Cardinality Ratios and Participation Requirements of Relations

RULES OF THE MINIWORLD

- Every Employee must work for a single Department.
- A Department may have several Employees working for it.
- Every Dept must have a manager
- No Employee can manage more than one Department.
- An Employee can work on several Projects.
- A Project may have several Employees working on it.

Nature of the Rules

- What MUST or MAY be true for each INSTANCE of an ENTITY TYPE in connection with a RELATIONSHIP type.
- Will rephrase above requirements in terms of Cardinality Ratios and Participation requirements
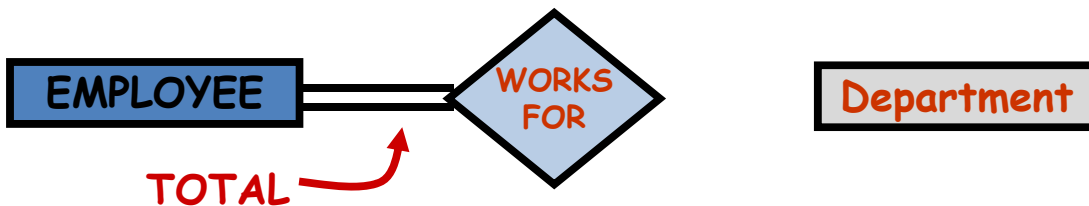
Employees and Departments

- Every Employee must work for a single Department.
- A Department may have several Employees working for it.
- For employees PARTICIPATION is TOTAL
  - Applies to Every Employee.
- For departments PARTICIPATION is PARTIAL
  - Newly set-up DEPT has no employees

EMPLOYEE   WORKS FOR   Department

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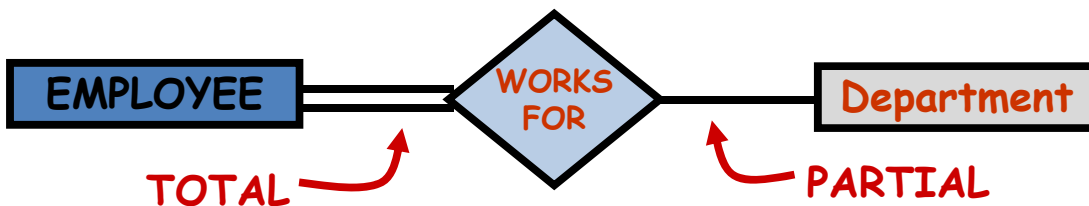 - Newly set-up DEPT has no employees

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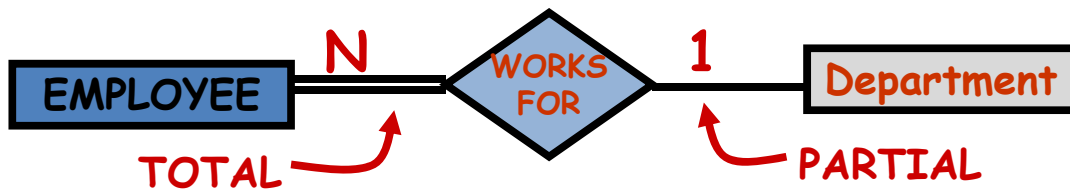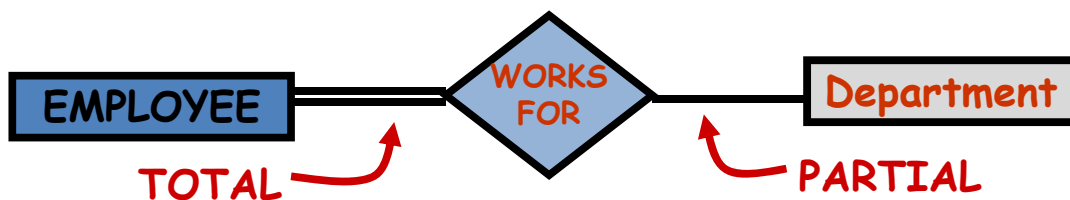 - Newly set-up DEPT has no employees

Employees and Departments

- CARDINALITY is 1:N
  - EMPLOYEE can work for only one DEPT,
  - but one DEPT can have many EMPLOYEEs.

