Existence-dependency

- An entity type \( A \) is said \textbf{existential-dependent} on an entity type \( B \) if the existence of \( A \) depends on the existence of \( B \).
  - If \( B \) is deleted, \( A \) must also be deleted. \( A \) is subordinate and \( B \) is dominant.
- Example: Employee's dependents cannot exist (as far as the DB is concerned) if the employee doesn't exist i.e. all dependents of employee are deleted if employee is deleted.

Weak entity types

- An entity type that does not have sufficient attributes to form a primary key is said a \textbf{weak entity type}.
- A member of a weak entity type is subordinate to dominant entity with which it is associated. Attributes of the dominant entity are combined with those of the subordinate one to form a superkey of the weak entity type.
- A \textbf{discriminator} of a weak entity type is a set of attributes that allows distinguishing among entities that depend on a single dominant entity.
- A \textbf{superkey} of a weak entity type is formed by taking the union of a superkey of the strong entity type on which it is existence-dependent and a discriminator.

Example of a weak entity type

- A company insurance policy may insure an employee and his/her dependents. An employee may or may not have dependent but a dependent must be associated with an employee. A dependent cannot exist without an employee.

![Diagram of weak entity type]

- Table for Employee:

<table>
<thead>
<tr>
<th>essn</th>
<th>sname</th>
<th>edob</th>
</tr>
</thead>
<tbody>
<tr>
<td>101</td>
<td>Clifante</td>
<td>Sunday, March 12, 1961</td>
</tr>
<tr>
<td>102</td>
<td>Smith</td>
<td>Monday, November 23, 1970</td>
</tr>
<tr>
<td>103</td>
<td>Washinton</td>
<td>Thursday, August 15, 1968</td>
</tr>
</tbody>
</table>

- 101 and 102 can have a child number 1 named Ali and born in 2000.
- \textit{Dependent} is a weak entity. It is existential-dependent of \textit{Employee}.
- The weak entity inherits all or part of the primary key from its strong counterpart. The \textit{Dependent} primary key is composed on \textit{essn} and \textit{dnum}.

Schema of a relationship type

- Relationship type schema:
  - Relationship type name,
  - Attributes (and their domains),
  - Cardinalities constraints,
  - Roles,
  - Key constraints.
**Extended E-R model**

- One entity type might be **subtype** of another.
  
  Example:
  
  - Freshman is a subtype of Student.
  
  - A relationship exists between a Freshman entity and the corresponding Student entity.

  Example: Freshman John is a subtype of Student John.

- This relationship is called **IsA.**

  - The 2 entities related by IsA are always descriptions of the same real-world object.

  Example: Freshman is a student.

**Properties of IsA**

- **Inheritance** - attributes of supertype apply to subtype.
  
  - Subtype inherits all attributes of supertype.

- **Transitivity** - Hierarchy of IsA.

  Example: Student is subtype of Person, Freshman is subtype of Student.

**IsA**

- Advantage: Use to create a more concise and readable E-R diagram.

  - Attributes common to different entity types need not to be repeated.

  - They can be grouped in one place as attributes of supertype.

**Hierarchy**

- Might have associated constraints:

  - **Covering/Overlapping constraints:** Union of subtype entities is equal to set of supertype entities.

    Example: Employee is either a secretary or a technician (or both).

  - **Disjointness constraint:** Sets of subtype entities are disjoint from one another.

    Example: Freshman, Sophomore, Junior and Senior are disjoint sets.
Tiny College

What is the E-R diagram corresponding to the following specification?

- Tiny College is divided into several schools: a school of business, a school of education and a school of applied science. Each school is administered by a dean. There is one dean for each school and each dean is assigned to only one school.

- Each school is composed of several departments. For example, the school of business has an accounting department and a computer information system department. Each school has at least one department. Each department belongs to only a single school.

- Each department offers several courses. For example, the management/marketing department offers courses such as introduction to management, principles of marketing, production management...

- A department may offer several classes of the same course.

- Each department has many professors assigned to it. One of those professors chairs the department. Only one of the professors can chair the department to which s/he is assigned and no professor is required to accept the chair position.

- Each professor may teach up to 4 classes, each one a class of a course. A professor may also be on a research contract and teach no classes at all.

- A student may enroll in several classes, but s/he takes each class only once during any given enrollment period. For example, during the current enrollment period a student may decide to take 5 classes but that student will not be enrolled in the same class five times during the enrollment period. Each student may enroll in up to 6 classes and each class may have up to 35 students in it.

- Each department has several students who major is offered by that department. However each student has only a single major and is therefore associated with a single department.

- Each student has an advisor in his/her department. Each advisor counsels several students. An advisor is also a professor, but not all professors advise students.