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
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
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
Employees and Departments

- CARDINALITY is 1:N
  - EMPLOYEE can work for only one DEPT,
  - but one DEPT can have many EMPLOYEES.
Employees and Departments

- CARDINALITY is 1:N
  - EMPLOYEE can work for only one DEPT,
  - but one DEPT can have many EMPLOYEES.
Employees and Departments

- CARDINALITY is 1:N
  - EMPLOYEE can work for only one DEPT,
  - but one DEPT can have many EMPLOYEES.
Employees and Departments

- CARDINALITY is 1:N
  - EMPLOYEE can work for only one DEPT,
  - 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
Employees and Departments

• \( \text{min} \geq 1 \) shows: PARTICIPATION for EMPLOYEES is TOTAL
• \( \text{min} = 0 \) shows: for DEPARTMENTS, PARTICIPATION is PARTIAL.
Compare Notations

- **# of Employees**: Dept can have N
- **# of Works_Fors**: Emp can have (1, 1)
- **# of Works_Fors**: Dept can have (0, N)
- **# of Departments**: Emp can have 1
- **# of Departments**: Dept can have PARTIAL TOTAIL
Ratio vs Min-Max

1 Department

Department attached to (0,N) rel-instances

Research

Employee attached to (1,1) relationship instances

N Employees

Joe

Cindy

Jane

Charles
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
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.
Departments and Managers

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

INFOMATION_SCHEMA

1. EMPLOYEE
2. WORKS_ON
3. Project

RELATIONSHIP_INFO

- M to N relationship between EMPLOYEE and PROJECT
- (0, N) relationship between EMPLOYEE and WORKS_ON
- (0, N) relationship between WORKS_ON and Project
Weak Entities In Both Versions

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