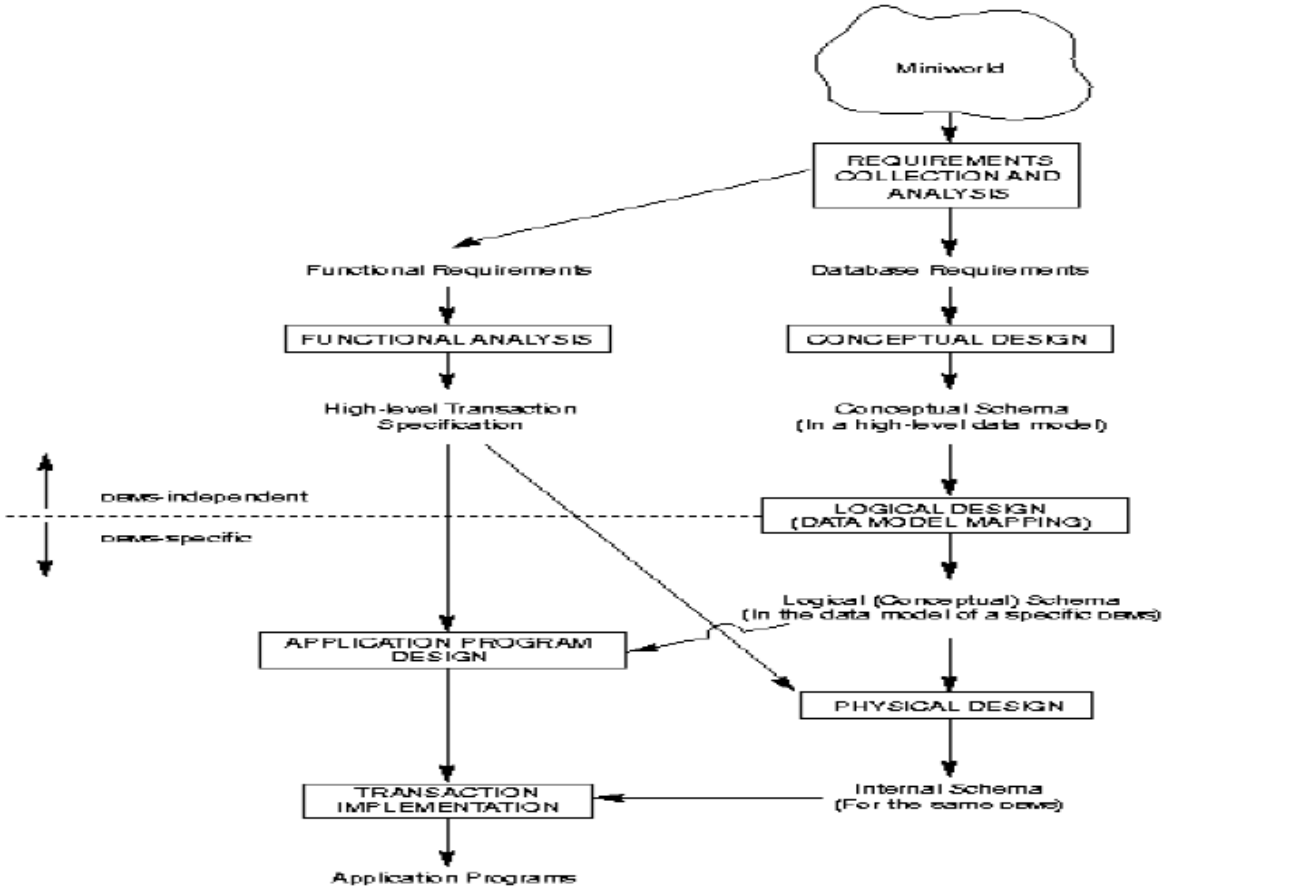
DATA MODELING USING THE ENTITY-RELATIONSHIP MODEL

Figure 3.1



Entity-Relationship (ER) Model

•The ER model is a high-level conceptual data model. It has not been implemented in any commercial DBMS (?), but is a powerful short hand often used in database design for a first rendition of the mini world.

