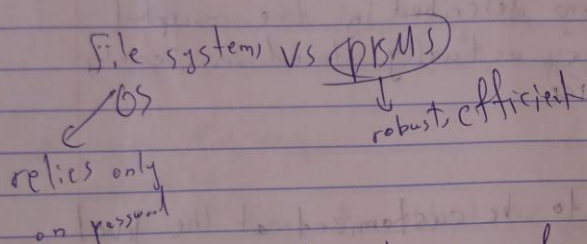# Chapter 1

A database is a collection of data, typically describing the activities of one or more related organizations

Entities & Relationships

DBMS: is a software designed to assist in maintaining and utilizing large collection of data

File systems vs (DBMS)

/OS
↓
relies only   robust, efficient

on password

~~A~~ 1.4 Advantages of DBMS

- Data independence
- Efficient data access
- Data Integrity and Security
- Data Administration
- Concurrent access and crash recovery
- Reduced Application Development time

1.5 §

data model: a collection of high-level data description constructs that hide many low-level storage details.

- semantic data model
- schema: a description of data in terms of data model

1.5.2 levels of abstraction

• conceptual (Logical) schema , describes the stored dt

• describes all relations stored in db

arriving at a good conceptual schema (conceptual db desig

• physical schema ⟶ additional storage info details

      ⤷ how relations described in the conceptual
        schema are actually stored on secondary
        storage device

• External schema:

end users   ⤷ allow data to be customized at the level
        of individual users or groups

Chapter 2

* the DB design process can be divided to six steps:

1. Requirement elicitation and analysis:-
   what data? what operations? what are users?
   what is the application built on top of DB?

2. Conceptual DB design: information gathered in the
   requirement step is used to develop a high-level description

   - this step is carried out using the ER mdl.
   - to match how users and developers think of data.

3. Logical DB design:
   - Implementation:
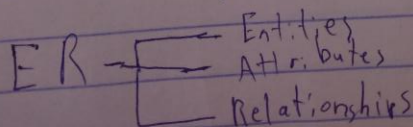   - Convert ER design to relational DB schema

4. Analysis and Refinement

5. physical DB design: Performance, indexing, clustering
6. Application and Security

⇒ Entity - Relationship Model (ER)

- the first step is to build the ER-diagram

ER ⎡ Entities
   ⎢ Attributes
   ⎣ Relationships

ER
Entity → Entities
→ Attributes
→ Key

Entity: real world objects distinguishable from others.
Student, Employee, Course

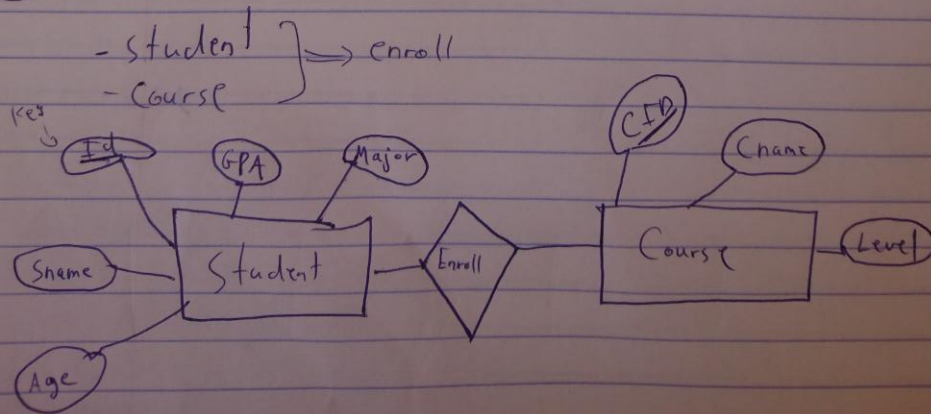Attributes: the characteristic of entities
Student: Ib, name, age, GPA, major

Key: is an attribute or minimal set of attributes whose
values uniquely identify an entity
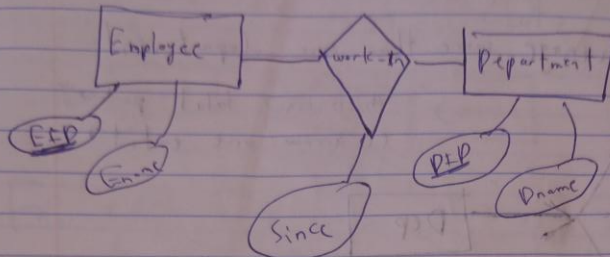
more than one key: candidate keys
- one of them must be primary

③ Relationships : is an association between two or more entities

- Student } → enroll
- Course

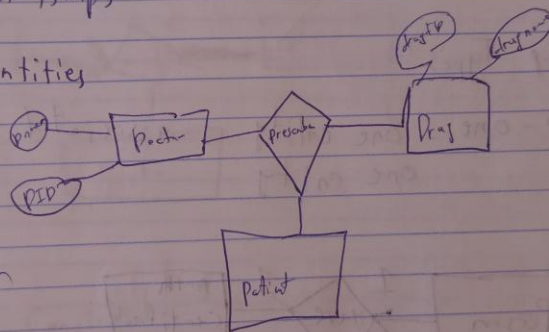- Relationships also may have an attribute(s)
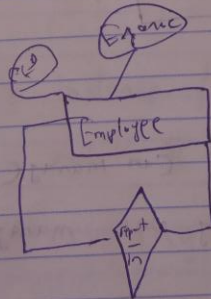- Employee works in department since date

