Agenda for Week – 2/03 and 2/05

Learn about

Learn about database design

- Know vocabulary
- Read an Entity relationship diagram (ERD)
- Identify relationships and cardinalities
- Describe the design process

Do

Do database design

- Practice creating ERD's
- Learn how to identify and create the different relationships and cardinalities of relationships
- Develop personal approach to database design

What is database design?

- Database design is the process of creating the structure or blueprint of stored data for an organization.
- The goals of database design are to produce a structure that:
  - Protects the integrity of the data;
  - Can be changed relatively easily; and
  - Stores all data required for organizational processing and decision making.

Database design

- A data model depicts “data at rest”.
- The processes that manipulate the data are controlled by application programmers – they are not the direct concern of a database designer.
- It is common to have a place to store data that may contain null values at any given point in time during the application data input process.
- A database designer tries to anticipate all the data that will be stored in order to create a place to store that data.

Heuristics: Redundant Data

Avoid redundant data that is composed of long alphanumeric data types.

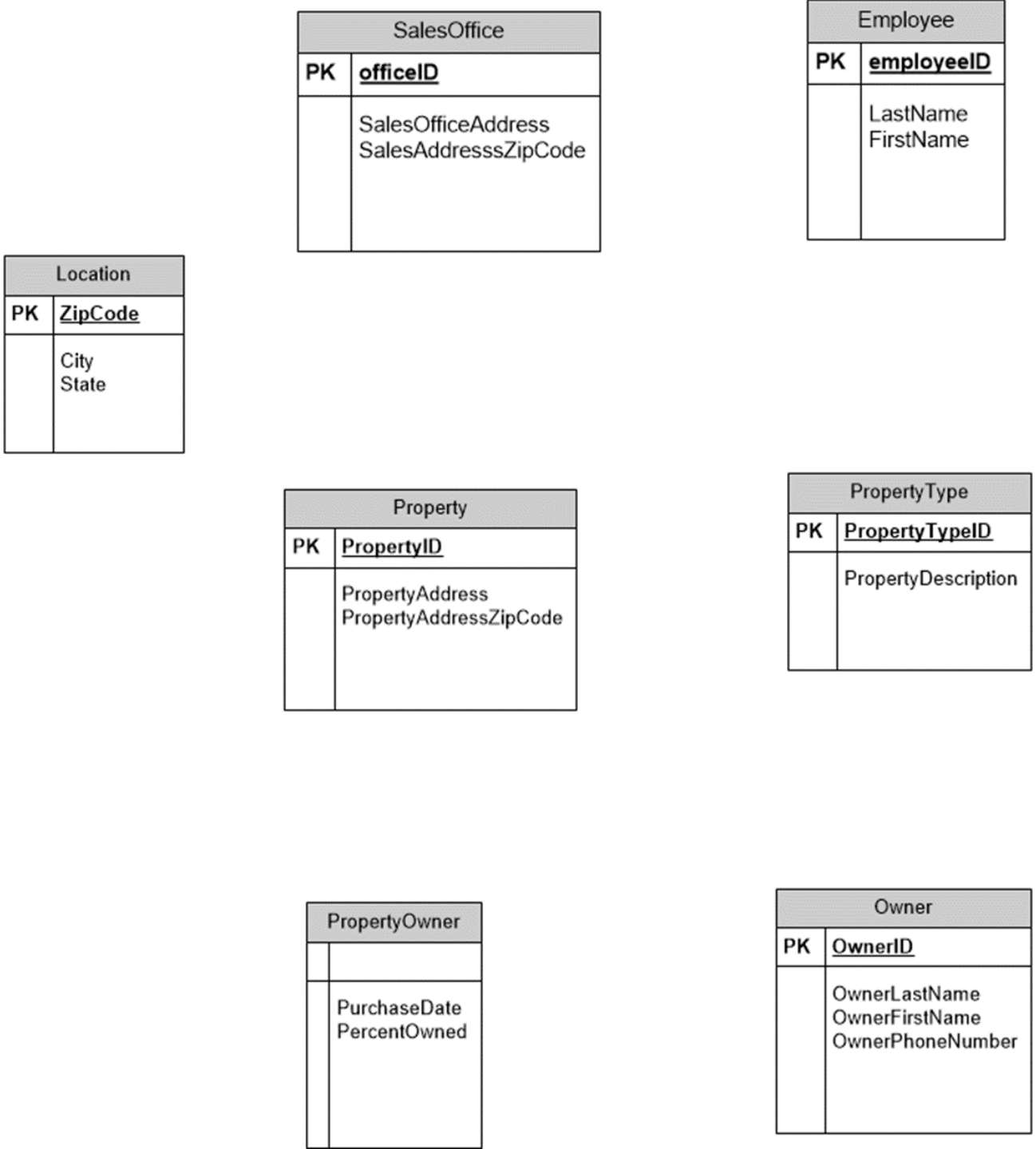
- Examples are names, addresses, comments, notes.
- Standardize any “descriptive” attributes such as categories or types.

