SIE04 – SISTEM BASIS DATA

Model Basis Data

Sesi 3, 4, 5, 6

Sub - CPMK

Mahasiswa menjelaskan entitas, atribut, kunci, pada suatu database dan hubungan kardinalitas setiap entitas tersebut (C2, A2).

Materi

1. Conceptual Data Model
2. Entity
3. Atributes
4. Relationship
5. Cardinality
6. Structural Constraint

1. Conceptual Data Model

Conceptual Data Model

There are 5 data models:

- Network Model
- Hierarchical Model
- Object-oriented Data Models
- Object-Relational Models
- Relational Model

1.1. Network Model

- The Network Model represents data as record types and also represents a limited type of 1:N relationship, called a set type.

- A 1:N, or one to many, relationship relates one instance of a record to many record instances using some pointer linking mechanism in these models.

1.1. Network Model (Cont.)

- The Network model has an associated record at a time language that must be embedded in a host programming language

1.1. Network Model (Cont.)

- **Network Model:**
  - The first network DBMS was implemented by Honeywell in 1964-65 (IDS System).
  - Adopted heavily due to the support by CODASYL (Conference on Data Systems Languages) (CODASYL - DBTG report of 1971).

1.1. Network Model (Cont.)

- **Network Model:**
  - Later implemented in a large variety of systems - IDMS (Cullinet - now Computer Associates), DMS 1100 (Unisys), IMAGE (H.P. (Hewlett-Packard)), VAX -DBMS (Digital Equipment Corp., next COMPAQ, now H.P.).

1.1. Network Model (Cont.)

- Advantages:
  - Network Model is able to model complex relationships and represents semantics of add/delete on the relationships.
  - Can handle most situations for modeling using record types and relationship types.

1.1. Network Model (Cont.)

- Advantages:
  - Language is navigational; uses constructs like FIND, FIND member, FIND owner, FIND NEXT within set, GET, etc.
    - Programmers can do optimal navigation through the database

1.1. Network Model (Cont.)

- Disadvantages:
  - Navigational and procedural nature of processing
  - Database contains a complex array of pointers that thread through a set of records.
    - Little scope for automated “query optimization”

1.2.Hierarchical Data Model

- The Hierarchical Data Model represents data as hierarchical data tree structures.
- Each Hierarchy represents a number of related records.
- There is No standard language for the Hierarchical model.

1.2.Hierarchical Data Model (Cont.)

- Advantages:
  - Simple to construct and operate
  - Corresponds to a number of natural hierarchically organized domains, e.g., organization (“org”) chart
  - Language is simple:
    - Uses constructs like GET, GET UNIQUE, GET NEXT, GET NEXT WITHIN PARENT, etc.

1.2.Hierarchical Data Model (Cont.)

- Disadvantages:
  - Navigational and procedural nature of processing
  - Database is visualized as a linear arrangement of records
  - Little scope for "query optimization”

1.3. Object-Oriented Data Models

- Object Oriented Data Models defines a database in terms of objects, their properties and their operations.

- Object with the same structure and behavior belong to a **class**, and classes are organized into hierarchies (or acyclic graphs).

- The operations of each class are specified in terms of predefined procedures called **methods**.

1.3. Object-Oriented Data Models (Cont.)

- Several models have been proposed for implementing in a database system.

- One set comprises models of persistent O-O Programming Languages such as C++ (e.g., in OBJECTSTORE or VERSANT), and Smalltalk (e.g., in GEMSTONE).

1.3. Object-Oriented Data Models (Cont.)

- Additionally, systems like O2, ORION (at MCC - then ITASCA), IRIS (at H.P.- used in Open OODB).

- Object Database Standard: ODMG-93, ODMG-version 2.0, ODMG-version 3.0.

1.4. Object-Relational Models

- Relational Model have been extending their models to incorporate object database concepts and other capabilities, these systems are referred to as object relational Models

1.4. Object-Relational Models (Cont.)

- Most Recent Trend. Started with Informix Universal Server.
  - Exemplified in the latest versions of Oracle-10i, DB2, and SQL Server and other DBMSs.
  - Standards included in SQL-99 and expected to be enhanced in future SQL standards.