N EMPLOYEE ══ WORKS FOR **1** — Department

TOTAL   PARTIAL

Employees and Departments

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EMPLOYEE ══ WORKS FOR — Department

TOTAL   PARTIAL

Employees and Departments

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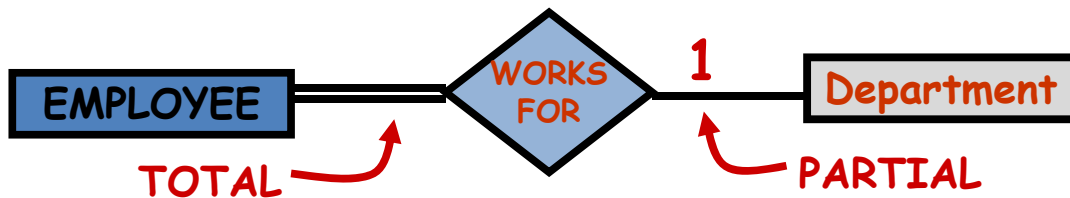 - but one DEPT can have many EMPLOYEEs.

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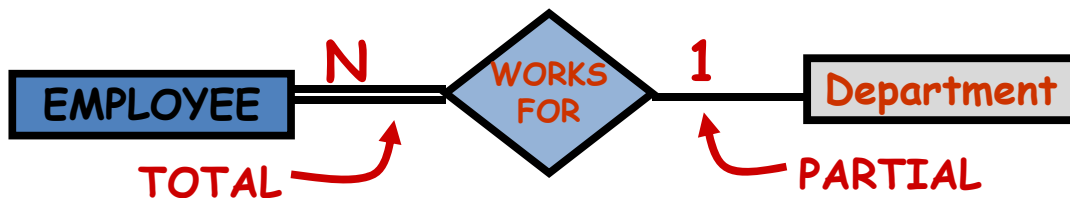 - but one DEPT can have many EMPLOYEEs.

Employees and Departments

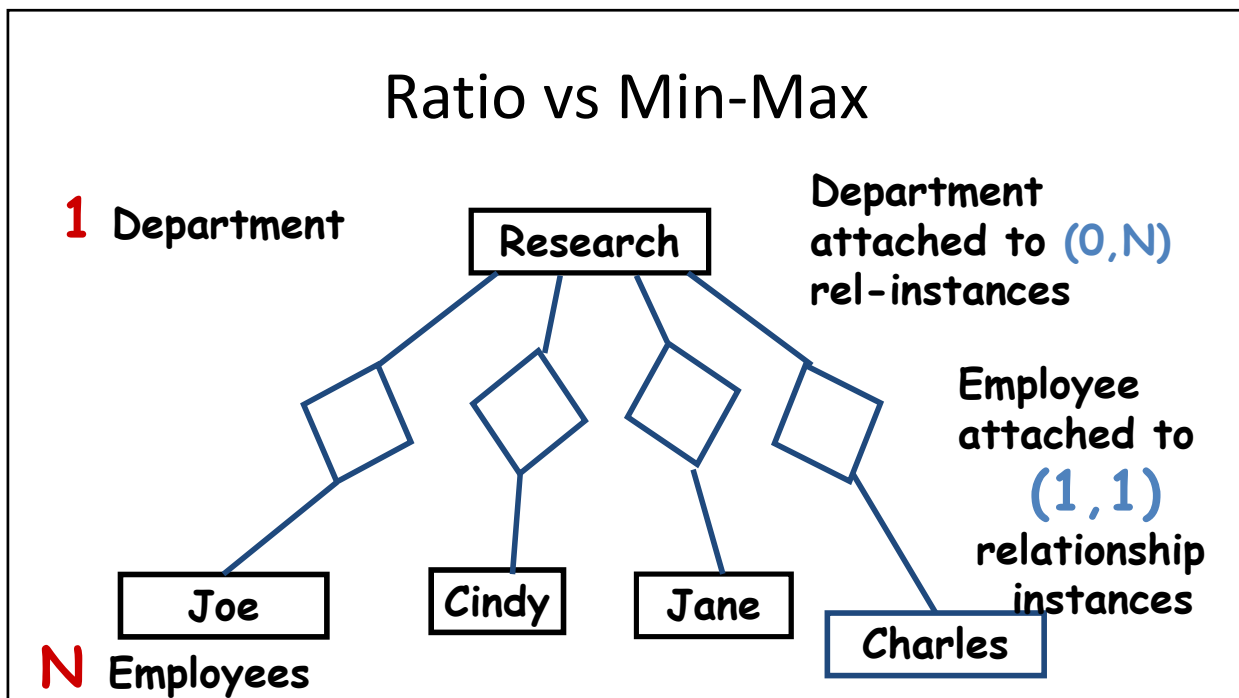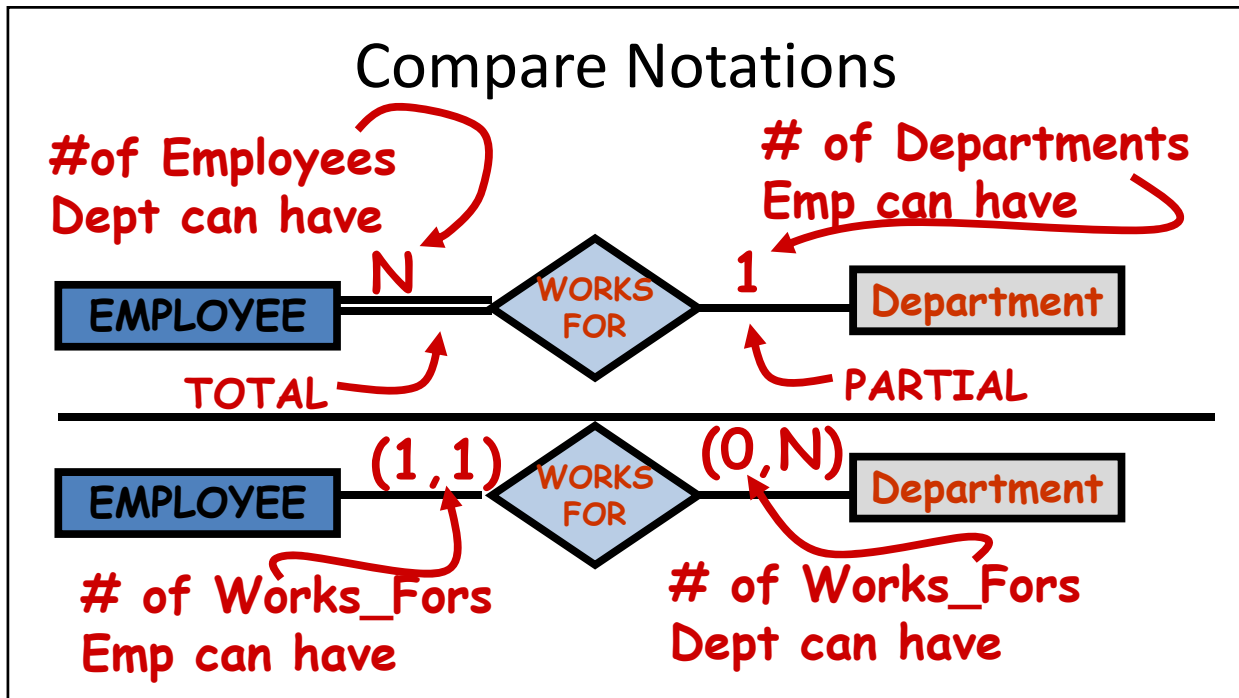- Min-Max notation combines Cardinality and Participation
- Each EMPLOYEE participates in exactly ONE WORKS_FOR instance
- But each department may have 0 or more EMPLOYEES

