Component 4/Unit 6b
Topic II Relational Databases

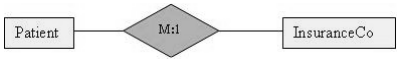
- Keys and relationships
- Data modeling
- Database acquisition
- Database Management System (DBMS)
- Database development

Connecting Data

- Candidate keys
- Primary key
  - Natural key
  - Surrogate key
- Foreign key
- Relationship

Data Modeling: Database Design

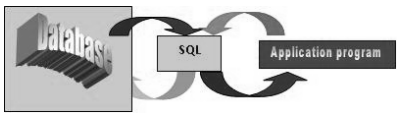
- Entities
- Entity-relation diagram (ER diagram)



- Maximum cardinality of the relationship
- Attributes
- Crow's foot diagrams

Database Acquisition

- Data is stored in and retrieved from a database by using SQL (Structured Query Language)



The Database Management System (DBMS)

- Metadata
- Administration of the database
- Carries out SQL statements and procedures
- Stored procedures
- Triggers
- Security (permissions)
- Handles processing problems
- Carries out backup & restore/recovery

Database Development

- From scratch
  - Existing data
  - Data model eventually becomes DB design
  - Merge existing databases
- Modification of existing database
  - Most databases have already been developed

Phases of Database Development

1. Gathering specifications
2. Design
   - Data modeling to Database design
3. Testing
4. Implementation
5. Maintenance
6. Modification (starts process all over again)

Gathering Specifications

- Attribute domains
  - Data type, length, legitimate values
- Business rules
- Input from users
- Forms and reports
- Existing files
- Outcome of this phase is a beginning data model

Design

- More definitive specifications are gathered
- The data model is perfected toward the database design
- Entities become tables
- Candidate keys are identified and finally primary keys are chosen
- Attributes are added subtracted as needed
- Finally relationships are indicated with the addition of foreign keys

Multiple Views of the Database

- Each user will have a different need/view of the database
- Forms, files and reports will all be of different views of the database
- All views of the database need to be resolved into the data model. The data model will not look like any one of the views.

Testing

- First evaluate design
- Confirm that data model contains all the information that users will need
  - Converse with users
  - Show them data model
  - Express “known” facts to users
    - Users can make objections

Implementation

- Database is created
- Tables are created with attributes, primary and foreign keys
  - This completes the relationships between tables.
- Business rules are carried out
  - SQL procedures
  - Triggers
  - Built-in DBMS features

DBMS Restrictions

- The database design may have to be adjusted to meet with any database DBMS restrictions.

Testing Again

- The database is populated with real and/or test data
- SQL is written that accommodates what the users have requested and the SQL is run against the database
- Bad results means that the database must be fixed. This can mean going all the way back to the design phase or it could be something more elementary

Entity Relationship model

- ER model (Peter Chen, 1976)
- Extended ER model
- Information Engineering (IE)(James Martin, 1990) or Crow's foot version of ER Model
- Integrated Definition 1, Extended Version (IDEF1X) – government standard
- National Institute of STDs and Technology (NIST) 1993
- Unified Modeling Language (UML)

Entities

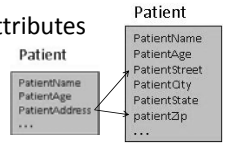
- Potential table
- Things that the user needs to keep track of
  - People, places, things, documents
- Object Classes (idea)
  - Actual occurrence is an instance of an entity class

Attributes

- Descriptors of entities
- Have to have a direct relationship with the entity.
  - Customer entity might have customer name as an attribute
- Can be shown in entity relationship model as balloons or be listed under the entity name.

Attributes Continued

- Composite attributes

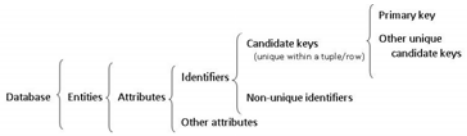


- Multi-value attributes

- Attribute domains

Attributes Continued

- Identifiers



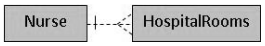
Primary Keys

- Primary key is the way to uniquely define a record
  - It must be unique within the table column. Composite key sometimes is necessary.
  - It's more efficient if it's short and numeric
  - It should not change (at least not often)
- Natural vs. Surrogate keys
  - A natural primary key should be something that the user is familiar with and/or is readily available.

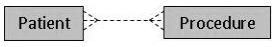
Relationship Classes

- One-to-one

- One-to-many

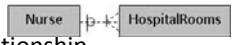


- Many-to-many

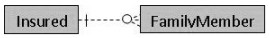


Relationships

- Maximum cardinality
- Parent-Child
- Minimum cardinality

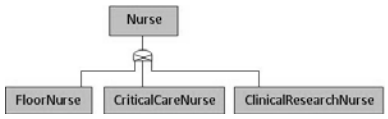


- Recursive relationship
- Weak and strong entities
- ID shared relationship



Relationships Continued

- Subtype and super type entities
  - Inheritance
  - Discriminator
  - Exclusive Vs Inclusive (Crow's Foot)
  - Complete Vs Incomplete (IDEF1X)



Relationships Continued

- Naming a relationship
  - Used to distinguish two relationships between the same two entities
  - Used to help clarify the relationship
  - Can be made up of a short phrase that describes the parent to child relationship followed by a short phrase that describes the child to parent relationship.