1.5. Relational Model

- Relational Data Model represents a database as a collection of tables, where each table can be stored as a separate file.

- Most relational database use the high level query language called SQL and support a limited form of user views.

1.5. Relational Model (Cont.)

- Proposed in 1970 by E.F. Codd (IBM), first commercial system in 1981-82.
- Now in several commercial products (e.g. DB2, ORACLE, MS SQL Server, SYBASE, INFORMIX).
- Several free open source implementations, e.g. MySQL, PostgreSQL

1.5. Relational Model (Cont.)

- Currently most dominant for developing database applications.
- SQL relational standards: SQL-89 (SQL1), SQL-92 (SQL2), SQL-99, SQL3, …

1.5. Relational Model (Cont.)

Concepts of The Relational Model :

- Entity
- Attributes
- Relationship

2. Entity

Entity

- Entity type
  - Group of objects with same properties, identified by enterprise as having an independent existence.

- Entity occurrence
  - Uniquely identifiable object of an entity type.

2.1. Entity Type

- Strong Entity
  - Entity type that is *not* existence-dependent on some other entity type.

- Weak Entity
  - Entity type that is existence-dependent on some other entity type.

2.2. Entity Symbols

Figure 3.14
Summary of the notation for ER diagrams.

3. Attributes

Attributes

- Attribute
  - Property of an entity or a relationship type.

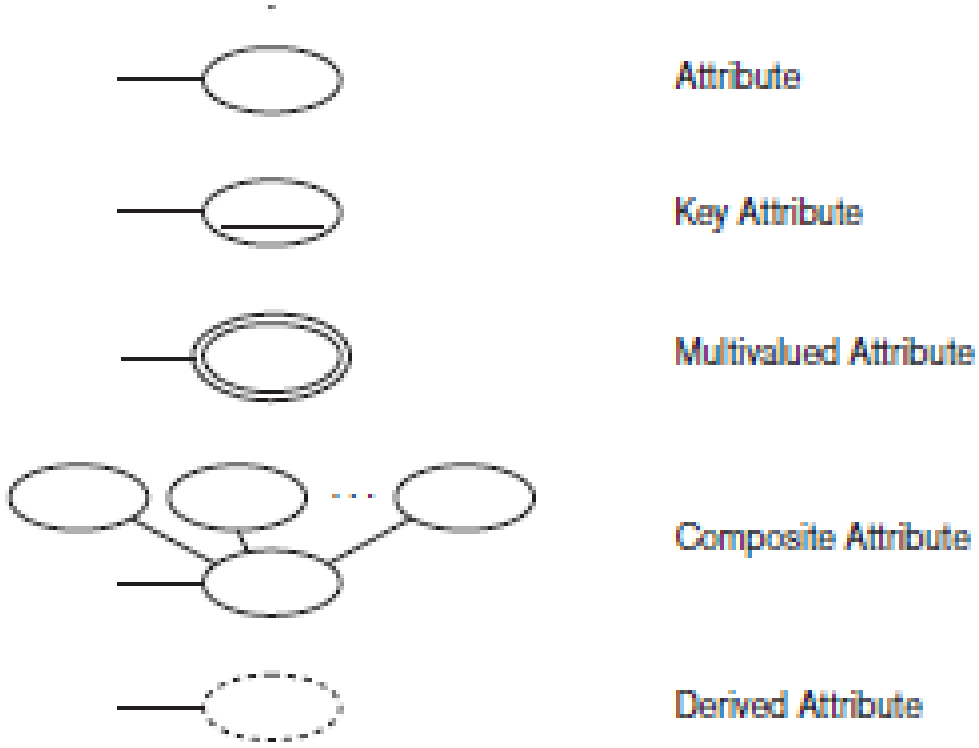


Figure 3.14
Summary of the notation for ER diagrams.

3.1. Attributes Type

- Simple Attribute
  - Attribute composed of a single component with an independent existence.

- Composite Attribute
  - Attribute composed of multiple components, each with an independent existence.

3.1. Attributes Type (Cont.)

- Single-valued Attribute
  - Attribute that holds a single value for each occurrence of an entity type.

- Multi-valued Attribute
  - Attribute that holds multiple values for each occurrence of an entity type.

