a many to many relationship between doctor and patient.

Relationships(4)

- Each ward has a consultant who is a doctor.
  - A doctor can be a consultant in only one ward
  - Each ward has only one consultant
  - The relationship is a one to one relationship

ER Diagram (Attributes not included)



Relational Model for the Hospital Database

The following tables are created:

1. Patient table (patientCode primary key)
2. Doctor table (doctorID primary key, wardID foreign key)
3. Ward table (wardID primary key, Consultant is foreign key to doctor table)

Creating Relationships

- Admission is converted into a table as:
  - Admission < PatientCode, WardCode, DateAdmitted, DateDischarged >
    - PatientCode and WardCode are foreign keys
    - **Primary Key**: PatientCode+WardCode+DateAdmitted
- Treatment is also converted into a table:
  - Treatment <PatientCode, DoctorID, Date, Treatment>
    - PatientCode and DoctorID are foreign keys. Treatment is a string.
    - **Primary Key** : PatientCode+DoctorID+Date

Some Queries

- The following queries are given as example:
  - Create table for ward entity
  - Insert data into Patient table
  - Select all patients admitted on May 10, 2010
  - Select all patients treated by doctor ‘John’

Create Ward Table

```
Create Table Ward
(
    WardID  char(10) Primary Key,
    WardName  varchar,
    Building    char(256),
    Phone       char(13),
    consultant integer references
  doctor(doctorID)
)
```

Insert Data into Patient Table

- Insert Into Patient (PatientCode,Name,Surname, DateOfBirth, PlaceOfBirth, Sex, Address,Phone)

  values (100, ‘John’ , ‘Smith’, 1980, ‘Dallas’, ‘Male’, ‘main street’ , ‘123456’)

List Patients Admitted on May 10, 2010

```
Select Name, Surname
FROM Patient JOIN Admission ON Patient.PatientCode =
    Admission.PatientCode
WHERE DateAdmitted = ‘2010-5-10’
```

List Patients Treated by Doctor ‘John’

```
SELECT Patient.Name, Patient.Surname
FROM Patient,  Treatment, Doctor
WHERE
    Patient.PatientCode = Treatment.PatientCode
    AND
    Treatment.DoctorID = Doctor.DoctorID
    AND
    Doctor.Name = ‘John’
```

Company Example (2)

- A company has several ***projects***.
- Each project is carried out in a different city, has a start date, period and budget.
- For each project some ***products*** are needed.
- These products are supplied by different ***suppliers***.

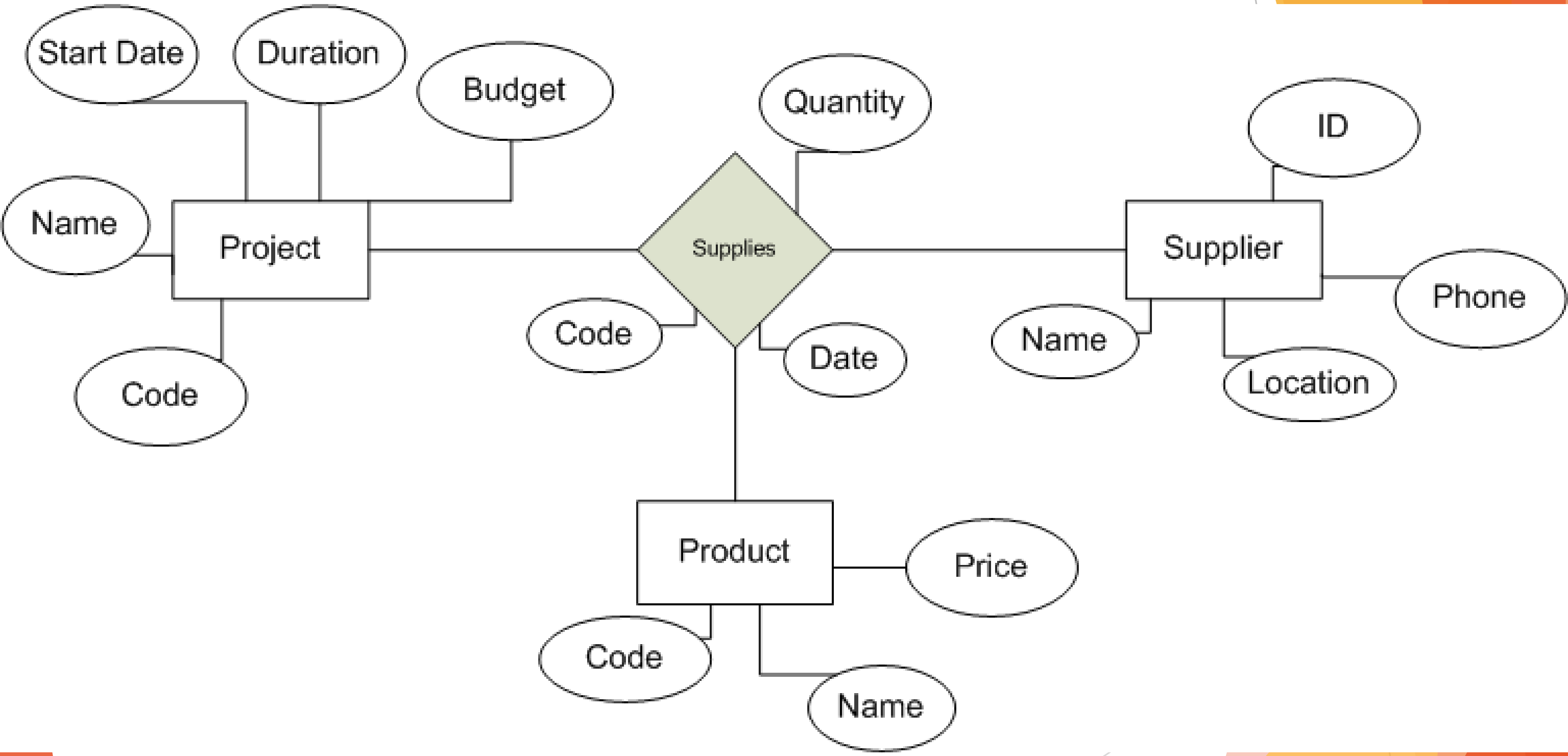
Entities

- Project:
  - Attributes: Project Code, Project Name, Project Start Date, Project Duration, Project Budget
- Product:
  - Attributes: Product Code, Product Name, Price
- Supplier:
  - Attributes: Supplier ID, Supplier Name, Location, Telephone

Relationships

- A supplier ***SUPPLIES*** some products for a project
- A project ***may get*** products from different suppliers
- A supplier may ***supply*** a product for different projects
  - There is a ternary relationship between supplier, product, and project

E-R Model


Start Date
Duration
Budget
Quantity
ID
Name
Project
Supplies
Supplier
Phone
Code
Date
Name
Location
Code
Product
Price
Code
Name

Create Table for Relationship

```
Create table supplies
(
   supplyCode Integer Primary key,
   sID Integer References supplier(ID),
   pcode Integer References product(code),
   pID Integer References project(code),
   quantity Integer,
    supplyDate Date
)
```

Summary

- Read the problem requirements very carefully
- Find entities and relationships
- Create E-R model for the database
- Convert E-R model to Relational model
- Create tables
- Insert data into the tables
- Write some queries to use the database (depends on the requirements)

Questions?