•The ER model was introduced by Peter Chen in 1976, and is now the most widely used conceptual data model.

•Much work has been done on the ER model, and various extensions and enhancements have been proposed.

Definitions

•An entity is an object in the mini world.

•An attribute of an entity can have a value from a value set (domain)

•Each entity belongs to some one entity types.t. Entities in one entity type have the same attributes (so each entity type is a set of similar entities).

•A key attribute of an entity type is one whose value uniquely identifies an entity of that type.

•A combination of attributes may form a composite key.

•If there is no applicable value for an attribute that attribute is set to a null value.

Entity Type/ Entity Set

Entity Type (Intension): EMPLOYEE

Attributes: Name, Age, Salary

Entity Set (Extension):

e_1 = (John Smith, 55, 80000)

e_2 = (Joe Doe, 40, 20000)

e_3 = (Jane Doe, 27, 30000)

.

.

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Attributes

- Attributes can be
  - composite / simple (atomic)
  - Single-valued / multivalued
  - stored / derived
  - key / monkey.

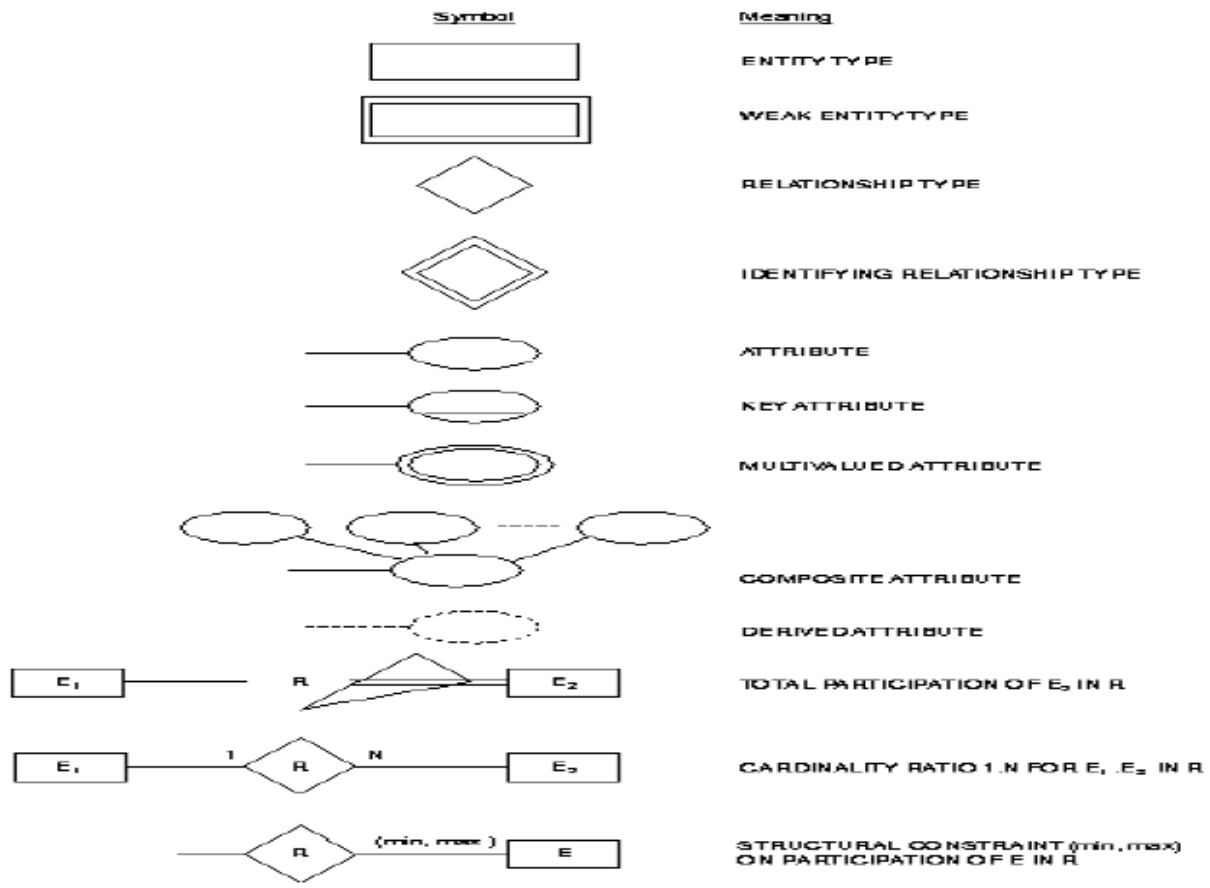
Attribute Examples

Name = John Doe
Birthdate = May 10, 1989
Age = 9
Degree = null
SSN = 123456789

Name = Jane Doe
Birthdate = July 11, 1960
Age = 38
Degree = B.S., M.S.
SSN = 987654321

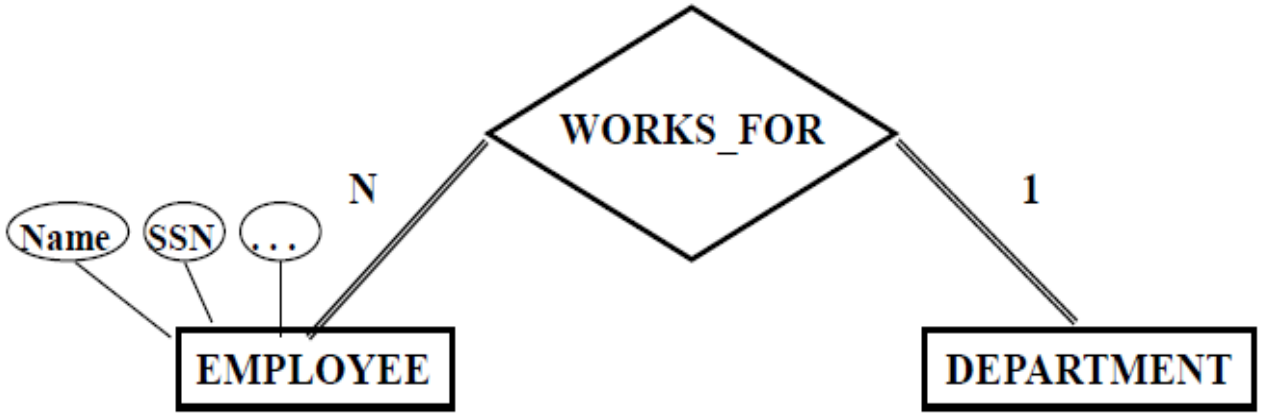
Name = John Doe
Birthdate = May 10
Birthyear = 1989
Age = 9
Degree = null
SSN = 123456789

Figure 3.15



Employee

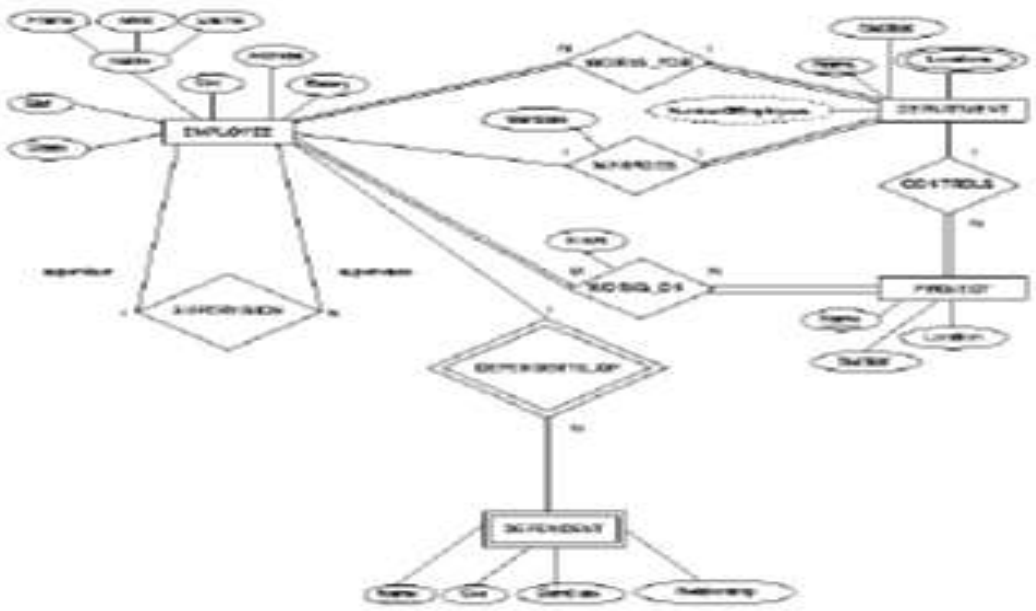
Name, SSN, Sex, Address, Salary, Birthdate, Department,
Supervisor, {Works on (Project, Hours)}