EMPLOYEE — (1,1) — WORKS FOR — (0,N) — Department

Employees and Departments

- `min>=1` shows: PARTICIPATION for EMPLOYEES is TOTAL
- `min=0` shows: for DEPARTMENTS, PARTICIPATION is PARTIAL.

EMPLOYEE — (1,1) — WORKS FOR — (0,N) — Department

Compare Notations

#of Employees
Dept can have

# of Departments
Emp can have

N

EMPLOYEE ═══ WORKS FOR ── 1 ── Department

TOTAL   PARTIAL

───────────────────────────────────

EMPLOYEE ── (1,1) ── WORKS FOR ── (0,N) ── Department

# of Works_Fors
Emp can have

# of Works_Fors
Dept can have

Ratio vs Min-Max

1 Department

Research

Department
attached to (0,N)
rel-instances

Joe   Cindy   Jane

Charles

Employee
attached to
(1,1)
relationship
instances

N Employees

Departments and Managers

- Every Department must have a manager.
- No Employee can manage more than one Department.
- For EMPLOYEEs, participation is PARTIAL:
  - some employees are not required to manage departments.
- But for DEPARTMENTs participation is TOTAL:
  - every department must have a manager

EMPLOYEE —— ◇ MANAGES ◇ ═══ **Department**

PARTIAL   TOTAL

Departments and Managers

- CARDINALITY: ONE to ONE (1:1).
  - Employee can manage only 1 department
  - departments have only 1 manager.
- EMPLOYEEs may participate in ZERO or ONE relationship instance
- Every department must participate in exactly ONE.

