Cardinality a.k.a. participation Constraints specifies the minimum and maximum number of entities that participate in a given relationship type...

There is a 1-1 relationship between faculty and offices at MSU...some offices may be unoccupied so we can adorn the ER diagram as follows

Consider the relation: teams(code,type,wins,losses,coachln,coachfn) in the sports database. A given college team is affiliated to exactly one college, so its participation in that relationship would be (1,1)

Conversely, a college is not required to sponsor any sports and the maximum number of teams is 70(?)

The generic name for such a relationship is called 1-many or many-1

Finally we could also specify that a relationship is many-many..

A student can enroll in many classes...a class enrolls many students..the constraints on this relationship would be (1,3) and (10,40) respectively.
Notes: if the minimum participation is 0, the relationship is called optional, if it is > 0 it is called mandatory...

Participation constraints can also be applied to attributes..if the min is 0, the attribute is optional, otherwise is mandatory... if max is 1 the attribute is single-valued, otherwise it is multi-valued.

EXAMPLE OF THREE WAY RELATIONSHIP

Existence Constraints...An entity of type E1 is "existence dependent" on an entity of type E2, if E1 cannot exist unless it is related to an entity of type E2.

eg. Given the Business Rule: Each employee must be assigned to exactly one department produces an existence dependency The relationship from employee to Department is called an "identifying relationship"
An entity is said to be a "weak entity" if it doesn't have enough attributes to form a unique key, but can only be identified by its association to another entity...weak entities are often existence dependent on another entity.

ISA hierarchies

Ramakrishnan Example, p. 36
Aggregation

Ramakrishnan Example, p. 213

Logical Transaction Design:

Data Flow Diagrams...

Processes are represented by circles, data files by parallel lines, agents by solid rectangles and "data flow" by arrows that may be labeled
Participation constraints can also be applied to attributes...if the min is 0, the attribute optional, otherwise mandatory...if max is 1 the attribute is single-valued, otherwise it is multi-valued.