Relationship instances of WORKS_FOR:
{(KV, CS), (Pan, EE), . . .}

ER Diagram for COMPANY Database

Figure 3.2



Relationship Type

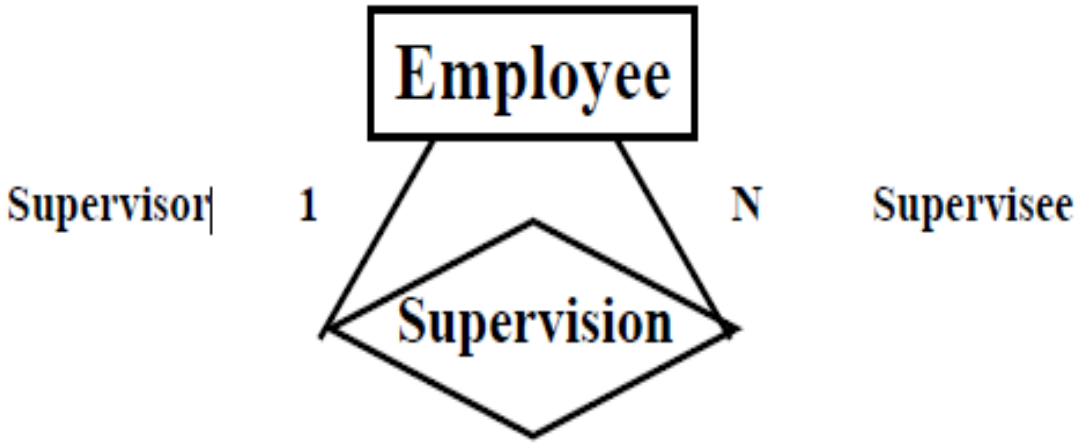
- A relationship type R among n entity types E1… Enis a set of relationship instances ri, where each riassociates n entities (e1… en), s.t. each ej□Ej. Informally, a relationship instance is an association of entities, with exactly one entity from each participating entity type.

- The degree of a relationship type is the number of participating entity types.

- In the ER model relationships are **explicitly** represented.

Entity Roles

•Each entity type in a relationship type plays a particular role that is described by a role name. Role names are especially important in recursive relationship types where the same entity participates in more than one role:



Weak Entity Type

•A weak entity type is one **without** any key attributes of its own. Entities belonging to a weak entity type are identified by being related to another entity type (called identifying owner) through a relationship type (called identifying relationship), in combination with values of a set of its own attributes (called partial key). A weak entity type has total participation constraint w.r.t. its identifying relationship.

Relationship Attributes

Relationship types can have attributes as well. In case of 1:1 or 1: N relationships, attributes can be migrated to one of the participating entity types.