* Types of Relationships:

(I) number of entities
  ① binary
  ② ternary
  ③ n-nary

4 - Unary

* oval → attributes
  rectangle → entity

- descriptive attribute : used to record info about a relationship
- many to many (employee works in several deps and deps can have more than one employee)
- one to many (one employee → many deps)

* key Constraint:

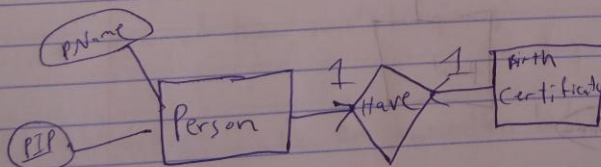Ex: Assume each department is managed by one employee
manager

– An employer can manage more than one department.
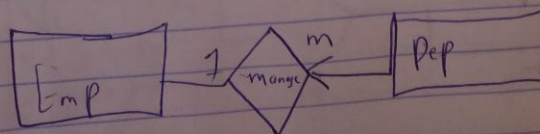
thick line: total portion
el arrow: one entity

* Relationship Types:

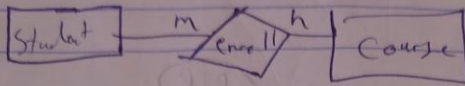① one – to – one : One entity is associated with only
one entity

② one – to – many ; One employee can manage several
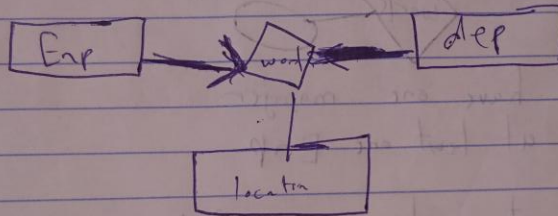deps each dep is manged by one manager

③ many-to-many

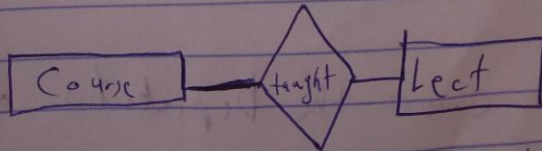- each student can enroll many courses,
course has many students

```
┌────────┐        ╱◇╲       ┌────────┐
│Student │───m───◇enroll◇───n│ Course │
└────────┘        ╲◇╱       └────────┘
```

Ex: each Emp work in one dep and location; a
dep can have many locations and emp

```
┌──────┐          ╱◇╲          ┌──────┐
│ Emp  │─────────◇work◇─────────│ dep  │
└──────┘          ╲◇╱          └──────┘
                    │
                 ┌──────┐
                 │Locatin│
                 └──────┘
```

* Participation Constraints:

① Total: every instance from entity E must
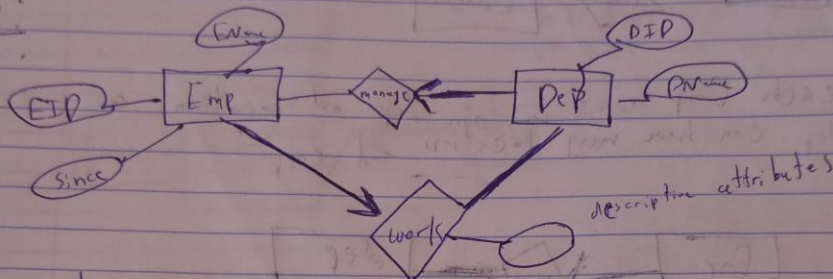participite in relation R.

- every course is taught by a lecturer.

```
┌──────┐        ╱◇╲        ┌──────┐
│Course│═══════◇taught◇════│ Lect │
└──────┘        ╲◇╱        └──────┘
```

in ER diagram, total part is denoted by a thick line

② Partial: any part that is not total is partial

Ex:

descriptive attributes
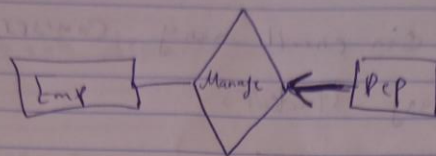
— each Dep must have one manager
— each Dep must have at least one Emp
— each Employee must work in one Dep
— an Employee can manage many Deps
— the system store the last work date

⇒ Week entity and Partial key:-

- the ministry of education make insurance for its emp.

- the insurance can cover the Dependents of every emp.
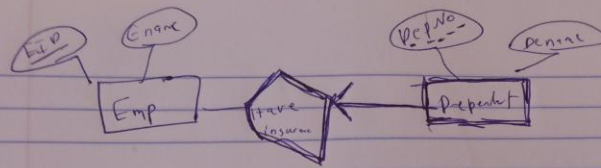
- Emp is the owner entity for dependent

- DepNo is a partial key

- Partial Key is an attribute that uniquely identifies a weak entity for a given owner entity.

⇒ Two restrictions with weak entity:

1- The owner and weak participate in one-to-many relation

2- The weak entity must have total Participation