N-M TOTAL PARTICIPATION:

- Employees are required to work on at least 1 project
- Employees can work on multiple projects
- Projects are not required to have employees
- Projects can have multiple employees

(More Precise Bounds)

- (1,_) means total participation (lower bound = 1)
  [an employee must work on at least 1 project]
- (0,_) means optional participation (lower bound = 0)
- [a project is not required to have employees]
- (_,N) means can participate at most N times
  [an employee can work on up to N projects]
- (_,M) means can participate in relationship M times
  [projects can have up to M employees]

N-M OPTIONAL PARTICIPATION:

- Employees are **not** required to work on a project
- Employees can work on multiple projects
- Projects are not required to have employees
- Projects can have multiple employees

- (0,N) means that an employee is not required to work on a project, and can work on at most N projects.
- (0,M) means that a project is not required to have employees, and can have at most M employees on it

N-1 TOTAL PARTICIPATION:

* Departments must belong to a school (== total participation).
* Departments can belong to only one school, while schools can have N departments) - Represent by arrow
* The school is like an attribute of the department because it can have only 1 value, and is a required value

(More Precise Bounds)

- (1,_) means total participation (lower bound = 1) [a department must be in a school]
- (0,_) means optional participation (lower bound = 0)
- [a school is not required to have departments]
- (_,1) means can participate at most 1 time [department can be in at most 1 school]
- (_,N) means can participate in relationship N times [schools can have up to N departments]

N-1 OPTIONAL PARTICIPATION:

* Students are not required to have an office (optional)
- If a student has an office, they can have at most one office (by school policy) - Represent by arrow
* The office is like an attribute of the student, because it can have only 1 value, but it is not efficient because some students do not have offices (empty value)

- (0,1) means a student can have at most one office, but is not required to have an office.
- (0,20) means an office can be assigned to at most 20 students (by school policy), but is allowed to be empty (have no students assigned)

1-1 TOTAL PARTICIPATION (ONE SIDED TOTAL):

* Departments must be chaired (== total participation).

- Departments can have only 1 chair
- Employees are not required to chair (optional participation), but if they do, they can only chair one department
- The chair is like an attribute of the department because it can have only 1 value, and it is a required value. The reverse, while possible, is very inefficient because most employees are not chairs (so attribute mostly empty)

(Equally Precise Bounds)

- (1,_) means total participation (lower bound = 1) [a department must have a chair]
- (0,_) means optional participation (lower bound = 0)
- [an employee is not required to be a chair]
- (_,1) means can participate at most 1 time [department can have at most 1 chair, and employees can chair at most one department if they are a chair]

1-1 OPTIONAL PARTICIPATION (BOTH DIRECTIONS):

- Employees are not required to have cellphones (optional), and a cellphone is not required to be assigned to anyone
- If an employee has a cellphone, they can have at most one cellphone (by company policy) - Represent by arrow and a cellphone can be used by only one employee
- The work cellphone could be an attribute of an employee (and vice-versa), but not efficient because often empty

- (0,1) means an employee is not required to have a cellphone, but can only have 1 if they do.

- (0,1) means a cellphone is not required to be assigned to any employee, but if it is, it can only be assigned to a single employee

1-1 TOTAL PARTICIPATION (BOTH SIDES TOTAL):

- Every employee is required to have a cellphone, and only one cellphone.
- Every cellphone is required to be assigned to an employee (the exactly correct number are leased, and returned if an employee leaves).
- Either the cellphone or the employee can be an attribute of each other. Either choice is viable and a matter of perspective. But it is far preferable to have this as a relationship rather than an attribute of both entities given redundancy issues.

(Equally Precise Bounds)

- (1,1) means an employee is required to have a cellphone, and can only have 1 cellphone
- (1,1) means every cellphone is required to be assigned to an employee, and it can be assigned to only 1 employee