Databases

A **database** is a persistent collection of **related data** supporting several different applications within an organisation.

Advantages of databases:

* Eliminates **redundancy**.
* Data from **all** applications is stored only once.
* All applications access the **same** physical copy of data.

**Metadata** adds context to data. Metadata and data are stored separately.

### Database Management Systems

A **database management system** (DBMS) simplifies data storage and access to multiple databases. It provides efficient, reliable and secure management of large amounts of persistent data.

A typical DBMS supports:

1. Definition
2. Manipulation
3. Querying

A DBMS supports **logical data independence** by allowing the view of the data to be changed, or data to be added without affecting the underlying organisation.

The way data is viewed is independant to how it is stored.

**Data integrity** is concerned with the **consistency** and **accuracy** of data in a database.

DBMSs provide **recovery** & **backup** mechanisms.

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| **Advantages** | **Disadvantages** |
| * **Querying** capabilities. * Reduced data **redundancy**. * Greater data **integrity**. * Improved data **security**. * Reduced **costs** for data entry, storage & retrieval. | * **Training** required for management & querying. * Complex & time-consuming to design. * **Costly** software, hardware & training. * Loss of **autonomy** by central control of data. * **Inflexible** due to complexity. |

### SQL

Structured Query Language (SQL) is split into 4 sets of commands:

1. **DDL** Data Definition Language
2. **DML** Data Modification Language
3. **DQL** Data Query Language
4. **DCL** Data Control Language

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| DDL | Modifies the **schema** of the database.  Used to add, change or delete **definitions** of tables or other objects. |
| DML | Modifies stored **data**.  Used to insert, update or delete **data** in tables. |
| DQL | Formulates **requests** and generates **reports**.  Uses **SELECT** command to query a table. |

### Transactions

A **transaction** is a group of actions that must happen **atomically** (all or nothing).

* Guarantees to move the DB from one **consistent state** to another.
* Each transaction is **isolated** from parallel execution of other.
* Ensures the DB is **recoverable** in case of failure (e.g. power loss).

### Database Users

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| DBMS Implementer | Builds the DBMS system. |
| DB Designer | Establishes the database schema. |
| DB Application Dev | Develops applications that operate on the database. |
| DB Administrator | Overall responsibility for:   * Access constraints * Backup & recovery * Monitoring performance |