EMPLOYEE —1— ◇ MANAGES ◇ —1═ **Department**
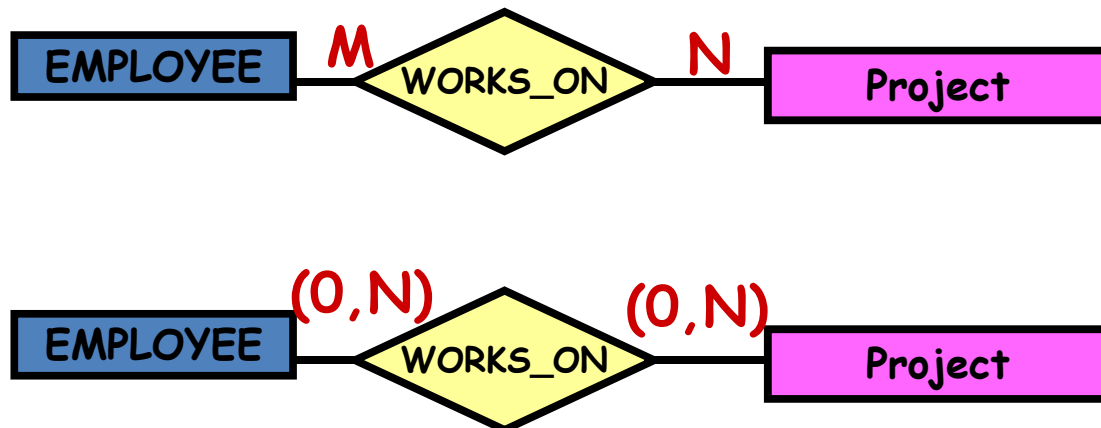
PARTIAL   TOTAL

Departments and Managers

- In Min-Max terms ….
- Emps participate 0 or 1 times in 'Manages' relationship
- Depts participate exactly 1 time in 'Manages' relationship

EMPLOYEE — (0,1) — MANAGES — (1,1) — Department
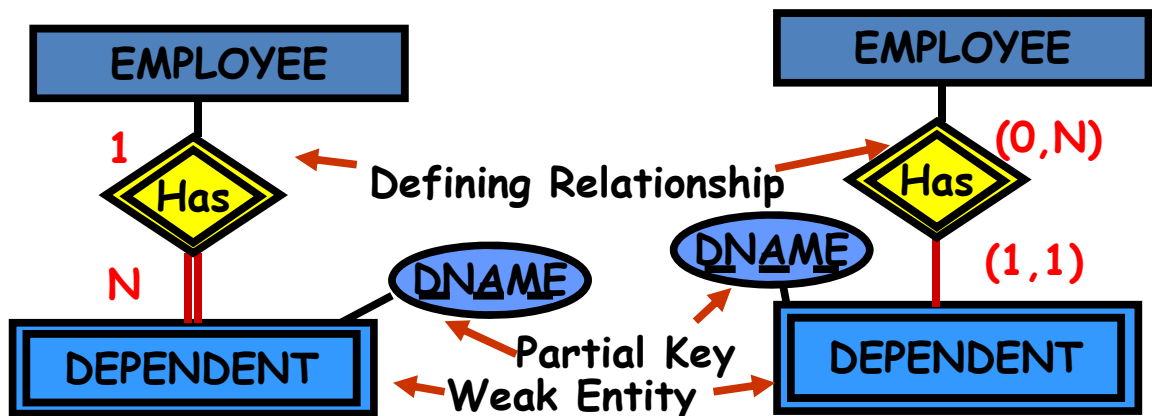
Employees and Projects

- An EMPLOYEE can work on several PROJECTs.
- A PROJECT may have several EMPLOYEEs working on it.
- PARTICIPATION: an EMPLOYEE could be working on NO project.
- An inactive project might have no-one working on it.
- PARTIAL on both sides
- this relation is N:M.

Employees and Projects

EMPLOYEE —M— ⟨WORKS_ON⟩ —N— Project

EMPLOYEE —(0,N)— ⟨WORKS_ON⟩ —(0,N)— Project

Weak Entities In Both Versions

- Ratios are 1:N or (0,N) & (1,1)
- Total Participation represented differently

EMPLOYEE

1 ⟨Has⟩ N DEPENDENT

← Defining Relationship →

DNAME ← Partial Key

DEPENDENT ← Weak Entity →

EMPLOYEE

(0,N) ⟨Has⟩ (1,1) DEPENDENT

DNAME

Summary

- Cardinality Ratios and Participation Requirements are Constraints put on relationships
- One representation uses double lines for mandatory participation and Ratio notation for cardinality
- Min-Max notation represents both constraints in one notation