Put sample data in a few rows of each entity so that you can determine whether or not the data will be redundant.

- If you don’t know what data will be stored, ask your client.

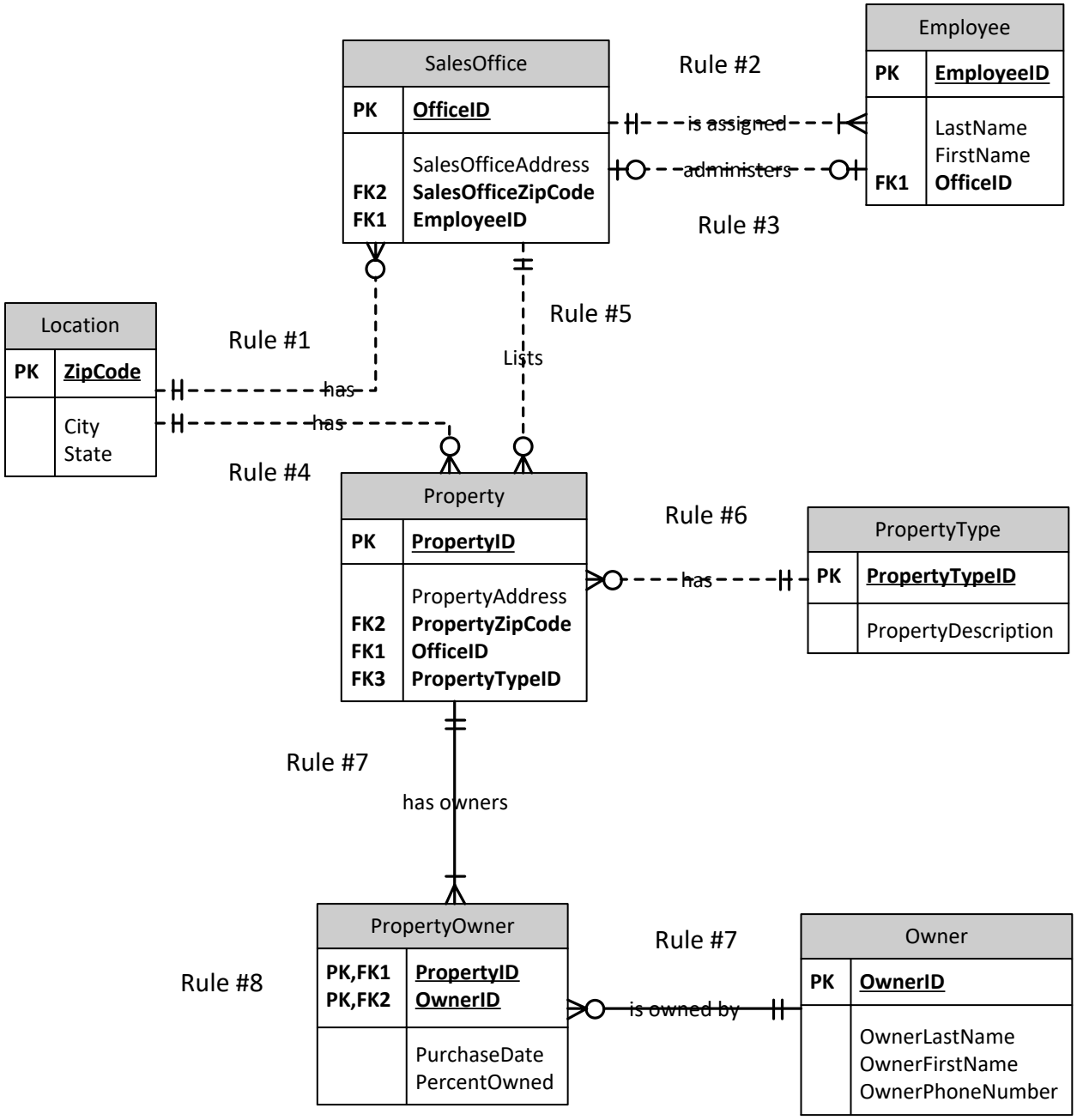
We are designing databases for a relational DBMS. Here are some of the rules of a relational database

All data is stored in two-dimensional tables.
Each table must have a column (or set of columns that are concatenated) that serves as a primary key.
A primary key must have a unique data value for each row in the table.
The intersection of a row and column (a cell) can have only one data value.
A table has a relatively fixed number of columns.
A table can have (theoretically) an unlimited number of rows.
Relationships are created through the use of foreign keys.


