Database Systems (INFO20003) Notes

Manish Khilari

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1 Data and Information

1.1 Data

Data is raw facts and figures.

1.2 Information

Information is data presented in a context that delivers valuable insights.

1.3 Databases

A database is a structured collection of data.

Advantages of databases include

- Data program independence
- Minimal data redundancy (no duplicate data)
- More efficient data sharing
- More efficient data maintenance

1.4 Data Dictionary (Metadata)

A data dictionary for a relation (table) is metadata about the attributes (columns) of the relation (table).

Column Name	Not Null?	Data Type	Range

1.5 Database Management System (DBMS)

A DBMS (such as MySQL) enables users to create, access, and update databases.

1.6 Relational Databases

- Set of relations / entity sets (tables) with entities (rows) and attributes (columns).
- Relation (table) has cardinality (number of rows) and degree / arity (number of columns).
- Relationships are logical links between tables.

1.7 Superkeys (SK)

A SK is a set of columns with values that form a tuple that uniquely identifies a row.

- (ID, FirstName, LastName)

1.8 Candidate Keys (CK)

A CK is a SK with no smaller SKs as subsets.

- (ID)
- (FirstName, LastName)

1.9 Primary Keys (PK)

The PK of a table is a chosen CK. All other CKs are alternate keys (AKs).

- (ID)

1.10 Foreign Keys (FK)

A FK is a PK of another table used for a relationship.

- (DogID)

2 Database Design

Conceptual → Logical → Physical

2.1 Conceptual Design

- Not database specific
- Entity Relationship (ER) model

2.2 Logical Design

- Not database specific
- Relational model (table columns, data types)

2.3 Physical Design

- Database specific
- Implementation details

3 Entity Relationship (ER) Models

3.1 Entities

An entity is a uniquely identifiable object with attributes.

3.2 Entity Sets

An entity set is a class of entities (same attributes).

3.3 Relationships

A relationship is a logical link between entities.

3.4 Relationship Sets

A relationship set is a logical link between entity sets.

A relationship set can have attributes.

3.5 ER Models

Chen's Notation

Employee with ID, FirstName, and LastName

- Entity Employee has attributes (ID, FirstName, LastName)
- (ID) is the PK.

Employee with multivalued PhoneNum

- Multivalued (array)

Employee with composite Address(Street, Suburb, State)

- Composite (structure)

Employee with derived YearsWorked

- Derived (can be determined using other attributes)

Employee work(StartDate) Shop

- Employee has **zero or many** shops to work
- Shop has **one or many** employees

Employee manage Shop

- Employee has **zero or many** shops to manage
- Shop has **exactly one** manager

Person own Dog

- Person has **zero or many** dogs to own
- Dog has **zero or one** owner

3.6 Weak Entities

A weak entity has a FK in its PK. It is in an **identifying relationship** with its owner.

- Weak entities have **exactly one** owner (strong entity).
- Weak entities are deleted when their owner is deleted.

Strong entity Person(PersonID, Name) has weak entity Child(ChildName, Age)

- (PersonID, ChildName) form PK of Child

4 Relational Models

Crow's Foot Notation

Employee manage Shop

- Employee has **zero or many** shops to manage
- Shop has **exactly one** manager

```
Employee(PK EmployeeID, FirstName NOT NULL, LastName NOT NULL)

Shop(PK ShopID, FK ManagerID NOT NULL, Location NOT NULL)
```

4.1 Many to Many Relationships (Associative Tables)

A many to many relationship is represented by an associative table.

An associative table has a PK formed by FKs of tables in the many to many relationship.

Employee work(StartDate) Shop

- Employee has **zero or many** shops to work
- Shop has **one or many** employees

```
Employee(PK EmployeeID, FirstName NOT NULL, LastName NOT NULL)

Shop(PK ShopID, Location)

EmployeeWorksShop(PFK EmployeeID, PFK ShopID, StartDate)
```