3.1. Attributes Type (Cont.)

- Derived Attribute
  - Attribute that represents a value that is derivable from value of a related attribute, or set of attributes, not necessarily in the same entity type.

4. Relationship

4.1. Relationship Types

- Relationship type
  - Set of meaningful associations among entity types.

- Relationship occurrence
  - Uniquely identifiable association, which includes one occurrence from each participating entity type.

4.1. Relationship Types (Cont.)

- General Relationship
  - Relationship type to connect the same entity type.

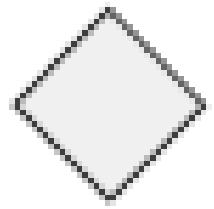
- Identifying Relationship
  - Relationship type to connect different entity type.

4.1. Relationship Types (Cont.)

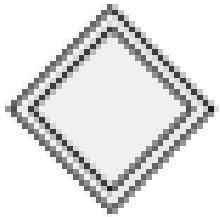
- Recursive Relationship
  - Relationship type where *same* entity type participates more than once in *different roles*.

- Relationships may be given role names to indicate purpose that each participating entity type plays in a relationship.

4.1. Relationship Types (Cont.)



Relationship



Indentifying Relationship

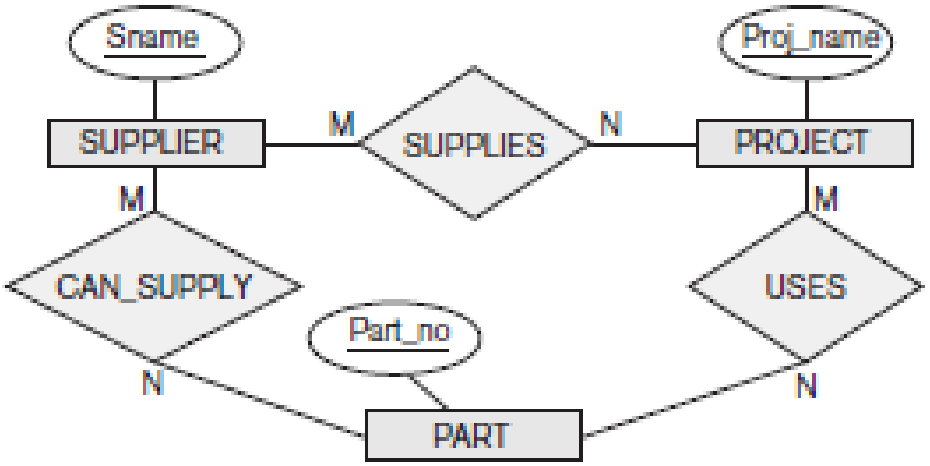
Figure 3.14
Summary of the notation for ER diagrams.

5. Cardinality

Cardinality

- The most common degree for relationships is binary.
- Binary relationships are generally referred to as being:
  - one-to-one (1:1)
  - one-to-many (1:n)
  - many-to-many (m:n)

Example of Cardinality



- This is the example of cardinality :
  - Supplier to Project = M : N (Many to Many)
  - Supplier to Part = M : N (Many to Many)
  - Project to Part = M : N (Many to Many)

5.1. Participation

- Summary of the Notation for Participation and Cardinality Ratio in ER Diagram

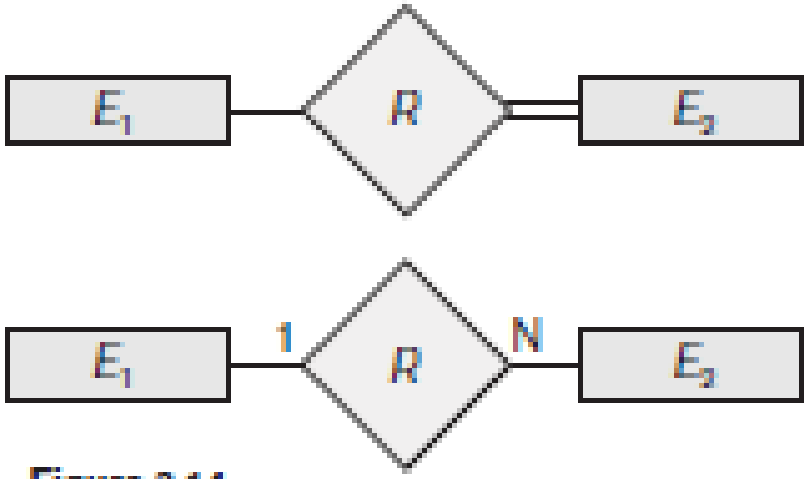


Figure 3.14
Summary of the notation for ER diagrams.

