**Data** Some values referring to real world facts, may be in various formats; **Database** A large collection of inter-related data; **Database management system** databases + a set of programs that store and access the data; Drawbacks of storing databases in file systems: Difficulty/Inefficiency in accessing data, Data redundancy and inconsistency, Data isolation (files may be in different formats), Atomicity problems, Concurrent access anomalies, Integrity problem;

**Data abstraction** physical level (how the data are actually stored, complex low-level data structured in detail), logical level (what data are stored, relations among data, physical data independence), view level (only part of the database, simplify user interaction)

**DBMS functional components** Storage manager, interface between the low-level data and the application programs/queries, consists of: File manager (manages the allocation of space on disk storage & the data structures used to represent information on disk), Transaction manager (ensures that the database remains in a consistent state), Authorization & integrity manager (tests for the satisfaction of integrity constraints and checks the authority of users to access data), Buffer manager (Responsible for fetching data from disk storage into main memory, decide what data to cache in main memory); Disk storage, consists of: Data files, Data dictionary (database schema), Indices; Query processor, converts high-level user requests to efficient low-level commands, consists of: DDL interpreter (Interprets DDL statements and records the definition in the data dictionary), DML compiler (Translates DML statements in a query language into an evaluation plan, query optimization), Query evaluation engine (Executes low-level instructions generated by the DML compiler)