Constraints in ER

- Constraint: an assertion about the database that must be true at all times
- Central in database design: give more semantics to the data, prevent wrong data entry, allow us to refer to entities, enable efficient storage and data lookup, etc.
- Various types of constraints, e.g.,
  - Existence of an entity is dependent on the existence of a relationship to another entity
  - Values of certain entities attributes in an entities set must be unique
  - …

Examples of important constraints in ER

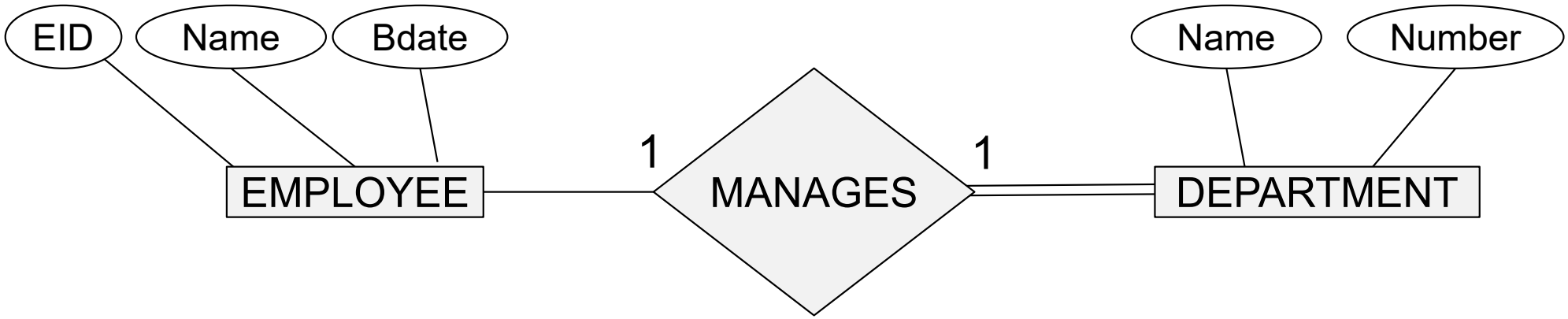
- Structural constraints of a (binary) relationship type
  - Cardinality Ratios constraint
    - Specifies the *maximum* number of relationship instances that each entity can participate in
    - 1:1, 1:N, N:1, M:N
  - Participation constraint
    - Specifies the *minimum* number of relationship instances that each entity can participate in, e.g.,
      Each EMPLOYEE must work for a DEPARTMENT
- Key constraint: each entity has an attribute uniquely identifying it, e.g.,
  EID uniquely identifies an employee

Participation constraints

- Specifies whether the existence of an entity depends on it being related to another entity via a relationship type
- Total participation, e.g.,
  Every employee must work for a department, i.e.,
  An employee entity can exist only if it participates in at least one WORKS_FOR relationship instance
- Partial participation, e.g.,
  Some employees are related to some department entity via MANAGES, but not necessarily all

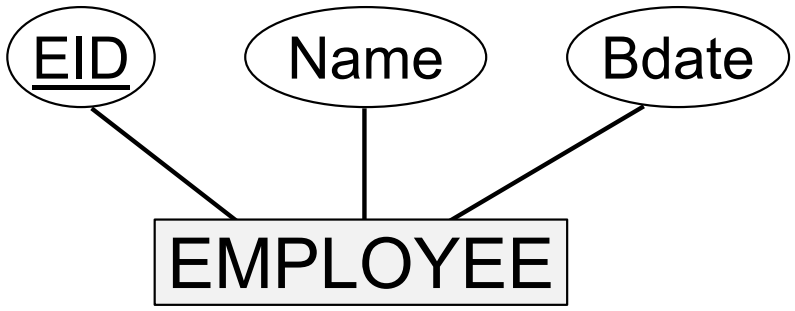
Participation constraints in ER diagrams

- Total participation is displayed as a double line connecting the participating entity type to the relationship
- Partial participation is represented by a single line



Key constraints

- An important constraint on the entities of an entity type, a.k.a. uniqueness constraint on attributes
- Key attribute: an attribute whose values are distinct for each individual entity in the entity set (i.e., its values can be used to identify each entity uniquely), e.g.,
  The EID attribute of EMPLOYEE is a key because no employees are allowed to have the same id
- In ER diagrams, each key attribute has its name underlined inside the oval



Key constraints

- Sometimes several attributes together form a key, i.e., the combination of the attribute values must be distinct for each entity
  - Define a composite attribute and designate it as a key attribute
- Usually an entity type has at least one key attribute
  - If two or more attributes are key attributes, then each is a key on its own (*Note*: there is no concept of “primary” key in ER)
  - If the entity has no key, it is called a *weak* entity type