Relationship

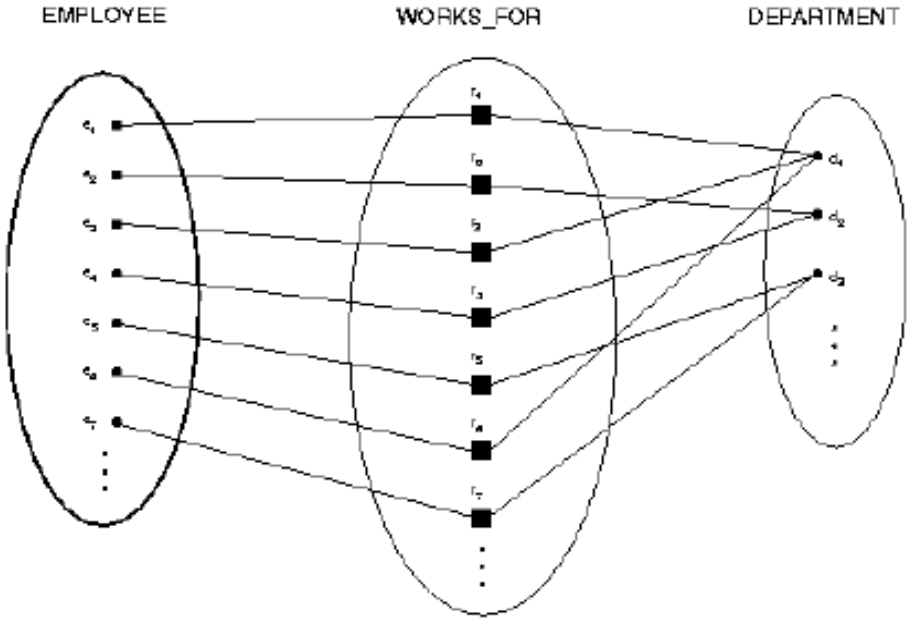


Figure 3.9

Figure 3.10

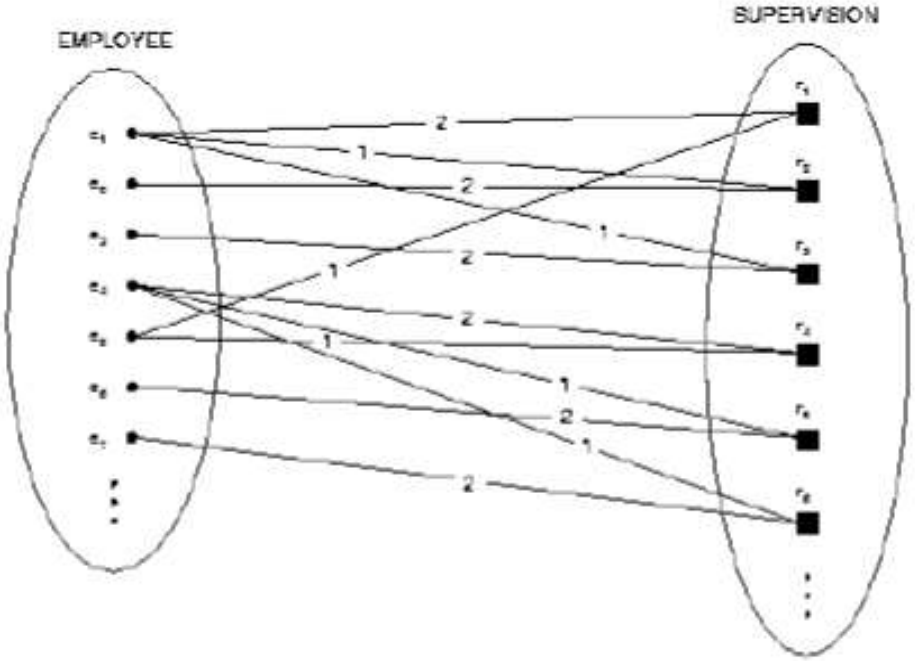


Figure 3.11

Structural Constraints

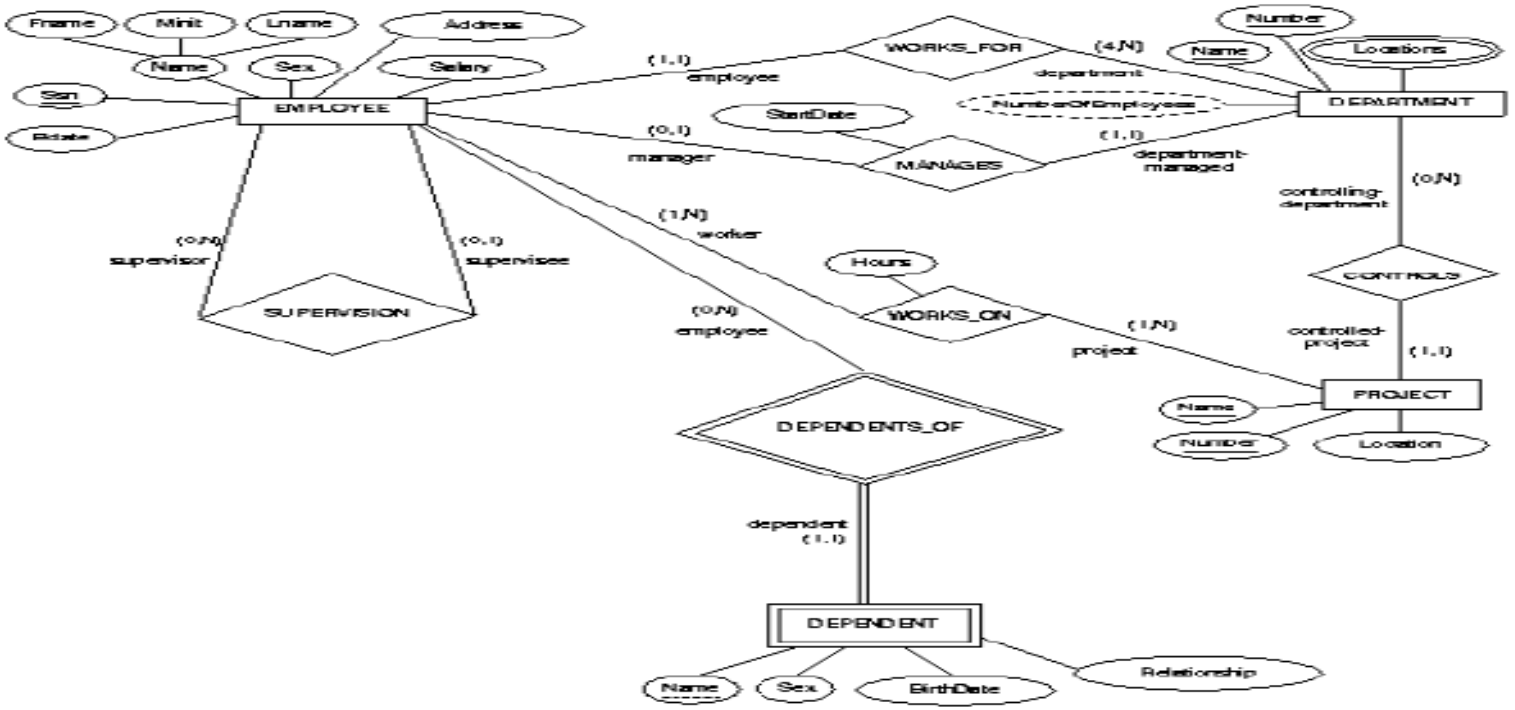
•Structural constraints of a relationship type:

–**Cardinality ratio:** Limits the number of relationship instances an entity can participate in, e.g. **1:1, 1: N, M: N**

–**Participation constraint:** If each entity of an entity type is **required** to participate in some instance of a relationship type, then that participation is **total**; otherwise, it is **partial**.