5.1.1.Example of Participation in Cardinality Ratio

- This is the complete example of Participation in Cardinality Ratio

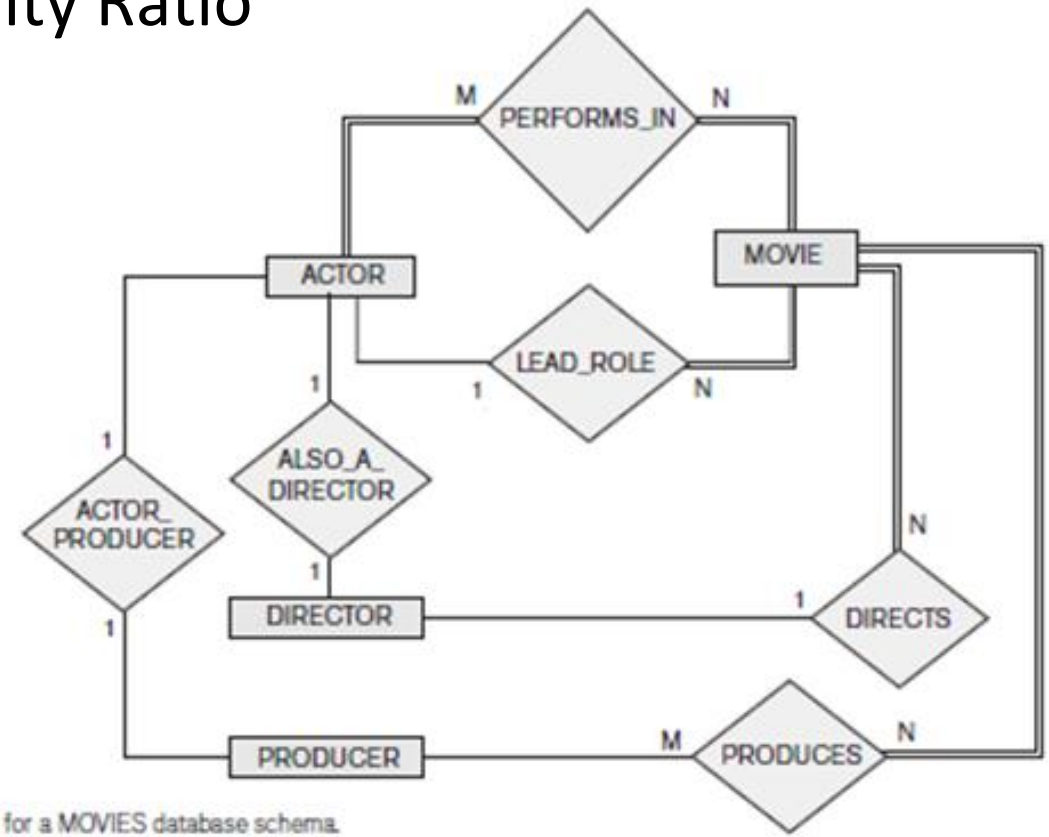


Figure 3.25
An ER diagram for a MOVIES database schema.

6. Structural Constraint

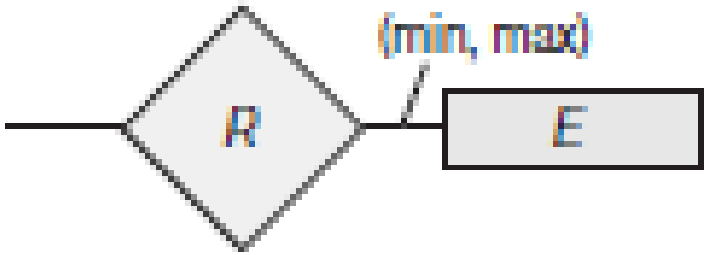
Structural Constraint

- Main type of constraint on relationships is called multiplicity.