SalesOffice
PK
officeID
SalesOfficeAddress
SalesAddresssZipCode
Employee
PK
employeeID
LastName
FirstName
Location
PK
ZipCode
City
State
Property
PK
PropertyID
PropertyAddress
PropertyAddressZipCode
PropertyType
PK
PropertyTypeID
PropertyDescription
PropertyOwner
PurchaseDate
PercentOwned
Owner
PK
OwnerID
OwnerLastName
OwnerFirstName
OwnerPhoneNumber

1. The firm has a number of sales offices in several states. Each sales office has one address in the U.S. An address in the U.S. has one and only one ZipCode which determines the city and state in which the address is located. A ZipCode, however, could be related to many sales offices.
2. Each sales office is assigned one or more employees. An employee is assigned to one and only one sales office.
3. For each sales office, there is always one and only one employee employed as the administrator for that office. An employee can administer only one office, but it is possible that an employee does not administer any sales office. Hint: It is possible to have more than one relationship between two entities. Each relationship must have its own relationship line and its own foreign key. It is also possible to have a one-to-one relationship.
4. The firm lists property for sale. Each property for sale has one and only one address in one location. The ZipCode determines the city and state in which the property address is located.

5. Each unit of property must be listed for sale with one and only one of the sales offices. A sales office may have any number of properties listed or may have no properties listed. A unit of property is an instance in the Property entity.
6. A unit of property is categorized by its PropertyType. For example, a unit of property may be a "commercial building." Other category types are "undeveloped residential land", "single family residence", and "multi-family residence." Each of those data values would be stored in the PropertyDescription attribute as entity instances in the PropertyType entity. There are a number of pre-determined category types that are available, but a given unit of property can be of only one category type. It is possible that a PropertyType is not related to any instances in the Property entity.
7. One or more owners own a unit of property. It is possible that an owner owns more than one unit of property. For each unit of property that an owner owns, the real estate firm wants to keep track of the date of purchase and the percentage that the owner owns. The PropertyOwner entity should serve as the intersection entity between Property and Owner.
8. This last point is not a relationship. The PropertyOwner entity does not have a primary key. What would be an appropriate primary key for the PropertyOwner entity?


SalesOffice
PK OfficeID
SalesOfficeAddress
FK2 SalesOfficeZipCode
FK1 EmployeeID
Rule #2
Employee
PK EmployeeID
LastName
FirstName
FK1 OfficeID
is assigned
administers
Rule #3
Location
PK ZipCode
City
State
Rule #1
has
has
Rule #4
Rule #5
Lists
Property
PK PropertyID
PropertyAddress
FK2 PropertyZipCode
FK1 OfficeID
FK3 PropertyTypeID
Rule #6
PropertyType
PK PropertyTypeID
PropertyDescription
has
Rule #7
has owners
PropertyOwner
PK,FK1 PropertyID
PK,FK2 OwnerID
PurchaseDate
PercentOwned
Rule #8
Rule #7
Owner
PK OwnerID
OwnerLastName
OwnerFirstName
OwnerPhoneNumber
is owned by

New Exercise!

Part 1. Design a database for a single hospital (there is only one hospital – it is not part of a group of hospitals). The hospital wants to keep track of data about transactions regarding patients. Sample data for patient is provided on the next slide so that you will know what data needs to be stored. The hospital wants to keep track of patient admittance, as well as patient treatment by health care professionals (HCPROF).

Assume that the hospital has a large number of HCPROF's, but they don't need to differentiate between physicians and other types of HCPROF's (like nurses, psychologists, physician assistants, etc.). Attributes of HCPROF include HCPROFID (identifier), lastname, firstname, type, and specialty. The hospital wants to keep track of the manager for a HealthCareProfessional. Each HCPROF can have only one manager. But a manager might manage multiple HCPROFs. All managers are also health care professionals. Sample data for a HCPROF is provided on the next slide.

Sample Data

HCPROFID	LastName	FirstName	Type	Specialty	Managed By
10885	Martin	Justine	Physician	Dermatology	Meera Agarwal
92670	Cheng	Randolph	APRN	General	Mumtaz Kutty
45671	Agarwal	Meera	Administrator	Hospital	Not managed by anyone
49305	Kutty	Mumtaz	Physician	Neurology	Meera Agarwal
40022	Rios	Juan	PA	Geriatrics	Meera Agarwal
57333	Salinas	Marta	APRN	Psychology	Mumtaz Kutty

PatientID	LastName	FirstName	DateTimeAdmitted	Admitting Health Care Professional
125	Jenkinson	Marta	1/15/2025 3:30AM	Mumtaz Kutty
130	Peters	Michael	7/12/2024 8PM	Mumtaz Kutty
125	Jenkinson	Marta	11/21/2024 4PM	Justine Martin
125	Jenkinson	Marta	9/8/2024 2PM	Justine Martin
140	Rogers	Jason	2/03/2025 9PM	Mumtaz Kutty