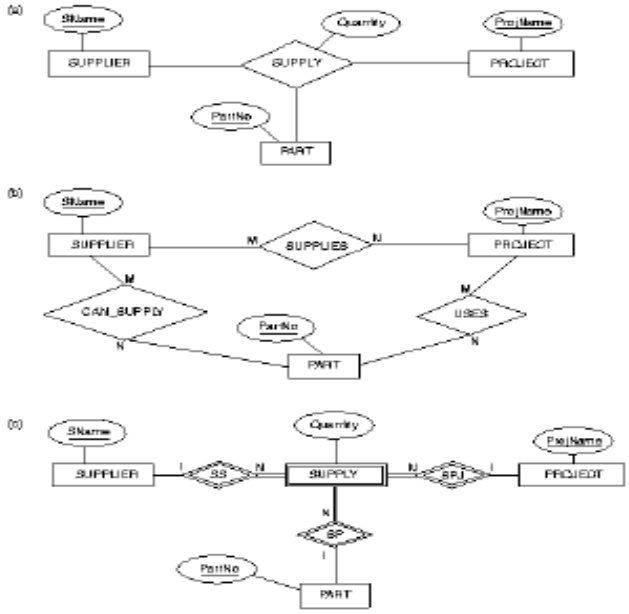
Structural Constraint Min, Max

A more complete specification of the structural constraint on a relationship type can be given by the integer pair (min, max), which means an entity must participate in at least min and at most max relationship instances.



A ternary relationship generally represents more information than 3 binary relationships

Figure 3.16



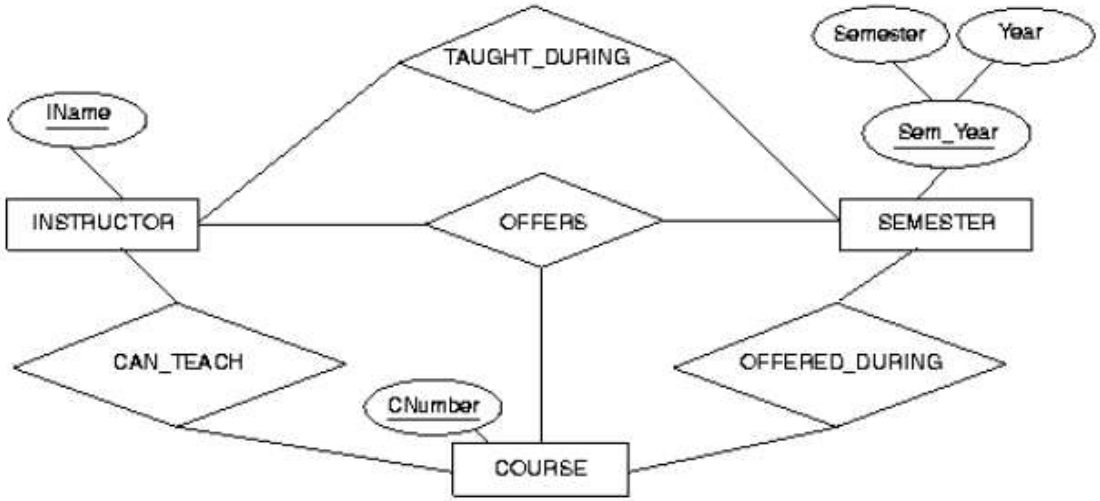


Figure 3.17

A Weak Entity with a Terary Identifying Relationship

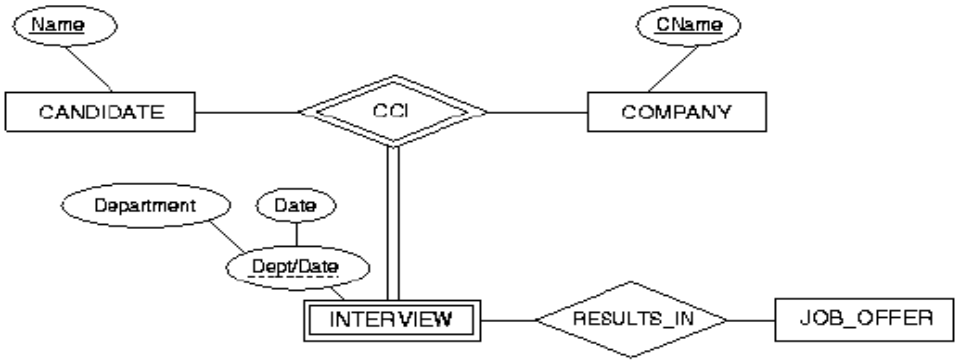


Figure 3.18