- Multiplicity - number (or range) of possible occurrences of an entity type that may relate to a single occurrence of an associated entity type through a particular relationship.

- Represents policies (called *business rules*) established by user or company.

Structural Constraint (Cont.)



Structural Constraint (min, max) on Participation of *E* in *R*

Figure 3.14
Summary of the notation for ER diagrams.

Another Example

Complete diagram of ER Diagram

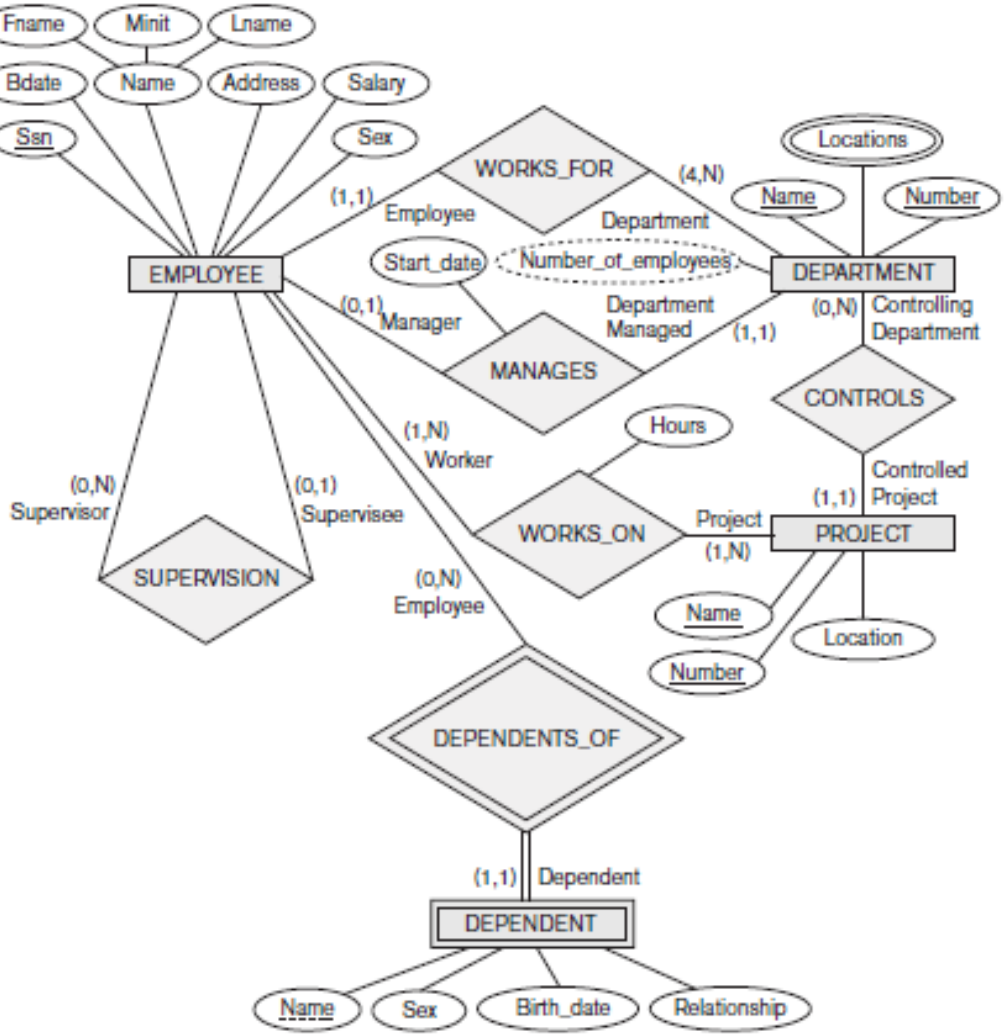


Figure 3.15
ER diagrams for the company schema, with structural constraints specified using (min, max) notation and role names.

Summary

- Conceptual Model Data
  - Network Model
  - Hierarchical Model
  - Object-oriented Data Models
  - Object-Relational Models
  - Relational Model

Summary (Cont.)

- Concept of The Relational Model :
  - Entity
  - Atributes
  - Relationship

- Cardinality Ratio :
  - **one-to-one (1:1)**
  - **one-to-many (1:n)**
  - **many-to-many (m:n)**

Thank You